DRAFT FINAL REPORT:
HYDROLOGY OF THE MIDDLE REACH OF RINCON CREEK
PIMA COUNTY, ARIZONA

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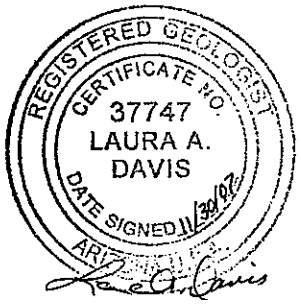
The Rincon Institute
Tucson, Arizona

by

Haley & Aldrich, Inc.
Tucson, Arizona

Sheldon D. Clark
Vice President

Laura A. Davis
Senior Hydrogeologist
Arizona Registered Geologist 37747
(registration expires 06/30/2008)



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HALEY&
ALDRICH

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EXECUTIVE SUMMARY

This report provides data regarding hydrogeologic conditions, streamflows and groundwater subflows in Rincon Creek, and presents a conceptual model of the hydrogeologic conditions of the middle reach of Rincon Creek. These data were collected to support an in-stream water rights application submitted by the National Park Service (NPS) for Middle Rincon Creek.

Literature review and field data collection provided information for the development of the site conceptual model. Information on climatic, surface water, geology, and hydrogeologic conditions provided in prior investigations was supplemented by data compilation and field activities including:

- An inventory of wells within 0.5-mile of the middle reach of Rincon Creek.
- Installation of seven monitoring wells in the alluvial aquifer.
- Monitoring of groundwater levels in the seven monitoring wells and three private wells completed in the bedrock aquifer.
- Monitoring of Rincon Creek surface water conditions (wetted reach lengths, surface water field parameter measurements).
- Water quality analyses of Rincon Creek surface water, alluvial aquifer, and bedrock aquifer samples.

The hydrogeologic conceptual model defined three principal hydrogeologic features:

- Rincon Creek,
- A shallow, unconfined aquifer consisting of unconsolidated alluvium, and
- A deeper, bedrock aquifer comprised of older consolidated sedimentary and crystalline rocks.

The middle reach of Rincon Creek appears to be in direct hydraulic communication with the alluvial aquifer, but not with the deeper bedrock aquifer.

Intermittent streamflows support and replenish pools within the middle reach of Rincon Creek, and between flow events, water levels in the pools are sustained by groundwater outflow from the alluvial aquifer. During periods of low or no precipitation, water in storage in the alluvial aquifer serves as a "reservoir" to sustain pool levels. In periods of extreme drought, the pool levels may recede to levels below the pool bottoms and groundwater in storage continues to serve as a subsurface reservoir supporting riparian vegetation and other aquatic dependent resources.

In the absence of streamflow to replenish groundwater stored in the alluvial aquifer, the alluvial aquifer is depleted by a combination of evapotranspiration and leakage to the underlying bedrock aquifer. Subflow through the shallow alluvial aquifer varies depending on the frequency of flow events that recharge the alluvial aquifer.

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Gerber for creating a hydrologic database and GIS map. A former Haley & Aldrich Senior Geologist, Alan Cuddy designed and initiated this study during the first years of this project. We also acknowledge Paul Kroger, Geno Foushee, Rana Taha, and Katherine Miller of Haley & Aldrich for hydrologic data collection. We appreciate the support of Dr. Andrew Weil, Mr. Anthony Lunt, and the X-9 Ranch Owners Association.

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1. INTRODUCTION

1.1 Purpose and Scope

This report provides data regarding hydrogeologic conditions, streamflows and groundwater subflows in Rincon Creek, and presents a conceptual model of the hydrogeologic conditions of the middle reach of Rincon Creek. These data were collected to support an in-stream water rights application submitted by the National Park Service (NPS) for Middle Rincon Creek.

Rincon Creek is located in Pima County, Arizona in the Rincon Valley (Figure 1). The middle reach of Rincon Creek flows along the southern boundary of the Rincon Mountain District of Saguaro National Park (SAGU). This stream supports a corridor of diverse riparian trees that provide important habitat for reptiles, mammals, birds, and aquatic invertebrates. The middle reach is shared with private landowners.

Concerned by the potential impact of existing and future groundwater development to the natural resources of Rincon Creek, SAGU filed an application with the Arizona Department of Water Resources (ADWR) in December 2002 to appropriate public water from the creek for instream flow maintenance. The two beneficial uses proposed in the application included recreational use and wildlife including fish.

The amount of water needed for water-related resources including riparian flora, reptiles, and aquatic macroinvertebrates is addressed in separate reports (Briggs, 2007; Goforth and Walker, 2007; Stitt and Swann, 2007).

1.2 Description of Project Area

Located in the Rillito River watershed (USGS Hydrologic Cataloging Unit 15050302), Rincon Creek lies in Pima County, just east of Tucson, Arizona. Rincon Creek headwaters originate in the southwestern Rincon Mountains on Coronado National Forest and Saguaro National Park property. The creek leaves SAGU property, flows through private land, and reenters the park at its confluence with Chimenea Creek. For approximately 1.5 miles, Rincon Creek flows along the southern boundary of SAGU before reentering private property. This 1.5-mile-long reach of Rincon Creek is the middle reach for which SAGU has claimed an instream flow right (Figure 1). The middle reach is defined in the instream flow maintenance application as beginning at the confluence of Rincon Creek and Chimenea Creek and ending at the SAGU property boundary along the western boundary of Section 17 in T15S, R17E (Figure 5). The lower reach of Rincon Creek flows approximately 10 miles through Rincon Valley to its confluence with Pantano Wash.

The Rincon Creek watershed covers approximately 74 square miles of land owned by Saguaro National Park, Coronado National Forest, the state of Arizona, and the private sector (Briggs et al., 1997). The watershed drainage area is approximately 39 square miles at the NPS Pool A gaging station and 44.5 miles at the USGS gaging station 09485000.

The middle reach of Rincon Creek is bordered to the south by private properties within the gated community of X-9 Ranch.

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1.2.1 Vegetation

The riparian woodland along the middle reach consists of a floodplain plant community and a terrace plant community (Briggs, 2007). The floodplain community is dominated by Arizona ash with secondary cohorts including cottonwood, willow, Arizona sycamore, and Arizona walnut. Hydrophytic sedges, rushes, and cattails represent emergent and aquatic vegetation within the creek channel and floodplain.

The terrace plant community is dominated by mesquite with secondary cohorts including acacias, wolfberry, hackberry, desert willow, burrobush, graythorn, desert broom, four-wing saltbush, and grasses and forbs.

Riparian vegetation monitoring of 7 transects across the middle reach was performed by Briggs (2007) from 2002 through 2006. Designed to detect the early symptoms of stress in riparian vegetation (especially in cottonwoods, sycamores, and emergent plants) the monitoring followed protocols outlined in Briggs et al. (2002) and included percent cover, species density, and trunk diameter of woody species.

Water resources needed to maintain riparian vegetation are quantified by Briggs (2007).

1.2.2 Topography

Elevation within the watershed ranges from 8,864 feet at Rincon Creek headwaters at Mica Mountain to approximately 2,795 feet at the confluence with Pantano Wash. The middle reach of Rincon Creek starts at an elevation of 3,161 feet at Chimenea Creek to approximately 3,112 feet at the western end of the 1.5-mile reach. The streambed gradient is approximately 0.0067 (35 feet per mile).

The Rincon Mountains rise steeply to the north of Rincon Creek. An elevation gain of about 650 feet in less than 2 miles occurs northward from the creek along Camino Loma Alta (Halpenny and Halpenny, 1985). To the south, alluvial plain landforms are less steep, rising at about 85 feet per mile (Halpenny and Halpenny, 1985).

1.3 Previous Investigations

Several investigations of hydrologic and geologic conditions have occurred in the Rincon Valley (Figure 2).

- Turner and Manera (1961) performed a geologic reconnaissance of the X-9 Ranch and vicinity to identify water supplies to support the development of the X-9 Ranch.
- Manera (1962) evaluated groundwater availability for the X-9 Ranch.
- Manera (1982, 1983, 1984) evaluated groundwater supplies available to the Rincon Water Company as part of an application for a Certificate of Adequacy of Water Supply with the Arizona Department of Water Resources.
- Drewes (1977) prepared a geologic map and cross-sections of the Rincon Valley.
- Halpenny and Halpenny (1985) and Halpenny (1986) evaluated groundwater supplies to the predecessor organization to the Rocking K Ranch.
- Baird et al. (2001) described riparian and hydrologic resources in the Rincon Mountain District of Saguaro National Park.

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- MacLeod et al. (2003) mapped perennial surface waters and developed a preliminary water budget for the Rincon Mountain District of Saguaro National Park.
- The Pima Association of Governments (PAG, 2004) assessed the subsurface hydrology of Rincon Valley.
- Haley & Aldrich (2003) monitored shallow groundwater levels in Rincon Valley downstream of the middle reach of Rincon Creek.
- Richard et al. (2005) prepared a geologic map and cross sections of Rincon Valley.
- Haley & Aldrich (2005) described the construction of shallow monitor wells installed along the middle reach of Rincon Creek.

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2. CLIMATE

The dry subtropical desert climate of the Rincon Creek watershed is characterized by a strong seasonal annual temperature cycle and semiannual precipitation. Temperatures on the valley floor below 4,500 feet often exceed 100°F during the summer, and temperatures below 32°F rarely last more than 24 hours during the winter (MacLeod et al., 2003). Normal or average annual precipitation in the Rincon Mountain District of Saguaro National Park is about 12.30 inches (http://www.friendsofsaguaro.org/climate.html). Late winter/early spring precipitation is produced by incursions of mid-latitude cyclones. During late summer/early fall, localized thunderstorms produced by maritime tropical air masses from the Gulf of Mexico account for about half the annual precipitation.

The Pima County Flood Control District (PCFCD) installed rain gage 4110 (Rincon Creek at X-9 Ranch) next to the USGS gaging station (number 09485000) in 1990. Data from 23 October 2005 through 30 April 2006 are provisional. Daily precipitation at this gage during the summer/early fall and winter/early spring periods ranged up to 1.65 inches on 20 July 2001 and 1.26 inches on 4 February 1998 (Appendix A, Table A-I). Daily precipitation for October 2003 through April 2006 is plotted on Figure 3. During this period, daily precipitation during the summer/early fall and winter/early spring periods ranged up to 0.84 inches on 23 August 2005 and 1.04 inches on 12 November 2003. The mean annual precipitation for water years 1990 through 2005 was 10.94 inches based on mean monthly precipitation:

Water	Mean Monthly Precipitation (inches)											
Years	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1990-2005	0.71	0.61	1.01	0.54	1.08	0.90	0.35	0.29	0.17	1.93	2.34	1.01

Monthly precipitation for water years 2004 and 2005 are summarized and averaged in Table I. During water year 2005 months May through September when alluvial aquifer monitoring was conducted for this investigation, monthly precipitation was less than the 1990-2005 mean monthly precipitation for four of the five months. May 2005 precipitation was 24% larger than the 1990-2005 mean, and June through September 2005 precipitation ranged from 6 to 72 percent lower than the 1990-2005 means:

	Total Monthly Precipitation (inches)				
	May	Jun	Jul	Aug	Sep
Water Year 2005	0.36	0.12	1.19	2.19	0.28
Percent Difference from 1990-2005 Mean	24%	-29%	-38%	-6%	-72%

Statewide, more than 95 percent of Arizona's precipitation is lost to evapotranspiration before runoff reaches stream channels (Arizona Interstate Stream Commission, 1967). Evaporation potentials illustrated in Montgomery and Harshbarger (1989) indicate that the Rincon Valley and Mountains average more than 64 inches per year. For the Rincon Creek watershed, MacLeod et al. (2003) calculated evapotranspiration losses of approximately 87% of precipitation. For the Sierra Vista sub-watershed of the San Pedro River located approximately 55 miles southeast of Rincon Creek, ADWR (1991) estimated riparian vegetation evapotranspiration was approximately 2.45 feet per year.

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3. SURFACE WATER CONDITIONS

Prominent surface water features in the study area include Rincon Creek and pools along Rincon Creek.

3.1 Springs, Seeps, and Tinajas

A field inventory of the Rincon Creek watershed conducted in 2002 identified two perennial springs within the Rincon Creek watershed in Chimenea Canyon (MacLeod et al., 2003). The inventory also identified 2 perennial seeps, 70 perennial tinajas, and 11 ephemeral tinajas. The ephemeral tinaja classification was applied to sites containing surface water "in all but the driest weeks of most years" and was distinguished from the perennial classification based on the site's abiotic and biotic characteristics (MacLeod et al., 2003). Many of these surface water sites are located between elevations of 4,900 and 7,380 feet.

The 2002 field inventory by MacLeod et al. (2003) and observations performed by Haley & Aldrich from May 2005 through April 2006 did not identify springs, seeps, or tinajas within the middle reach of Rincon Creek.

3.2 Rincon Creek

Rincon Creek is an intermittent stream that flows in response to precipitation events and snowmelt. Two gages monitor streamflow events on the middle reach: the USGS gaging station 09485000 and the NPS Pool A gaging station (320745110365701). The NPS also installed staff gages at Pools B and C.

3.2.1 USGS Gage Streamflow Data, Water Years 1953 – 2005

Located approximately 0.6 miles downstream of Pool A, the USGS gaging station (number 09485000) has collected streamflow data since 1 October 1952. The station was operated as a continuous water stage station measuring annual runoff and discharge peaks except during October 1974 through September 1989 when it was operated as a crest-stage partial record station. Tables II and III, Figures 6 and 8, and Appendix B present USGS streamflow data.

For water years 1953 through 2005, mean monthly streamflow at the USGS gage ranged from 0.051 to 15.512 cubic feet per second (cfs), with a mean annual discharge of 5.879 cfs (Table II). The average mean monthly discharge was higher during the winter/early spring months than in the summer/early fall.

Average Mean Monthly Discharge Data from USGS Gage 09485000 (cfs)
Water Years 1953 - 2005

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2.231	1.913	8.085	15.512	15.238	12.699	3.920	0.172	0.051	1.093	9.050	2.552

The highest mean monthly flows observed during the wet year(s) 1966 and 1993 ranged from 130 cfs in December 1965 to 247 cfs in January 1993 (Figure 6). More recently, in water year 2005, mean monthly flows were recorded in December through May and in August, reaching a maximum mean monthly flow of 33.3 cfs during February.

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Total discharge at the USGS gage from May through September 2005 was approximately 0.77 percent of the average annual mean discharge for May-September.

Mean Monthly Discharge from USGS Gage 09485000 (cfs) Water Year 2005				
May	Jun	Jul	Aug	Sep
0.046	0	0	0.052	0

Drought conditions in Arizona during 1999-2004 were worse than droughts experienced in the early 1940s (Phillips and Thomas, 2005). The annual mean discharge at the USGS gage at Rincon Creek (#09485000) for water years 1999–2004 was compared to the average of the annual mean discharges for water years 1953 through 2004. Compared to the period 1953 through 2004, the percentage of average annual mean discharge at the USGS gage during water years 1999 through 2004 was below average except in 2001:

Period of	Percentage of Average Annual Mean Discharge for Water Year					
Record	1999	2000	2001	2002	2003	2004
1953-2004	25	17	190	4.4	14	45

Annual mean discharge at the USGS gage in water year 2005 was approximately 92 percent of the average annual mean discharge for 1953-2004.

3.2.2 NPS Pool A Gage Streamflow Data, 2003 – 2005

In June 2003, NPS installed a surface water gaging station at Pool A (Station #320745110365701, Rincon Creek Near Madrona Ranger Station). The drainage area is 39 square miles. Located approximately 0.6 miles upstream of the USGS gage, Pool A gage data were recorded by a datalogger at 15-minute intervals. Staff gages also were installed at Pool B (about 0.2 miles downstream of Pool A) and Pool C (about 300 feet downstream of Pool B).

Manual gage height readings were recorded biweekly from 11 June 2003 through 30 September 2005 at each pool. NPS surface water station data are included in Appendix B. From 2003 – present, NPS staff measured depth and surface areas of Pools A, B, C, and D. These data have not yet been published.

Mean monthly discharge at Pool A for water years 2004 and 2005 is presented in Table III. Mean daily discharge for water years 2004 and 2005 is illustrated in Figure 7. Mean daily discharge for water years 2003-2005 are presented in Appendix B.

For water years 2003-2005, mean daily discharge at Pool A ranged from 0 cfs during several months to 505 cfs on February 12, 2005, with a mean annual discharge of 3.54 cfs (Appendix B). Maximum mean monthly flows at Pool A were observed during early spring similar to the spring discharge at the USGS gage (Figure 8). Larger mean monthly discharge rates were observed in times of higher precipitation as summarized below:

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	Average Mean Monthly Discharge and Mean Monthly Precipitation Water Years 2004-2005											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
USGS (cfs)	0	0	0.012	8.95	25.42	11.18	5.59	0.053	0	0.004	0.081	0.002
Pool A (cfs)	0	0	0.08	7.60	18.27	11.81	5.74	0.15	0	0	0.025	0
Precipitation (inches)	0.54	0.80	0.36	1.54	1.28	0.82	0.64	0.18	0.08	1.65	2.13	0.76

Mean monthly discharge at the Pool A gage in May 2005 was nearly three times the discharge measured at the USGS gage. No flow was recorded at the Pool A gage during June through September 2005.

	Mean Monthly Discharge (cfs), Water Year 2005				
	May	Jun	Jul	Aug	Sep
USGS Gage	0.046	0	0	0.052	0
Pool A Gage	0.08	0	0	0	0

Mean monthly discharge at the Pool A gage in May 2005 (0.08 cfs) was approximately 38 percent of the mean monthly discharge in May 2004 (0.21 cfs). Mean monthly discharge at the Pool A gage in May-September 2005 was approximately 31 percent of the mean monthly discharge in May-September 2004.

3.2.3 Rincon Creek Water Chemistry

Surface water samples were collected during one low flow event in May 2005. The investigation plan included collecting stream samples under medium and high flow conditions as well, but such flows did not occur during the study period.

Analysis of samples collected in May 2005 at Pool A and the USGS gage during low flow conditions indicated that surface water is characterized as calcium bicarbonate type water (Table IV and Figure 9).

Field parameters were measured from 10 locations along the middle reach between May 2005 and January 2006 (Table V). Due to below normal winter precipitation, the locations were dry when monitored during February through April 2006 and limited data are available to describe changes in temperature, specific conductivity, and pH at the monitoring locations. In general, as temperature increased during the late spring/summer months in 2005, specific conductivity increased from as low as 190 micromhos per centimeter (umhos/cm) at Pool D to as high as 700 umhos/cm at Pool 3. The pH ranged from slightly acidic to slightly basic from 6.2 pH units at Pool B to 8.5 pH units at the Tributary, and is likely influenced by biological activity in the pools.

3.2.4 Temporal/Spatial Variations in Wetted Lengths of Study Reach

Wetted lengths of the middle reach were monitored biweekly by NPS staff from 2003 through April 2006 and monthly by Haley & Aldrich from May 2005 through April 2006. Wetted lengths represented reaches of pooled and/or flowing surface water. Figures 10, 11, and 12 illustrate the approximate lengths of wetted reaches between the USGS gage and Chimenea Creek in 2003, 2004, and 2005.

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Water persisted longest in the middle reach between Pools C and D. Wetted lengths were longest during and following winter flow events, and receded during the spring and early summer when runoff from summer precipitation rewetted the stream. June and July tended to have the shortest wetted reach lengths; and January through April the most extent. From November 2005 through April 2006, the creek was dry during the bimonthly monitoring events.

3.2.5 Pool Characteristics

Water level elevations were monitored at three pools (A, B, and C) equipped with staff gages. Daily mean water surface elevations for Pool A and observed staff plate gage values for Pools B and C are presented in Table VIII. Surface water elevations for Pool A and wells RC-1, RC-2, and RC-3; and for Pools B and C and wells RC-4, RC-5, and RC-6 are presented in Figures 17 and 18, respectively.

During 2004-2005, Pool A water levels rose during the winter months and dried out during the summer. Alluvial aquifer groundwater levels at wells RC-1, RC-2, and RC-3, located approximately 450 feet downstream of Pool A, decreased from April through September 2005. From April through July, groundwater levels were highest at well RC-2. Well RC-3, located farthest from the stream channel, had the lowest groundwater elevations throughout the period. Water levels in RC-1, located next to the creek, declined through August but rebounded in September. Comparison of pool water level elevation data with water level elevation data in monitor wells RC-1, RC-2, and RC-3 from the period April 2005 through September 2005 are limited, but do indicate a linear decline in pool levels and groundwater levels (Figure 17). These changes in water levels indicate that pool levels are sustained by groundwater in the alluvium.

Pools B and C are located approximately 575 and 340 feet upstream of the RC-4, RC-5, and RC-6 well array (Figure 5). Similar to Pool A, Pools B and C contained water during the winter months and became dry during the summer. Groundwater levels in RC-4, RC-5, and RC-6 declined from April through August 2005 and became dry during August. Comparison of pool water level elevation data with water level elevation data in monitor wells RC-4, RC-5, and RC-6 from the period April 2005 through September 2005 are limited, but do indicate a linear decline in pool levels and groundwater levels (Figure 18). These changes in water levels indicate that pool levels are sustained by groundwater in the alluvium, though the data are limited.

Elevations for surface water and the pool bottom at Pool B are estimated (Table VIII, Figure 18). In April 2007, the NPS resurveyed staff gages at Pools A and C, measuring points and benchmarks at wells RC-1 through RC-7, and the measuring point at the Lunt well. The Pool B staff gage was relocated in May 2005 following damage during February 2005 streamflow events and destroyed during a July 2006 flood event. Because the Pool B staff gage could not be resurveyed during April 2007, all elevations for this pool are estimated. Comparisons of prior survey data indicated that Pool B surface water level elevations and the pool bottom elevation were higher than Pool C elevations. Using 2007 survey data for all objects except Pool B, Figure 18 does not accurately reflect elevational differences between Pool B and Pool C.

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4. GEOLOGY

The geology of Rincon Valley was recently mapped by Richard et al. (2005). Prior studies describing area geology included Turner and Manera (1961), Davidson (1973), Drewes (1977), Halpenny and Halpenny (1985), Halpenny (1986), and MacLeod et al. (2003). Figure 4 presents surficial geology near the middle reach of Rincon Creek. Cross-sectional representations of geology perpendicular to and along the middle reach of Rincon Creek are presented in Figures 13 through 15.

4.1 Regional Geology

Two major faults occur in the Rincon Creek watershed. The Catalina Detachment Fault trending westward in the northern part of the watershed is downthrown to the south by several hundred feet (Figure 4). The Pantano Fault trending north-northwestward just east of Pantano Wash is downthrown to the west-southwest by about 850 feet. Represented as a concealed fault by Davidson (1973), the Pantano Fault was not illustrated on the geologic map prepared by Richard et al. (2005) because the exact location and geometry of the fault is unknown (Richard, personal communication, 2007). The Pantano Fault is not illustrated in this report.

While the Catalina Detachment Fault has little or no impact on groundwater flow, the Pantano Fault appears to act as a hydrogeologic barrier between Rincon Valley groundwater and Tucson basin groundwater (Halpenny and Halpenny, 1985). The Tucson basin is located northwest of Rincon Valley and is not illustrated in this report.

The Rincon Mountains are a metamorphic core complex of mixed granitoid and gneiss of Proterozoic, Cretaceous, and Tertiary age composing the footwall complex of the mountains (Richard et al., 2005). The leucocratic granitoid Wrong Mountain Quartz Monzonite dominates the footwall (Drewes, 1977) and intrudes into older schist, gneiss, diorite, granodiorite, and granite. In the Rincon Creek area, Wrong Mountain Quartz Monzonite occurs in heterogeneous gneiss and mylonite (TXmy), mixed granitoid and gneiss (TXg), and schist and gneiss (TXgn) as illustrated on Figure 4 (Richard et al., 2005).

Precambrian Rincon Valley Granodiorite and other granite/granitoid phases underlie most of the central part of Rincon Valley (Richard et al., 2005). Limestone outcrops of the Cambrian-aged Abrigo Formation and Bolsa Quartzite occur in localized areas in the X-9 Ranch area (Richard et al., 2005). The Bolsa Quartzite is up to 150 feet thick and is conformably overlain by the Abrigo Limestone (Turner and Manera, 1961). The Abrigo Formation thickness exceeds 86 feet as indicated by the Green Tank mine shaft in Section 10, T15N, R17E (Manera, 1982).

Late Jurassic to Cretaceous Bisbee Group sedimentary rocks occur north of Rincon Creek in Sections 10 through 14, T15S, R16E.

The primary sources of data describing Tertiary to Quaternary geology in the Rincon Valley were summarized in reports assessing the occurrence, movement, and availability of groundwater prepared in support of a large master planned community at Rocking K Ranch and its predecessor organization (Halpenny and Halpenny, 1985; Halpenny 1986), and water supply studies conducted in support of the development of the X-9 Ranch (Turner and Manera, 1961; Manera, 1962). In the Rocking K area in Township 15 South, Range 16 East, Halpenny and Halpenny (1985) identified the Quaternary Fort Lowell Formation and the

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Tertiary Tinaja Formation as the primary water-bearing units. These formations do not occur as outcrops in Rincon Valley. In the X-9 Ranch area, Manera (1962) identified the Pantano Formation as the principal aquifer.

A red-brown to tan sandstone and conglomerate, the Oligocene Pantano Formation outcrops east of Sentinel Butte in the X-9 Ranch area (Richard et al., 2005). Well indurated to weakly consolidated and very poorly sorted, the Pantano Formation is not considered to be a prolific water-bearing unit (Halpenny and Halpenny, 1985).

Miocene to Pliocene Tinaja Formation unconformably overlies the Pantano Formation in the Tucson basin and provides water to wells completed within the formation. Composed of gravel to clayey silt and mudstone and interbedded with basaltic andesite flows and dacite tuff, the Tinaja beds do not outcrop in Rincon Valley, but may occur at depth in the western portion of the valley (Halpenny and Halpenny, 1985). West of the Pantano Wash, the Tinaja Formation was encountered at 1,030 feet during well drilling at D(15-16)29bbd.

The Fort Lowell Formation unconformably overlies the Tinaja beds in the Tucson basin. Composed of gravel to clayey silt, the Fort Lowell Formation is loosely packed to weakly cemented and coarser-grained than the Tinaja. With an average porosity of 30 percent and hydraulic conductivity ranging from 150 to 700 gallons per day per square foot, the Fort Lowell Formation is the primary water bearing unit of the Tucson basin (Halpenny and Halpenny, 1985). Well yields range from 500 to 1,500 gallons per minute (gpm). Fort Lowell Formation does not outcrop in Rincon Valley, but may occur at depth in the western portion of the valley.

In the eastern portion of the valley, Quaternary alluvial deposits occur along modern stream and wash channels traversing the Rincon Valley Granodiorite and other granite / granitoid units mapped by Richard et al. (2005). Surficial materials in the western half of the valley are comprised of Quaternary alluvium, floodplain, and terrace deposits.

The Quaternary sediments overlying the primary water-bearing units include alluvium and terrace deposits. Surficial geology in the western portion of Rincon Valley are dominated by these deposits. Alluvium and terrace deposits range in thickness from a few inches to about 100 feet (Halpenny and Halpenny, 1985).

Holocene alluvial deposits in Rincon Valley provide efficient infiltration of runoff and storage of groundwater for utilization by riparian vegetation. These materials provide for temporary storage and infiltration of runoff from Rincon Creek through older alluvium to the underlying bedrock (e.g., Fort Lowell Formation, Tinaja Formation, or Pantano Formation). Holocene alluvium underlies the bed of Rincon Creek and is approximately 200 to 800 feet wide. The thickness of the Holocene alluvium is reported to vary between 40 and 100 feet (Halpenny, 1986). Based on published reports, maps, and review of well driller's logs, the Holocene alluvium is generally comprised of extremely coarse and permeable mixtures of gravel, coarse sand, cobbles and occasional silt lenses.

4.2 Study Area Geology

This section describes geology along the middle reach of Rincon Creek (Figure 4). Geologic cross sections parallel and transverse to the middle reach are illustrated on Figure 14 and 15.

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4.2.1 Bedrock Geology

South of the middle reach, bedrock outcrops are predominantly the Precambrian Rincon Valley Granodiorite and other granitic units from Sentinel Butte to the downstream end of the reach. East of Sentinel Butte, bedrock outcrops south of the study reach are primarily Tertiary Pantano Formation. The Pantano Formation also outcrops along the bottom of the middle reach of Rincon Creek and in a few locations north of the reach (Richard et al., 2005).

North of the middle reach, Wrong Mountain Quartz Monzonite outcrops within 0.75 mile as heterogeneous gneiss and mylonite (TXmy), mixed granitoid and gneiss (TXg), and schist and gneiss (TXgn).

Just east of Sentinel Butte, a concealed fault contact lies between the Pantano Formation and the Rincon Valley Granodiorite.

Abrigo Formation limestone outcrops about 0.75 mile south southeast of the middle reach of Rincon Creek.

4.2.2 Quaternary Geology

Holocene alluvium within and adjacent to the middle reach of Rincon Creek consists of channel and terrace deposits (Richard et al., 2005). Terrace deposits are composed of sand, silt, and clay with pebble and cobble bar deposits. Channel sediments include coarse, very poorly-sorted sand, gravel, cobbles, and boulders. Along the middle reach, the alluvium is approximately 800 feet wide.

Lithologic logs of seven monitor wells installed in the terrace south of the study reach indicated that the alluvium was approximately 7.5 to 15 feet thick, composed of coarse sand with gravel, and underlain by the Pantano Formation.

4.2.3 Floodplain and Terrace Extent

As part of the hydrologic investigation, the floodplain alluvium/terrace boundaries were mapped by field observation of the contact between young, unconsolidated alluvium and adjacent consolidated bedrock or older alluvial deposits (Figure 5). The width of alluvium/terrace deposits along the middle reach of Rincon Creek was approximately 800 feet.

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5. HYDROGEOLOGIC CONDITIONS

The Rincon Creek watershed lies within the Upper Santa Cruz alluvial basin in the Basin and Range Lowlands Hydrogeologic Province (White et al., 1963). This province is characterized by northwest-trending mountain ranges separated by alluvial valleys and basins. Composed of fractured metamorphic and igneous rocks, the mountain ranges tend to act as aquifer boundaries. Sedimentary units within the mountains tend to be well-lithified with low transmissivity, but in some localities may act as important aquifers (Montgomery and Harshbarger, 1989).

Between the mountain ranges, basins are filled with as much as several thousand feet of Quaternary- and Tertiary-aged erosional materials. Acting as the principal aquifers in the Basin and Range Lowlands Province, basin-fill deposits have a range of permeability and can store large volumes of groundwater (Halpenny et al., 1952). Quaternary floodplain alluvium occurring along modern drainage channels is generally composed of unconsolidated coarse-grained sand and gravel. The floodplain alluvium tends to be highly permeable and may yield large amounts of groundwater to wells where saturated (Montgomery and Harshbarger, 1989).

The primary geologic units within the study area include Holocene alluvium, and mid-Tertiary aged Pantano Formation overlying Precambrian granitic rocks. The contact between the base of the Pantano Formation and the underlying granite is along a southwest dipping low-angle detachment fault (Richard et al., 2005; Manera, 1982). The Pantano Formation consists of a well-cemented, reddish-brown conglomerate and varies in thickness up to approximately 400 feet. Overlying the Pantano Formation are modern stream deposits and Holocene floodplain and terrace deposits (Richard et al., 2005).

The following sections provide information regarding the shallow alluvial aquifer from data collected during the drilling, construction, and testing of alluvial wells RC-1 through RC-7. Information on the water bearing properties of the underlying bedrock and the bedrock aquifer are based on interpretation of well logs, pump tests, and water quality data at the X-9 Ranch (Manera, 1982).

5.1 Hydrogeologic Units

For the purposes of this investigation, two principal hydrogeologic units are described:

- the shallow, unconfined aquifer consisting of unconsolidated alluvium and terrace deposits, and
- the underlying bedrock aquifer comprised of the Pantano Formation and the deeper granite.

5.1.1 Alluvial Aquifer

5.1.1.1 Alluvial Aquifer Materials

Information regarding the drilling, construction, and testing of alluvial wells RC-1 through RC-7 is provided in *Construction of Monitor Wells RC-1, RC-2,*

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RC-3, RC-4, RC-5, RC-6, and RC-7 at Rincon Creek, Pima County, Arizona (Haley & Aldrich, 2005). Appendix D, Table D-III lists well construction data including revised measuring point elevations and ground surface elevations following the April 2007 resurvey performed by the National Park Service.

Descriptions of the alluvial aquifer materials were based on the cuttings observed during drilling and construction of alluvial wells RC-1, RC-2, RC-3, RC-4, RC-5, RC-6, and RC-7 in April 2005. The alluvial wells were drilled through approximately 7.5 to 15 feet of alluvial material to the top of the underlying Pantano Formation conglomerate. The wells were drilled within the terrace deposits outlined in Figures 4 and 5. Two well arrays were installed approximately perpendicular to Rincon Creek: RC-1, RC-2, and RC-3 located downstream of Pool A and RC-4, RC-5, and RC-6 located downstream of Pool C.

The alluvial materials described during drilling generally consisted of yellow-brown, rounded to sub-rounded, well-sorted to poorly-sorted, coarse sand with gravel. Observations of alluvial thickness during drilling indicates a slight increase in thickness towards the upland area within the terrace deposits. The alluvial thickness for wells RC-1, RC-2, and RC-3 were 7.5 feet, 12 feet, and 15 feet, respectively, while the alluvial thickness for wells RC-4, RC-5, and RC-6 were 8 feet, 10 feet, and 12 feet, respectively. The alluvial thickness at well RC-7 was approximately 5 feet.

5.1.1.2 Alluvial Aquifer Characteristics

After completion of the alluvial wells, static water levels in the wells ranged from approximately 3.5 to 10 feet below land surface (bls) on 29 April 2005 (Haley & Aldrich, 2005). Based on the 29 April 2005 water levels, the saturated thickness of the alluvial aquifer ranged from 0 feet at RC-7 to approximately 6 feet at RC-2 (Appendix C, Figures C-1 through C-7).

Short term constant rate pumping tests and recovery tests were performed on wells RC-1, RC-2, and RC-3 on 11 May 2005 (Appendix D). The pumping tests were conducted for 30 minutes at wells RC-1 (38 gallons per minute [gpm]) and RC-3 (33 gpm), and 45 minutes at RC-2 (33 gpm). Estimated hydraulic conductivity values were calculated using the Cooper-Jacob analytical method. Based on the pumping and recovery tests, the estimated hydraulic conductivity of the alluvial materials ranged from 630 feet per day to 1,900 feet per day.

5.1.1.3 Groundwater Flow in Alluvial Aquifer

Table IX and Appendix C provide water level elevation data for alluvial wells RC-1 through RC-7 from approximately May through September 2005. Appendix C figures C-1 through C-7 are water level elevation hydrographs for these wells. Groundwater levels were recorded at 15-minute intervals in wells RC-1, RC-2, and RC-3 using dataloggers. Mean daily water levels for these wells are presented on the hydrographs. Water levels were measured in wells RC-1 and RC-3 from 11 May 2005 to 30 September 2005, and in well

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RC-2 from 04 June 2005 to 30 September 2005. Water levels in wells RC-4 through RC-7 were measured manually using a water level sounder approximately once per month from the end of April 2005 through September 2005.

The wells were installed in April 2005 after a period of winter rainfall (Figure 3). The water level hydrographs indicate that water levels in the alluvial aquifer wells steadily declined from the end of April to late July 2005. Summer monsoon rains during late July through August resulted in sharp peaks in the hydrograph in well RC-1 and relatively subdued peaks in RC-2 and RC-3 (Figures C-1 through C-3). The alluvial aquifer at wells RC-4 through RC-7 did not appear to be affected by the summer monsoon rains, and were dry during this time period. However, water levels in wells RC-4 through RC-7 were only measured once per month, and influences of the monsoon rains may not have been observed during these monitoring events. Although streamflow data at Pool A indicated there was no surface flow in Rincon Creek at this location during July or August 2005 (Table III), the hydrograph peaks in water levels at wells RC-1, RC-2, and RC-3 suggest recharge occurred from the stream. Mean daily discharge data from the USGS gage indicated streamflow in Rincon Creek only occurred on 04 August 2005 (0.12 cfs) and 09 August 2005 (1.5 cfs) (USGS, 2006). Tributaries between Pool A and the USGS gage may have contributed to the streamflow measured at the USGS gage.

Following the summer monsoon rains, water levels continued to decline in wells RC-1 through RC-3 until wells RC-1 and RC-3 went dry at the end of September 2005. Well RC-2 was the only well that was not dry at this time. Well RC-2 appears to be located in a slight depression on top of the Pantano Formation, resulting in a slightly greater saturated thickness.

Based on water level information from the alluvial aquifer wells, the alluvial aquifer went dry at wells RC-4 and RC-5 between 01 June and 08 July 2005 (Figures C-4 and C-5). The alluvial aquifer at well RC-6 went dry sometime between 08 July and 05 August 2005 (Figure C-6). The alluvial thickness at RC-7 observed during drilling was only 5 feet. This well has been dry since it was installed (Figure C-7), with no saturated thickness within the alluvium at this location during the study period. As indicated on Figures C-1 and C-3, water levels measured at RC-1 and RC-3 in late September 2005 were below the bottom of the alluvial aquifer. Well RC-2 did not go dry during the study period (Figure C-2).

Figure 16 is a groundwater elevation map for the alluvial aquifer on 29 April 2005. The water levels in the alluvial wells were relatively high on 29 April 2005 compared to May through September 2005. The groundwater elevation contours on Figure 16 indicate that the lateral direction of groundwater movement in the alluvial aquifer is from east to west, approximately parallel to Rincon Creek. The hydraulic gradient within the alluvial aquifer was approximately 0.01 feet per foot, similar to the stream gradient.

Water level elevation data for alluvial monitor wells RC-4, RC-5, and RC-6 indicate a slight hydraulic gradient away from the creek, providing further

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indication that the creek and the alluvium are hydraulically connected (Figure 18).

5.1.1.4 Alluvial Aquifer Water Chemistry

Groundwater samples were collected from RC-1, RC-2, and RC-3 for inorganic laboratory analyses (Table VI). Groundwater type as defined by the predominant cation and anion indicate that groundwater in the alluvial aquifer is a sodium-sulfate type at well RC-1 and a calcium-sulfate type at wells RC-2 and RC-3. Total dissolved solids ranged from 160 to 240 milligrams per liter. Specific conductance measured in well RC-2 appeared incongruous with the TDS concentration and with measurements obtained at wells RC-1 and RC-3, and is likely a measurement error.

5.1.2 Bedrock Aquifer

5.1.2.1 Well Inventory

A well inventory performed for this study searched ADWR's Wells 55 Registry (ADWR, 2004) and identified 22 domestic or stock watering wells within 0.5 mile of the middle reach of Rincon Creek (Table X, Figure 5). Eight of these wells were field checked to verify location. Additional unregistered and unknown wells may exist in the area.

In addition, a water supply investigation conducted in 1982 at the X-9 Ranch for the Rincon Water Company (RWC), Manera (1982) provided data collected during the drilling, construction, and testing of water supply wells in the 1960s. The water supply wells can be classified into two groups: wells completed in the Pantano Formation, and wells drilled into the contact of the Pantano Formation and the underlying granite.

Data from driller's logs and well completion forms were used to evaluate subsurface conditions. Information appearing on these forms is often limited, and in many cases, of limited detail.

A. Wells Completed in the Pantano Formation

The two wells completed in the Pantano Formation in the study area include the following:

- D(15-17)17ada (ADWR well number 55-633106; aka Lunt well)
- D(15-17)17acb (ADWR well number 55-633108; aka McKenzie well)

The Lunt well was drilled to a total depth of 455 feet bls. The driller's log for this well indicates that fractures were encountered during drilling, but a bail down test indicated the well would only make about 3 gallons per minute (gpm). The well log indicates the top of the Pantano Formation was encountered at about 14 feet bls, and a casing was set to 10 feet bls. This well does not appear to be completely sealed off from the unconsolidated alluvial aquifer, and water level elevations appear to fluctuate with streamflow. The static water level fluctuated from about 10 to 20 feet below the measuring

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point from March 2003 to March 2006 (Figure C-10). Water quality data were not available for this well.

The McKenzie well was drilled to a total depth of 152 feet bls. The driller's log did not indicate that fractures were encountered during drilling. The log indicates that the Pantano Formation was possibly encountered at a depth of 21 feet bls. A 16-inch casing was installed to a depth of 26.5 feet and was perforated from 12 to 24 feet. It is not known whether the well was completed as an open hole from 26.5 feet to the total depth of 152 feet. A bailer test on this well following completion indicated 2 feet of drawdown at a rate of 60 gpm. This well appears to produce water from the unconsolidated alluvial aquifer. The static water level in 1965 was 12 feet bls. Water quality data were not available for this well.

The available well logs, static water levels, and pumping rates indicate that these two wells may be open to the shallow, unconsolidated alluvial aquifer. The Pantano Formation does not appear to transmit appreciable quantities of water to these wells.

B. Wells Completed in the Pantano Formation and Underlying Granite

Wells drilled to the contact of the Pantano Formation and the underlying granite include:

- D(15-17)16acc (ADWR well number 55-607532; aka RWC 1)
- D(15-17)16adc (ADWR well number 55-607531; aka RWC 8)
- Possibly D(15-17)16bda (ADWR well number 55-564266; aka Weil Well)
- Possibly D(15-17)16acd (ADWR well number 55-537373; aka Bixler Well)

These wells are characterized by static water levels of approximately 65-80 feet bls, and comparatively high production rates. The RWC 1, Weil, and Bixler wells were cased through the alluvial aquifer. Because detailed construction records are not available for RWC 8, it is not possible to determine if this well is sealed through the alluvial aquifer. Manera (1982, 1984) reported water level fluctuations in RWC 8 that mirrored seasonal precipitation patterns.

During drilling of RWC 1 and RWC 8 at the X-9 Ranch, the static water level was approximately 8 feet bls until the contact between the Pantano Formation and the underlying granite was encountered. According to Manera (1982), this contact was encountered at depths of approximately 265 and 340 feet, respectively, at RWC 1 and RWC 8. Once this contact was encountered, the water levels in the boreholes dropped to depths of 75 and 64 feet bls, respectively.

Pumping rates at RWC 1 and RWC 8 were reported to range from 560 to 1,550 gpm (Manera, 1982).

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5.1.2.2 Bedrock Aquifer Hydrogeology

Based on previous investigations and review of publicly available data, the bedrock aquifer, as defined for this investigation, is characterized by variable production rates depending on well depth, and water levels much deeper than the alluvial aquifer. Wells completed in the Pantano Formation tend to reflect low production rates and deeper water levels, while wells completed in the deeper crystalline rocks or in both Pantano Formation and deeper crystalline rocks reflect higher production rates and deeper water levels.

Manera (1962, 1982) suggested that some wells in the X-9 Ranch area may intercept water-producing fractures. Well D(15-17)10cca draws water from fractured limestone that is recharged by leakage from Rincon Creek (Manera, 1962). A fracture intercepted by wells RWC 1 and RWC 8 may represent the sole of the thrust plate (Manera, 1982). The lower aquifer at these wells is comprised of sand, gravel, and clay layers near the contact between the Pantano Formation and the underlying granite. Manera (1982) suggested these materials could be gouge formed during thrust faulting.

Available data are not sufficient to describe the direction of groundwater movement in the bedrock aquifer.

Groundwater levels were measured in three private wells located within 0.5 miles of the middle reach of Rincon Creek from late 2002 or early 2003 through April 2006 (Table XI). Weil well D(15-17)16bda and Bixler well D(15-17)16acd are active domestic wells, and Lunt well D(15-17)17ada is an inactive stock watering well (Figure 5). Hydrographs for these wells are presented in Appendix C.

Groundwater levels declined in the domestic wells by 6.15 feet in the Bixler well from February 2003 through April 2006 and by 6.60 feet in the Weil well from September 2002 through April 2006 (Appendix C, Figures C-8, C-9 and C-13).

From April through December 2004, groundwater levels in the inactive stock well (Lunt) declined about 10 feet (Appendix C; Figures C-10 and C-13). Between December 2004 and February 2005; groundwater levels increased by about 10 feet and gradually declined by more than 12 feet through April 2006. As indicated in section 5.1.2.1, this well does not appear to be completely sealed off from the alluvial aquifer and groundwater levels in this well may be influenced by alluvial aquifer conditions.

Water level elevations are higher in the alluvial aquifer than in the bedrock aquifer. Manera (1982) reported static water depths of approximately 8 feet as wells RWC 1 and RWC 8 were drilled through the alluvial aquifer. In the bedrock aquifer, static water depths increased to 75 feet in RWC 1 and 64 feet in RWC 8 at drilling depths of 265 feet and 340 feet, respectively.

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5.1.2.3 Bedrock Water Chemistry

Groundwater collected from the Weil well in April 2005 was analyzed for inorganic constituents (Table VI). Turner and Manera (1961) and Manera (1982) reported inorganic results for samples collected from Rincon Water Company wells RWC 1 in the 1960s through 1980 and RWC 8 in 1968 (Table VII). The ability to interpret bedrock water quality data is limited due to varying dates of sample collection. Temporal variations may account for some of the water quality differences.

Figure 9 presents a trilinear diagram for water quality at RWC 1, RWC 8, and the Weil well collected in 1980, 1968, and 2005. Water quality results for RWC 1 and the Weil well are similar, including similar elevated TDS, sulfate, and fluoride (Tables VI and VII). The similarity in water levels and water quality for RWC 1 and the Weil well indicate these wells may be completed within the same water-bearing zone.

The water quality from RWC 8 was distinct from that of RWC 1 and the Weil well, with lower hardness, sulfate, and fluoride concentrations (Table VII). The static water level of RWC 8 is similar to those of RWC 1 and the Weil well (Manera, 1982), but the distinct water quality at RWC 8 suggests that RWC 8 may be completed in a different water bearing zone. Temporal variations may account for some of the water quality differences.

The trilinear water quality diagram indicates that water chemistry differs between the alluvial aquifer and bedrock aquifer (Figure 9). The alluvial aquifer groundwater (RC-1, RC-2, and RC-3) appears as a calcium sulfate type while the bedrock aquifer groundwater (Weil and RWC 1) appears as a sodium sulfate type. Furthermore, bedrock aquifer water chemistry of active wells is distinct from surface water chemistry (Pool A, USGS Gage) which appears as a calcium bicarbonate type. The 1968 groundwater sample collected from RWC 8 was comparable to the Pool A sample.

5.1.3 Groundwater Use

Private wells withdraw an unknown amount of water from the deep aquifer each year. A well inventory performed for this study searched ADWR's Wells55 Registry (ADWR, 2004) and identified 22 domestic or stock watering wells within 0.5 mile of the middle reach of Rincon Creek (Table X, Figure 5). Well depths ranged from 15 to 500 feet. Eight of these wells were field checked to verify location. Additional unregistered and unknown wells may exist in the area.

The Rincon Water Company (RWC) has withdrawn groundwater from the deep aquifer since 1986. RWC groundwater withdrawals have averaged 25 ac-ft/yr, primarily from well RWC 1 (Table XII). During the study period of the middle reach, RWC withdrawals totaled 14.58, 16.55, and 24.87 ac-ft in 2003, 2004, and 2005, respectively.

The Pima Association of Governments (2004) estimated that exempt wells in Rincon Valley pumped 0.5 acre-feet per well annually, similar to exempt wells in the Tucson AMA. Applying this estimate to the 22 domestic or stock watering wells near the

middle reach of Rincon Creek, approximately 11 acre-feet of groundwater may be pumped on an annual basis. One of these wells, D(15-17)17bba, was installed by RWC as a non-exempt water supply well capable of pumping 50 gpm. The current status of this well is unknown.

5.2 Alluvial Groundwater – Surface Water Interaction

Data describing alluvial groundwater and surface water interaction are limited due to the below normal precipitation during the study period. However, comparison of pool water level elevation data with alluvial monitor well data from the period April 2005 through September 2005 do indicate that surface water, including pools in the middle reach of Rincon Creek, is hydraulically connected to the alluvial aquifer.

Comparison of Pool A water level elevation data with water level elevation data from monitor wells RC-1, RC-2, and RC-3, from the period April 2005 through September 2005, indicate a direct and linear decline in pool levels and groundwater levels. These changes in water levels indicate that pool levels are sustained by groundwater levels in the alluvial aquifer (Figures 17 and C-11). In April and May 2005, groundwater elevations in the alluvial aquifer were higher than pool levels indicating a gradient from the aquifer toward the pool. Alluvial water levels in RC-1, RC-2, and RC-3 in August and September 2005 suggest water level increases in direct response to streamflow even though no surface water flows were recorded at Pool A. These water level responses indicate a direct hydraulic connection between Rincon Creek and the alluvial aquifer.

Comparison of Pool B and Pool C water level elevation data with water level elevation data from monitor wells RC-4, RC-5, and RC-6, located downstream of the pools, indicate similar responses (Figures 18 and C-12). Although the data are limited, they do indicate a similar decline in pool levels and alluvial groundwater levels, indicating that pool water levels are sustained by groundwater in the alluvial aquifer and indicate a direct hydraulic connection between Rincon Creek and the alluvial aquifer.

August 2005 water level data in alluvial monitor wells RC-1 and RC-2 indicate several short duration increases in water level (Appendix C), probably in response to streamflow events in Rincon Creek resulting from precipitation events recorded in August 2005. The observed water level responses in alluvial monitor wells RC-1 and RC-2 during August 2005 provide further indication of the direct hydraulic connection between surface water flows in Rincon Creek and water levels in the alluvial aquifer.

Water level data collected from wells RC-1 through RC-7 were used to estimate the approximate lateral extent of groundwater in the alluvial aquifer within the study area (Figure 19). The lateral extent of saturated alluvium at approximately monthly intervals was estimated using water level measurements from wells RC-1 through RC-7 and the lateral extent of the alluvial aquifer was estimated using vegetation and geomorphic features. Figure 19 shows a gradual decrease in the alluvial aquifer "reservoir" for the months May 2005 through September 2005. Decreases in the lateral extent of the alluvial aquifer result from a combination of evapotranspiration and leakage from the alluvial aquifer to the underlying bedrock aquifer. Estimates of the relative proportion of evapotranspiration and leakage are discussed in the next section.

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5.2.1 Water Budget Estimate

Due to limited information, developing a water budget for the middle reach of Rincon Creek is difficult and requires the use of simplifying assumptions, including estimates of subflow. In addition, investigations along the middle reach of Rincon Creek have not included measurements of evapotranspiration or seepage from the alluvial aquifer to the bedrock aquifer.

A water budget was calculated using water year 2004 data, the first complete year for which streamflow data were available near the upper and lower boundaries of the Middle Reach of Rincon Creek. The 51.6-acre surface area defined for the water budget extended between the terrace boundaries on either side of the Creek and between the Pool A gage and the USGS gage (Figure 19). This area was calculated by running an ESRI ArcMap 9.1 area calculation routine on the polygon representing the water budget area. The terrace boundaries were mapped by field observation of the contact between young, unconsolidated alluvium and adjacent consolidated bedrock or older alluvial deposits.

Inflows to the alluvial aquifer between the Pool A gage and the USGS gage were precipitation, seepage from stream to aquifer, and subflow. Outflows from the alluvial aquifer included evapotranspiration, seepage from aquifer to stream, subflow, and leakage from the alluvial aquifer to the underlying bedrock aquifer.

The cross-sectional area for Pool A was assumed to be the same as the cross-sectional area at wells RC-1, RC-2, and RC-3. At the USGS gage, the cross-sectional area was assumed to be similar to the cross sectional area at RC-7.

The cross-sectional area for Pool A was estimated by calculating four subareas:

1) The rectangular area between RC-1 and RC-2 equaled the average depth to bedrock times the distance between the wells:
   $A_1 = 0.5\ (7.5\ ft + 12\ ft) \times 132.2\ ft$
   $A_1 = 1{,}289\ ft^2$
2) The rectangular area between RC-2 and RC-3 equaled the average depth to bedrock times the distance between the wells:
   $A_2 = 0.5\ (12\ ft + 15\ ft) \times 142.7\ ft$
   $A_2 = 1{,}926\ ft^2$
3) The triangular area between RC-1 and the northern alluvial aquifer boundary equaled half of the product of the depth to bedrock at RC-1 times the distance between RC-1 and the boundary:
   $A_3 = 0.5\ (7.5\ ft \times 88.9\ ft)$
   $A_3 = 333\ ft^2$
4) The triangular area between RC-3 and the southern alluvial aquifer boundary equaled half of the product of the depth to bedrock at RC-3 times the distance between RC-3 and the boundary:
   $A_4 = 0.5\ (15\ ft \times 153.2\ ft)$
   $A_4 = 1149\ ft^2$

The total cross-sectional area for Pool A was 4,697 ft^2.

The cross-sectional area for the USGS gage was estimated by calculating the trapezoidal area along the RC-7 cross section. The longer parallel side of the trapezoid equaled the surface distance along the cross section between the northern

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and southern boundaries of the alluvial aquifer; this distance measured 239 ft. The shorter parallel side of the trapezoid representing the bedrock surface was assumed to be half the length of the surface distance across the alluvial aquifer, 119.5 ft. The bedrock elevation along the bottom of the trapezoid was assumed to equal the RC-7 bedrock elevation of 3,134.5 feet above mean sea level. The thickness (t) of the aquifer was calculated by subtracting the bedrock elevation from the average surface elevations at RC-7, the intersection of the cross section with the northern alluvial aquifer boundary, and the intersection of the cross section with the southern alluvial aquifer boundary:

$$t = [(3{,}144.5 \text{ ft} + 3{,}143 \text{ ft} + 3{,}158 \text{ ft})/3] - 3{,}134.5 \text{ ft} = 14 \text{ ft}$$

The trapezoidal cross-sectional area for the USGS gage was calculated as

$$A = 0.5\ (239 \text{ ft} + 119.5 \text{ ft}) \times 14 \text{ ft}$$
$$A = 2{,}510 \text{ ft}^2$$

For purposes of calculating a water budget, subflow was assumed to occur through half the thickness of the alluvial aquifer. This assumption was based, in part, on observed water levels in alluvial monitor wells which indicated the thickness of saturated alluvium decreases to zero during parts of the year, and streamflow data at Pool A which indicated streamflow occurred from late December 2004 through late May 2004. The saturated portion of the cross-sectional areas at Pool A and the USGS gage were approximately 1,978 and 1,027 square feet, respectively. Calculations of saturated cross-sectional areas were

1) Pool A
    a. The saturated rectangular area between RC-1 and RC-2 equaled half the cross-sectional area:
    $A_{1,saturated} = 0.5 \times 1{,}289 \text{ ft}^2 = 644.5 \text{ ft}^2$
    b. The saturated rectangular area between RC-2 and RC-3 equaled half the cross-sectional area:
    $A_{2,saturated} = 0.5 \times 1{,}926 \text{ ft}^2 = 963 \text{ ft}^2$
    c. The saturated triangular area between RC-1 and the northern alluvial aquifer boundary was estimated mathematically. The angle opposite the surface distance between RC-1 and the boundary was
    $a = \tan^{-1} 88.9 \text{ ft}/7.5 \text{ ft} = 85.2°$
    Assuming saturated thickness (b) of the triangle was 3.75 ft, the length of the water table in the cross-sectional triangle was
    $l = 3.75 \text{ ft} \times \tan 85.2° = 44.7 \text{ ft}$
    The saturated triangular area was
    $A_{3,saturated} = 0.5 \times l \times b = 0.5\ (44.7 \text{ ft} \times 3.75 \text{ ft}) = 84 \text{ ft}^2$
    d. The saturated triangular area between RC-3 and the southern alluvial aquifer boundary was estimated mathematically. The angle opposite the surface distance between RC-3 and the boundary was
    $a = \tan^{-1} 153.2 \text{ ft}/15 \text{ ft} = 84.4°$
    Assuming saturated thickness (b) of the triangle was 7.5 ft, the length of the water table in the cross-sectional triangle was
    $l = 7.5 \text{ ft} \times \tan 84.4° = 76.5 \text{ ft}$
    The saturated triangular area was
    $A_{4,saturated} = 0.5 \times l \times b = 0.5\ (76.5 \text{ ft} \times 7.5 \text{ ft}) = 287 \text{ ft}^2$
    e. Total saturated cross-sectional area for Pool A was 1,978 ft^2.
2) USGS
    a. The trapezoidal cross-sectional area at RC-7 was graphically represented. Assuming the saturated thickness (b) equaled half the

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depth to bedrock at RC-7, or 7 ft, the length of the water table surface was measured to be approximately 174 ft.

b. The saturated cross-sectional area at the USGS gage was calculated using the trapezoidal area formula:
$A_{saturated} = 0.5\ (174\ ft + 119.5\ ft) \times 7\ ft = 1{,}027\ ft^2$

Subflow fluxes were calculated using Darcy's Law, Q = KiA, where Q is subflow, K is hydraulic conductivity, i is hydraulic gradient, and A is the saturated cross-sectional area. As discussed in Section 5.1.1.3, the hydraulic gradient of 0.01 was determined from monitor well water level elevations (Figure 16). The hydraulic conductivity of the alluvial aquifer was assumed to be 1,200 feet per day based on pumping tests conducted at wells RC-1, RC-2, and RC-3 (Appendix D).

The evapotranspiration (ET) rate was assumed to be 2.5 feet per year based on studies in the San Pedro River (ADWR, 1991). This evapotranspiration rate averages the ET rates for five categories of vegetation occurring along the San Pedro River basin in June 1986: cottonwood, dense mesquite, medium-dense mesquite, willow, and cienega/dense grass. Scott et al. (2000) noted that the San Pedro ET rate did not distinguish between water derived from groundwater versus water derived from recent precipitation, river bank flooding, or other sources. The actual ET rate for Rincon Creek in 2004 may be different than the averaged rate for the San Pedro River based on the type, density, and extent of vegetation present along the middle reach of Rincon Creek. For water year 2004, the estimated volume of ET for Rincon Creek equaled the 51.6-acre surface area multiplied by the ET rate of 2.5 feet per year, or 129 acre-feet per year.

Precipitation and streamflow measurements were obtained from PCFCD rain gage 4110 at Rincon Creek and the Pool A and USGS stream gages. Annual precipitation during water year 2004 totaled 12.19 inches, or 1.02 feet (Table A-I, Appendix A). The volume of precipitation for water year 2004 equaled the product of the 51.6-acre surface area times 1.02 feet precipitation, or 52 acre-feet per year.

Leakage from the alluvial aquifer to the bedrock aquifer was estimated to be total output less USGS streamflow less evapotranspiration less subflow.

Components of the water year 2004 water budget were:

Water Year 2004 Water Budget				
Inputs (acre-feet)		Outputs (acre-feet)		Output as % of Total Inflow
Precipitation	52	Evapotranspiration	129	5
Pool A Streamflow	2,260	USGS Streamflow	2,016	80.5
Subflow	199	Subflow	103	4
Total	2,511	Leakage	263	10.5
		Total	2,511	

Performing similar calculations for water year 2005 yields the following results:

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Water Year 2005 Water Budget			
Inputs (acre-feet)		Outputs (acre-feet)	
Precipitation	40	Evapotranspiration	129
Pool A Streamflow	2,880	USGS Streamflow	4,173
Subflow	199	Subflow	103
Total	3,119	Leakage	-1,286
		Total	3,119

These values indicate substantially greater output than input to the Middle Reach during water year 2005, indicating additional sources of input such as unmeasured tributary flow (surface water and subflow) or solving for leakage, leakage from the lower bedrock aquifer into the alluvial aquifer, which is not supportable based on monitor well water level data.

Similarly, calculations for water year 2006 yield the following results:

Water Year 2006 Water Budget			
Inputs (acre-feet)		Outputs (acre-feet)	
Precipitation	>37	Evapotranspiration	129
Pool A Streamflow	6,570	USGS Streamflow	3,155
Subflow	199	Subflow	103
Total	6,806	Leakage	3,419
		Total	6,806

Water year 2006 data are not included in this report. Because precipitation data for August and September 2006 were not available, the volume of precipitation during water year 2006 may have exceeded 37 acre-feet. Values for water year 2006 indicate substantially greater input to the study area than output. To balance the water budget, much higher seepage losses (50%) would be required. A possible source of error in the 2006 water budget includes ungaged flow at the USGS gage as a result of the July 2006 flood events. Pool A discharge records for August 18 through September 30, 2006 were presented as estimates in the National Park Service's summary of daily mean discharge values for water year 2006.

Considerable uncertainty exists in these estimates, including assumptions of subflow volumes, possible inputs from tributary flows (surface water and subflow), and estimates of leakage to the bedrock aquifer. As indicated above, the measured parameters for water budget inputs were precipitation and Pool A streamflow, whereas subflow was estimated based on assumptions regarding alluvial aquifer geometry and the saturated thickness of the alluvial aquifer. Measured outputs included only streamflow at the USGS gage. Of the remaining outputs, subflow and evapotranspiration were estimated, and leakage from the alluvial aquifer was estimated by difference. Recommendations for additional data collection and gaging locations which may eliminate some of the water budget uncertainty are presented in subsequent sections of this report.

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6. HYDROGEOLOGICAL CONCEPTUAL MODEL

The principal hydrogeologic features of the middle reach of Rincon Creek include:

- Rincon Creek,
- The shallow alluvial aquifer comprised of unconsolidated alluvium underlying Rincon Creek, and
- The deeper bedrock aquifer comprised of the Pantano Formation and the underlying crystalline rocks. The deeper bedrock aquifer underlies the shallow alluvial aquifer.

Data collected in support of this investigation and review of previous investigations in the Rincon Valley indicate that flows in Rincon Creek are in direct hydraulic connection with the shallow alluvial aquifer. Flows in Rincon Creek support and replenish pools within the middle reach of Rincon Creek. Water levels in these pools are also sustained by groundwater outflow from the alluvial aquifer between flow events on Rincon Creek.

Discharge of groundwater from the shallow alluvial aquifer includes subflow, leakage to the underlying bedrock aquifer, and evapotranspiration. Subflow from the shallow alluvial aquifer varies depending on the frequency of flow events that recharge the alluvial aquifer. Leakage from the shallow alluvial aquifer to the underlying bedrock may be on the order of 10.5% of inputs to the study reach.

During periods of low or no precipitation, water in storage in the alluvial aquifer serves as a "reservoir" to sustain pool levels. In periods of extended drought, groundwater levels drop below pool bottoms. In the absence of streamflow to replenish groundwater stored in the alluvial aquifer, the alluvial aquifer is depleted by a combination of evapotranspiration and leakage to the underlying bedrock aquifer.

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7. HYDROGEOLOGICAL CONCEPTUAL MODEL

The hydrogeological conceptual model describes the Rincon Creek system in general terms. Some assumptions used in the model could be supported by additional investigation, including

- Refine estimates of the leakage from the alluvial aquifer to the Pantano Formation. During the winter when evapotranspiration is at a minimum, the decline of water levels at shallow wells following the winter precipitation season could be an indirect measurement of seepage.
- Quantification of evapotranspiration rates.
- Continued monthly monitoring of inputs and outputs to the system (e.g., streamflow, precipitation, groundwater levels).
- Verification that private well D(15-17)17bba (McKenzie) is inactive, or quantification of pumpage at this well.

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REFERENCES

1. Arizona Department of Water Resources (ADWR), 1991. "Hydrographic Survey Report for the San Pedro River Watershed." Volume 1: General Assessment. Phoenix, Arizona. 20 November 1991.

2. ------, 2004. Wells 55 Data CD-Rom.

3. Arizona Interstate Stream Commission, 1967. "Water Resources, State of Arizona."

4. Baird, K.J., MacNish, Robert D., and Guertin, D.P., 2001. "An Evaluation of Hydrologic and Riparian Resources in Saguaro National Park, Tucson, Arizona." HWR No. 01-010, Department of Hydrology and Water Resources, and University of Arizona Research Laboratory for Riparian Studies, University of Arizona, Tucson. 2001.

5. Briggs, Mark, 2007. "Draft -- Quantifying Instream Flow Required to Maintain Middle Rincon Creek's Bottomland Plant Communities and Pool System." March 2007.

6. Briggs, Mark K., Schmid, M.K., and Halvorson, William L., 1997. "Monitoring Riparian Ecosystems: An inventory of Riparian Habitat Along Rincon Creek Near Tucson, Arizona, Technical Report No. 58." April 1997.

7. Briggs, Mark K., Gorman, C., Lett, D., Gimblett, R., and Halvorson, William L., 2002. "Monitoring Riparian Ecosystems; A Second Inventory of Riparian Habitat Along Rincon Creek Near Tucson, Arizona." Arizona Game and Fish Department, Heritage Project Number U98022. The Rincon Institute, Tucson, Arizona. 2002.

8. Davidson, E.S., 1973. "Geohydrology and Water Resources of the Tucson Basin, Arizona." U.S. Geological Survey Water-Supply Paper 1939-E.

9. Drewes, Harald D., 1977. "Geologic Map and Sections of the Rincon Valley Quadrangle, Pima County, Arizona." U.S. Geological Survey Miscellaneous Investigations Series, I-997. Version 1.0, 1 sheet, scale 1:48,000.

10. Goforth, Christine L., and Walker, David, 2007. "Aquatic Macroinvertebrates and Their Relationship to Water Availability and Streamflow in Middlle Rincon Creek, Saguaro National Park East." 2007.

11. Haley & Aldrich, Inc., 2003. "Rincon Creek Shallow Groundwater Monitoring Program, Rincon Valley, Pima County, Arizona." 7 October 2003.

12. ------, 2005. "Construction of Monitor Wells RC-1, RC-2, RC-3, RC-4, RC-5, RC-6, and RC-7 at Rincon Creek, Pima County, Arizona." 30 June 2005.

13. Halpenny, Leonard C., et al., 1952. "Ground Water in the Gila River Basin and Adjacent Areas, Arizona—A Summary." U.S. Geological Survey Open-File Report.

Printed on 30% post-consumer recycled paper

14. Halpenny, Leonard C., and Halpenny, Philip C., 1985. "Evaluation of Adequacy of Groundwater Supply, Ranchlands Water Company, Rincon Valley, Pima, County, Arizona." Arizona Water Development Corporation.

15. Halpenny, Leonard C., 1986. "Supplemental report, Evaluation of Adequacy of Groundwater Supply, Ranchlands Water Company, Rincon Valley, Pima, County, Arizona." Arizona Water Development Corporation.

16. Manera, Paul A., 1962. "The Geology and Ground-Water Resources of the Upper Rincon Valley, Pima County, Arizona." 17 May 1962.

17. ------, 1982. "Evaluation of the Ground Water Supply Available to the Rincon Water Company, Vail, Pima County, Arizona." 19 July 1982.

18. ------; 1983. "Supplement to Evaluation of the Ground Water Supply Available to the Rincon Water Company, Vail, Pima County, Arizona." 20 May 1983.

19. ------, 1984. "Evaluation of Ground Water Supply Available to the Rincon Water Company, Vail, Pima County, Arizona." 20 March 1984.

20. MacLeod, A.H., Briggs, Mark K., and Ostergaard, E., 2003. "Identify and Map Water Resources of the Rincon Mountain District in Saguaro National Park." April 2003.

21. Montgomery, Errol L., and Harshbarger, John W., 1989. "Arizona Hydrogeology and Water Supply", in Jenney, J.P. and Reynolds, Stephen J., 1989, "Geologic Evolution of Arizona," *Arizona Geological Society Digest* 17, p. 827-840.

22. Phillips, Jeff V., and Thomas, B.E., 2005. "Hydrologic Conditions in Arizona During 1999-2004: A Historical Perspective." U.S. Geological Survey Fact Sheet 2005-3081. September 2005.

23. Pima Association of Governments (PAG), 2004. "Groundwater Conditions in Rincon Valley." August 2004.

24. Richard, Stephen M., 2007. Personal communication with Linda L. Dufek, Haley & Aldrich, Inc., on 13 March 2007.

25. Richard, Stephen M., Spencer, Jon E., Youberg, Ann M., and Ferguson, Charles A., 2005. "Geologic Map of the Rincon Valley Area, Pima County, Arizona": Arizona Geological Survey Digital Geologic Map 44 (DGM-44), version 1.0, 11 p., 1 sheet, scale 1:24,000.

26. Scott, R.L., Shuttleworth, W.J., Goodrich, D.C., and Maddock, T., 2000. "The Water Use of Two Dominant Vegetation Communities in a Semiarid Riparian Ecosystem." Agricultural and Forest Meteorology, 105, 241-256.

27. Stitt, Eric W., and Swann, Don E., 2007. "Aquatic Herpetofauna and Surface Water Availability in Rincon Creek, Saguaro National Park, Pima County, Arizona." 2007.

28. Turner, Samuel F., and Manera, Paul A., 1961. "Geologic Reconnaissance of the X-9 Ranch and Vicinity in Rincon Valley, Pima County, Arizona." August 1961.

Printed on 30% post-consumer recycled paper

29. U.S. Geological Survey (USGS), 2006. USGS Surface-Water Daily Statistics for Arizona, USGS 09485000 Rincon Creek near Tucson, AZ. http://nwis.waterdata.usgs.gov/az/nwis/dvstat/?search_site_no=09485000&agency_cd=USGS&referred_module=sw&format=sites_selection_links, accessed July 2006.

30. White, N.D., Stulik, Ronald S., Morse, E.K., and others. 1963. "Annual Report on Ground Water in Arizona, Spring 1962 to Spring 1963." Arizona State Land Department Water-Resources Report Number 15.

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TABLE I

AVERAGE MONTHLY PRECIPITATION, WATER YEARS 2004 - 2005
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

	Precipitation (inches)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2004	1.03	1.20	0.32	0.88	1.08	1.32	0.92	0.00	0.04	2.11	2.06	1.23
2005	0.04	0.40	0.4	2.2	1.48	0.32	0.36	0.36	0.12	1.19	2.19	0.28
Average	0.54	0.80	0.36	1.54	1.28	0.82	0.64	0.18	0.08	1.65	2.13	0.76

NOTES AND ABBREVIATIONS:

1. Source: Pima County Flood Control District.
   Daily precipitation data are from Pima County ALERT Flood Warning gages.
   PCFCD makes no warranty, expressed or implied, regarding the accuracy of the data provided.

TABLE II

MEAN MONTHLY DISCHARGE DATA FROM USGS GAGE 09485000
WATER YEARS 1953 – 2005
RINCON CREEK
PIMA COUNTY, ARIZONA

Water	Mean Monthly Discharge Data from USGS Gage 09485000 (cubic feet per second)											
Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1953	0	0	0	0	0	6.1	0.12	0	0	2.17	1.24	0
1954	0	0	0	0	0	12.1	0.11	0	0	3.29	29.4	0.05
1955	0.097	0	0	0	0	0	0	0	0	12.6	64	0.713
1956	0.419	0.1	0.09	0.077	0	0	0	0	0	0.161	0	0
1957	0	0	0	35.5	6.59	3.08	0.473	0	0	0.016	32.4	10.9
1958	0	0.813	1.74	0.235	0.304	42.5	13.6	0.181	0	1.26	7.47	0.017
1959	9.38	2.94	0.777	0.129	0.1	0.039	0	0	0	0.187	22.7	0.07
1960	0.039	1.14	6.46	62.7	15.1	7.54	0.433	0.039	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0.613	9.08	2.82
1962	0	0.317	18.4	20.4	13.3	18.8	3.95	0.048	0	0	0	0.003
1963	0	0	0	0.265	21	4.3	0.547	0.006	0	0	39.6	7.57
1964	0.006	0.003	0	0	0	0	0	0	0	0.026	2.09	18.6
1965	0.406	0.103	0.103	2.64	3.46	4.21	4.95	0.052	0	0	0.277	0
1966	0	0	129.8	36.3	67.9	32.6	4.07	0.432	0.11	0.826	9.02	12.1
1967	0.365	0.177	0.061	0	0	0	0	0	0	0.419	0.129	0.037
1968	0	0	26.7	10.1	50	13.5	4.69	0.513	0.073	0	4.9	0.212
1969	0	0	0	6.54	2.6	3.87	0.961	0.07	0	0	1.74	0.588
1970	0	0.137	0.071	0.071	0.038	4.59	0.408	0.049	0	0.32	1.87	19.1
1971	0.006	0	0	0	0	0	0	0.24	1.48	0.007	37.1	9.95
1972	12.1	3.82	21.7	2.92	0.545	0.299	0.059	0	0	0.748	0.256	0.024
1973	23.3	3.34	2.68	1.75	75.2	74.4	18	1.95	0.17	1.31	0.001	0
1974	0	0	0	2.05	0.147	0.004	0	0	0	0.09	2.27	0
1987	---	---	---	---	---	---	---	---	---	---	---	---
1988	0	0.137	0.142	10.1	11.6	1.64	1.21	0.391	0	3.39	29.3	0.253
1989	0.053	0.002	0.005	1.44	0.812	0.751	0.251	0.005	0	0.123	0.065	0
1990	0	0	0	0	3.47	2.73	0.294	0.005	0	---	---	2.41
1991	0.071	0.082	7.25	33.9	13.9	56.6	16.9	0.33	0.001	0.001	0	0
1992	0	0	10	21.5	39.7	48.4	13.4	0.397	0.005	0	9.28	0.017
1993	0	0	40.6	247.1	54.6	23.9	4.6	0.179	0.005	0	23.7	4.15
1994	0.004	0.988	0.267	0.232	0.346	6.06	0.631	0.041	0	0	0.868	6.29
1995	0	18	40.8	97.8	73.5	25.9	2.26	0.438	0.052	0	0.004	0.837
1996	0	0	0	0	0	0	0	0	0	0.009	0.011	1.14
1997	0	0	0	0.478	0.045	8.19	0.107	0.016	0	0	0.134	0.014
1998	0.002	0	14.2	5.53	85.8	59.3	42	1.11	0.155	2.74	1.1	1.47
1999	0.083	0.023	0	0	0	0	0	0	0	11.8	4.38	2.12
2000	0.01	0	0	0	0	0	0	0	0	0.032	11.9	0.564
2001	42.9	44.4	1.52	2.82	16.6	16.3	11.2	0.269	0	0.458	3.28	0.074
2002	0	0	0	0	0	0	0	0	0	0.019	3.19	0
2003	0	0	0	0	2.03	7.88	0.384	0.027	0	0	0.015	0
2004	0	0	0	0	2.14	20.2	10.9	0.06	0	0.007	0.109	0.003
2005	0	0	0.023	17.9	48.7	2.16	0.287	0.046	0	0	0.052	0
Average	2.231	1.913	8.085	15.512	15.238	12.699	3.920	0.172	0.051	1.093	9.050	2.552

TABLE III

MEAN MONTHLY DISCHARGE DATA FROM USGS GAGE 09485000 and NPS POOL A GAGE
WATER YEARS 2004-2005
RINCON CREEK
PIMA COUNTY, ARIZONA

USGS Gage 09485000 (cubic feet per second)												
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2004	0	0	0	0	2.14	20.2	10.9	0.06	0	0.007	0.109	0.003
2005	0	0	0.023	17.9	48.7	2.16	0.287	0.046	0	0	0.052	0
Average	0	0	0.012	8.95	25.42	11.18	5.59	0.053	0	0.004	0.081	0.002

NPS Pool A Gage (cubic feet per second)												
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2004	0	0	0	0	3.24	22.4	11.3	0.21	0	0	0.05	0
2005	0	0	0.16	15.2	33.3	1.22	0.18	0.08	0	0	0	0
Average	0	0	0.08	7.60	18.27	11.81	5.74	0.15	0	0	0.025	0

NOTES AND ABBREVIATIONS:

1. NPS Pool A Gage = Surface Water Station 320745110365701

TABLE IV
SUMMARY OF ANALYSES FOR INORGANIC CONSTITUENTS IN SURFACE WATER
MAY 2005
RINCON CREEK
PIMA COUNTY, ARIZONA

Stream Sample Location		Pool A	USGS Gage
Sample Date		05/10/05	05/10/05
Laboratory		DMA	DMA
Compound	Units		
Calcium	mg/l	**23**	**35**
Magnesium	mg/l	**3.1**	**4.0**
Potassium	mg/l	1.0 U	1.0 U
Silica	mg/l	**18**	**20**
Sodium	mg/l	**18**	**20**
Alkalinity as CaCO3	mg/l	**77**	**140**
Alkalinity as HCO3	mg/l	**94**	**170**
Chloride	mg/l	**7.5**	**7.4**
Fluoride	mg/l	**0.14**	**0.47**
Nitrate-N	mg/l	0.10 U	0.10 U
Sulfate	mg/l	**21**	**16**
Total Phosphorus	mg/l	0.05 U	**0.13**
Total Dissolved Solids	mg/l	**110**	**180**
pH (field)	pH units	**7.8**	**7.6**
Specific Conductance (field)	umhos/cm	**220**	**260**
Temperature (field)	Degrees Celsius	**21**	**21**
Daily mean discharge	cfs	0.12	0.09

NOTES AND ABBREVIATIONS:
1. cfs = cubic-feet per second
2. Daily mean = mean of depth to water measurements recorded at 15-minute intervals
3. DMA = Del Mar Analytical of Phoenix, Arizona.
4. mg/l = Milligrams per liter.
5. umhos/cm = Micromhos per centimeter.
6. U = Not detected; numerical value represents the Reporting Limit for that compound.

TABLE V

RINCON CREEK SURFACE WATER FIELD PARAMETER DATA, 2005 - 2006
RINCON CREEK
PIMA COUNTY, ARIZONA

Location	Sample Date	Staff Gage (feet)	Stream Flow (cfs)	Field Parameters		
				Temperature (Celsius)	pH	Specific Conductivity (umhos/cm)
Weil Bridge	05/04/05	NA	NA	20.5	7.45	245
	06/01/05	NA	NA	Dry	---	---
	07/08/05	NA	NA	Dry	---	---
	08/05/05	NA	NA	Dry	---	---
	09/02/05	NA	NA	Dry	---	---
	10/07/05	NA	NA	Dry	---	---
	11/07/05	NA	NA	Dry	---	---
	12/09/05	NA	NA	Dry	---	---
	01/06/06	NA	NA	Dry	---	---
	02/10/06	NA	NA	Dry	---	---
	03/10/06	NA	NA	Dry	---	---
	04/07/06	NA	NA	Dry	---	---
Pool A (1)	05/04/05	1.80	0.14	19	6.9	205
	06/01/05	1.61	0	19	6.6	240
	07/08/05	-0.04	0	Dry	---	---
	08/05/05	-0.04	0	Dry	---	---
	09/02/05	-0.04	0	Dry	---	---
	10/07/05	NA	NA	Dry	---	---
	11/07/05	NA	NA	Dry	---	---
	12/09/05	NA	NA	Dry	---	---
	01/06/06	NA	NA	Dry	---	---
	02/10/06	NA	NA	Dry	---	---
	03/10/06	NA	NA	Dry	---	---
	04/07/06	NA	NA	Dry	---	---
Pool B (2)	05/04/05	ND	NA	20	7.6	240
	06/01/05	1.68	NA	22	7.0	265
	07/08/05	NM	NA	29	6.2	400
	08/05/05	<0.18	NA	Dry	---	---
	09/02/05	<0.14	NA	Dry	---	---
	10/07/05	<0.10	NA	Dry	---	---
	11/07/05	<0.10	NA	Dry	---	---

See last page of Table V for notes and abbreviations.

TABLE V
RINCON CREEK SURFACE WATER FIELD PARAMETER DATA, 2005 - 2006
RINCON CREEK
PIMA COUNTY, ARIZONA

Location	Sample Date	Staff Gage (feet)	Stream Flow (cfs)	Field Parameters		
				Temperature (Celsius)	pH	Specific Conductivity (umhos/cm)
Pool B (2)	12/09/05	<0.10	NA	Dry	---	---
	01/06/06	<0.10	NA	Dry	---	---
	02/10/06	<0.10	NA	Dry	---	---
	03/10/06	<0.08	NA	Dry	---	---
	04/07/06	<0.08	NA	Dry	---	---
Pool B (FP)	06/01/05	NA	NA	21.5	7.3	260
	07/08/05	NA	NA	32	7.0	320
	08/05/05	NA	NA	Dry	---	---
	09/02/05	NA	NA	Dry	---	---
	10/07/05	NA	NA	Dry	---	---
	11/07/05	NA	NA	Dry	---	---
	12/09/05	NA	NA	Dry	---	---
	01/06/06	NA	NA	Dry	---	---
	02/10/06	NA	NA	Dry	---	---
	03/10/06	NA	NA	Dry	---	---
	04/07/06	NA	NA	Dry	---	---
Pool 3	05/04/05	NA	NA	18	7.4	220
	06/01/05	NA	NA	22	7.2	265
	07/08/05	NA	NA	Dry	---	---
	08/05/05	NA	NA	Dry	---	---
	09/02/05	NA	NA	27	6.6	700
	10/07/05	NA	NA	Dry	---	---
	11/07/05	NA	NA	Dry	---	---
	12/09/05	NA	NA	Dry	---	---
	01/06/06	NA	NA	Dry	---	---
	02/10/06	NA	NA	Dry	---	---
	03/10/06	NA	NA	Dry	---	---
	04/07/06	NA	NA	Dry	---	---
Pool C (4)	05/04/05	1.36	NA	19	7.3	240
	06/01/05	1.29	NA	23	7.2	260
	07/08/05	NM	NA	31	7.4	380

See last page of Table V for notes and abbreviations.

TABLE V
RINCON CREEK SURFACE WATER FIELD PARAMETER DATA, 2005 - 2006
RINCON CREEK
PIMA COUNTY, ARIZONA

Location	Sample Date	Staff Gage (feet)	Stream Flow (cfs)	Field Parameters		
				Temperature (Celsius)	pH	Specific Conductivity (umhos/cm)
Pool C (4)	08/05/05	<0.70	NA	Dry	---	---
	09/02/05	<0.70	NA	Dry	---	---
	10/07/05	<0.70	NA	Dry	---	---
	11/07/05	<0.70	NA	Dry	---	---
	12/09/05	<0.70	NA	Dry	---	---
	01/06/05	<0.70	NA	Dry	---	---
	02/10/06	<0.70	NA	Dry	---	---
	03/10/06	<0.70	NA	Dry	---	---
	04/07/06	<0.70	NA	Dry	---	---
Pool 5	05/04/05	NA	NA	20	7.4	250
	06/01/05	NA	NA	23	7.3	280
	07/08/05	NA	NA	Dry	---	---
	08/05/05	NA	NA	31	7.6	210
	09/02/05	NA	NA	30	7.0	400
	10/07/05	NA	NA	Dry	---	---
	11/07/05	NA	NA	Dry	---	---
	12/09/05	NA	NA	Dry	---	---
	01/06/06	NA	NA	Dry	---	---
	02/10/06	NA	NA	Dry	---	---
	03/10/06	NA	NA	Dry	---	---
	04/07/06	NA	NA	Dry	---	---
Tributary	05/04/05	NA	NA	26	8.5	270
	06/01/05	NA	NA	Dry	---	---
	07/08/05	NA	NA	Dry	---	---
	08/05/05	NA	NA	28.5	7.5	210
	09/02/05	NA	NA	Dry	---	---
	10/07/05	NA	NA	Dry	---	---
	11/07/05	NA	NA	Dry	---	---
	12/09/05	NA	NA	Dry	---	---
	01/06/06	NA	NA	Dry	---	---
	02/10/06	NA	NA	Dry	---	---

See last page of Table V for notes and abbreviations.

TABLE V

RINCON CREEK SURFACE WATER FIELD PARAMETER DATA, 2005 - 2006
RINCON CREEK
PIMA COUNTY, ARIZONA

Location	Sample Date	Staff Gage (feet)	Stream Flow (cfs)	Field Parameters		
				Temperature (Celsius)	pH	Specific Conductivity (umhos/cm)
Tributary	03/10/06	NA	NA	Dry	---	---
	04/07/06	NA	NA	Dry	---	---
Pool D (TR 6)	05/04/05	NA	NA	20.5	8.2	280
	06/01/05	NA	NA	23	7.6	310
	07/08/05	NA	NA	Dry	---	---
	08/05/05	NA	NA	27	7.5	190
	09/02/05	NA	NA	Dry	---	---
	10/07/05	NA	NA	Dry	---	---
	11/07/05	NA	NA	Dry	---	---
	12/09/05	NA	NA	Dry	---	---
	01/06/06	NA	NA	Dry	---	---
	02/10/06	NA	NA	Dry	---	---
	03/10/06	NA	NA	Dry	---	---
	04/07/06	NA	NA	Dry	---	---
USGS Gage	05/04/05	NA	0.15	23.8	8.1	265
	06/01/05	NA	0	24	7.6	340
	07/08/05	NA	0	Dry	---	---
	08/05/05	NA	0	Dry	---	---
	09/02/05	NA	0	Dry	---	---
	10/07/05	NA	NA	Dry	---	---
	11/07/05	NA	NA	Dry	---	---
	12/09/05	NA	NA	Dry	---	---
	01/06/06	NA	NA	Dry	---	---
	02/10/06	NA	NA	Dry	---	---
	03/10/06	NA	NA	Dry	---	---
	04/07/06	NA	NA	Dry	---	---

See last page of Table V for notes and abbreviations.

TABLE V
NOTES AND ABBREVIATIONS

1. See Figure 5 for locations of monitoring points.

2. NA = Not applicable or available

3. ND = No data; staff gage damaged

4. NM = Not measured

5. cfs = cubic feet per second

6. umhos/cm = micromhos per centimeter

7. Information in parentheses indicates cross-channel transect numbers.
   FP = Ford Pool, the former name of Pool B.

8. < = No water level measureable. Number reflects the lowest number readable on the staff plate (the aggradation line).

TABLE VI
SUMMARY OF ANALYSES FOR INORGANIC CONSTITUENTS IN GROUNDWATER
APRIL 2005
RINCON CREEK, PIMA COUNTY, ARIZONA

Well Identifier		RC-1	RC-2	RC-3	Weil
Sample Date		04/28/05	04/26/05	04/27/05	04/27/05
Laboratory		DMA	DMA	DMA	DMA
Compound	Units				
Calcium	mg/l	**21**	**23**	**26**	**54**
Magnesium	mg/l	**4.8**	**3.1**	**3.6**	**5.2**
Potassium	mg/l	**2.1**	1.0 U	1.0 U	**10**
Silica	mg/l	**52**	**20**	**22**	**71**
Sodium	mg/l	**31**	**17**	**19**	**170**
Alkalinity as CaCO3	mg/l	5.0 U	5.0 U	5.0 U	5.0 U
Alkalinity as HCO3	mg/l	6.1 U	6.1 U	6.1 U	6.1 U
Chloride	mg/l	**5.8**	**5.5**	**5.7**	**43**
Fluoride	mg/l	**0.45**	**0.31**	**0.32**	**5.6**
Nitrate-N	mg/l	0.10 U	0.10 U	0.10 U	**0.15**
Sulfate	mg/l	**19**	**16**	**16**	**280**
Total Dissolved Solids	mg/l	**240**	**160**	**180**	**780**
pH (field)	pH units	**8.0**	**6.8**	**8.0**	**7.4**
Specific Conductance (field)	umhos/cm	**210**	**950***	**200**	**920**
Temperature (field)	Degrees Celsius	**20**	**20**	**20**	**22**

NOTES AND ABBREVIATIONS:
1. DMA = Del Mar Analytical of Phoenix, Arizona.
2. mg/l = Milligrams per liter.
3. umhos/cm = Micromhos per centimeter.
4. U = Not detected; numerical value represents the Reporting Limit for that compound.
5. * = Suspect result.
6. Weil = D(15-17)16bda.

TABLE VII

GROUNDWATER CHEMISTRY DATA
RINCON WATER COMPANY WELLS
RINCON CREEK, PIMA COUNTY, ARIZONA

Well Identifier	RWC 1	RWC 1	RWC 1	RWC 1	RWC 1	RWC 1	RWC 1	RWC 1	RWC 1	RWC 1	RWC 1	RWC 1	RWC 8	RWC 8
Date Sampled	03-63	02-68	05-70	02-71	03-71	03-71	05-71	06-71	08-71	09-71	02-80	02-80	09-68	09-68
Date Received	3/5/63	NA	5/4/70	2/24/71	3/2/71	NA	5/26/71	6/23/71	8/6/71	9/16/71	2/22/80	2/22/80	9/23/68	9/23/68
Compound (ppm)											untreated water	treated water	top	bottom
Aluminum	---	---	---	---	---	---	0.7	1.2	---	---	<0.1	<0.1	---	---
Arsenic	---	---	---	---	---	---	<0.01	<0.01	---	---	---	---	---	---
Bicarbonate (HCO3)	190	152	193	226	205	221	202	211	---	---	225.2	203.6	110	102
Boron	---	---	---	---	---	---	0.06	<0.01	---	---	0.15	0.16	---	---
Calcium	---	44	43	60	50	56	60	52	---	---	46	47	26	23
Carbonate (CO3)	---	---	---	nil	---	---	0	0	---	---	0	0	0	0
Chloride	38	36	34	46	54	46	92	28	---	---	41.1	42.5	12	12
Chromium	---	---	---	---	---	---	<0.01	<0.05	---	---	---	---	---	---
Conductivity	---	---	---	---	---	---	112	114	---	---	880	1090	---	---
Copper	---	---	---	---	---	---	<0.01	<0.01	---	---	<0.01	<0.01	---	---
Fluoride	3.4	3.4	4	4.85	5.15	5.8	7	3	2.1	2.54	4.9	0.24	0.8	0.3
Iron (Fe)	---	---	0.3	nil	---	---	<0.05	<0.05	---	---	0.08	0.1	---	---
Magnesium	---	5	6	4.7	6	7	8	5	---	---	6	6	4	4
Manganese	---	---	0.15	---	---	---	<0.01	0.02	---	---	<0.01	<0.01	---	---
Nitrate (NO3)	---	---	---	nil	---	---	3.1	0.5	---	---	0.9	2.2	---	---
pH	---	---	7.6	7.45	7.4	7.7	8	8	---	---	7.4	7	7.6	7.4
Phosphate	---	---	---	---	---	---	1	1	---	---	<0.1	<0.1	---	---
Potassium	---	---	---	---	---	---	1	9	---	---	9.4	9.8	---	---
ratio of Sodium/Calcium	---	---	1.3	---	---	---	---	---	---	---	---	---	---	---
Silica	---	---	---	---	---	---	70	70	---	---	73	75	---	---
Sodium (computed)	---	92	55	279	189	262	152	165	---	---	182	233	19	19
Sulfate	330	148	44	505	256	475	207	300	---	---	298	420	14	14
Total alkalinity as CaCO3	---	---	---	186	---	---	---	---	---	---	---	---	---	---
Total hardness as CaCO3	---	---	134	162	---	---	---	---	---	---	139.8	142.3	80	72
Total Dissolved Solids	625	510	379	1222	765	1073	624	650	---	---	774	938	185	174
Zinc	---	---	---	---	---	---	0.12	0.1	---	---	0.01	0.01	---	---
Laboratory	T	---	H	ETL	UofA	I	BC	BC	BC	BC	BC	BC	V/H	V/H

Note: Date sampled is estimated month based on date samples were received.
Source: Turner and Manera (1961), Geologic Reconnaissance of the X-9 Ranch & Vicinity in Rincon Valley.
Manera (1982), Evaluation of the Groundwater Supply Available to the Rincon Water Company.

T = Turner & Associates
H = Harris Lab
I = Ionics Inc.
BC = BC Lab
V/H = Valley Lab/Harris Lab
UofA = University of Arizona
ETL = Engineers Testing Laboratory

RWC 1 = Well 55-607532, D(15-17)16acc
RWC 8 = Well 55-607531, D(15-17)16adc

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A [(1)]	10/01/03	-0.04	3155.51	---	
	10/02/03	-0.04		---	
	10/03/03	-0.04		---	
	10/04/03	-0.04		---	
	10/05/03	-0.04		---	
	10/06/03	-0.04		---	
	10/07/03	-0.04		---	
	10/08/03	-0.04		---	
	10/09/03	-0.04		---	
	10/10/03	-0.04		---	
	10/11/03	-0.04		---	
	10/12/03	-0.04		---	
	10/13/03	-0.04		---	
	10/14/03	-0.04		---	
	10/15/03	-0.04		---	
	10/16/03	-0.04		---	
	10/17/03	-0.04		---	
	10/18/03	-0.04		---	
	10/19/03	-0.04		---	
	10/20/03	-0.04		---	
	10/21/03	-0.04		---	
	10/22/03	-0.04		---	
	10/23/03	-0.04		---	
	10/24/03	-0.04		---	
	10/25/03	-0.04		---	
	10/26/03	-0.04		---	
	10/27/03	-0.04		---	
	10/28/03	-0.04		---	
	10/29/03	-0.04		---	
	10/30/03	-0.04		---	
	10/31/03	-0.04		---	
	11/01/03	-0.04		---	
	11/02/03	-0.04		---	
	11/03/03	-0.04		---	
	11/04/03	-0.04		---	
	11/05/03	-0.04		---	
	11/06/03	-0.04		---	
	11/07/03	-0.04		---	
	11/08/03	-0.04		---	
	11/09/03	-0.04		---	
	11/10/03	-0.04		---	
	11/11/03	-0.04		---	
	11/12/03	-0.04		---	
	11/13/03	-0.04		---	
	11/14/03	-0.04		---	
	11/15/03	-0.04		---	
	11/16/03	-0.04		---	
	11/17/03	-0.04		---	
	11/18/03	-0.04		---	
	11/19/03	-0.04		---	

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A [(1)]	11/20/03	-0.04	3155.51	---	
	11/21/03	-0.04		---	
	11/22/03	-0.04		---	
	11/23/03	-0.04		---	
	11/24/03	-0.04		---	
	11/25/03	-0.04		---	
	11/26/03	-0.04		---	
	11/27/03	-0.04		---	
	11/28/03	-0.04		---	
	11/29/03	-0.04		---	
	11/30/03	-0.04		---	
	12/01/03	-0.04		---	
	12/02/03	-0.04		---	
	12/03/03	-0.04		---	
	12/04/03	-0.04		---	
	12/05/03	-0.04		---	
	12/06/03	-0.04		---	
	12/07/03	-0.04		---	
	12/08/03	-0.04		---	
	12/09/03	-0.04		---	
	12/10/03	-0.04		---	
	12/11/03	-0.04		---	
	12/12/03	-0.04		---	
	12/13/03	-0.04		---	
	12/14/03	-0.04		---	
	12/15/03	-0.04		---	
	12/16/03	-0.04		---	
	12/17/03	-0.04		---	
	12/18/03	-0.04		---	
	12/19/03	-0.04		---	
	12/20/03	-0.04		---	
	12/21/03	-0.04		---	
	12/22/03	-0.04		---	
	12/23/03	-0.04		---	
	12/24/03	-0.04		---	
	12/25/03	-0.04		---	
	12/26/03	-0.04		---	
	12/27/03	-0.04		---	
	12/28/03	-0.04		---	
	12/29/03	-0.04		---	
	12/30/03	-0.04		---	
	12/31/03	-0.04		---	
	01/01/04	-0.04		---	
	01/02/04	-0.04		---	
	01/03/04	-0.04		---	
	01/04/04	-0.04		---	
	01/05/04	-0.04		---	
	01/06/04	-0.04		---	
	01/07/04	-0.04		---	
	01/08/04	-0.04		---	

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A (1)	01/09/04	-0.04	3155.51	---	
	01/10/04	-0.04		---	
	01/11/04	-0.04		---	
	01/12/04	-0.04		---	
	01/13/04	-0.04		---	
	01/14/04	-0.04		---	
	01/15/04	-0.04		---	
	01/16/04	-0.04		---	
	01/17/04	-0.04		---	
	01/18/04	-0.04		---	
	01/19/04	-0.04		---	
	01/20/04	-0.04		---	
	01/21/04	-0.04		---	
	01/22/04	-0.04		---	
	01/23/04	-0.04		---	
	01/24/04	-0.04		---	
	01/25/04	-0.04		---	
	01/26/04	-0.04		---	
	01/27/04	-0.04		---	
	01/28/04	-0.04		---	
	01/29/04	-0.04		---	
	01/30/04	-0.04		---	
	01/31/04	-0.04		---	
	02/01/04	-0.04		---	
	02/02/04	-0.04		---	
	02/03/04	-0.04		---	
	02/04/04	-0.04		---	
	02/05/04	-0.04		---	
	02/06/04	-0.04		---	
	02/07/04	-0.04		---	
	02/08/04	-0.04		---	
	02/09/04	-0.04		---	
	02/10/04	-0.04		---	
	02/11/04	-0.04		---	
	02/12/04	-0.04		---	
	02/13/04	-0.04		---	
	02/14/04	-0.04		---	
	02/15/04	-0.04		---	
	02/16/04	-0.04		---	
	02/17/04	-0.04		---	
	02/18/04	0.42		3155.93	
	02/19/04	2.12		3157.63	
	02/20/04	2.16		3157.67	
	02/21/04	2.12		3157.63	
	02/22/04	2.08		3157.59	
	02/23/04	2.10		3157.61	
	02/24/04	2.15		3157.66	
	02/25/04	2.10		3157.61	
	02/26/04	2.15		3157.66	
	02/27/04	2.21		3157.72	

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A [(1)]	02/28/04	2.88	3155.51	3158.39	
	02/29/04	2.64		3158.15	
	03/01/04	2.43		3157.94	
	03/02/04	2.34		3157.85	
	03/03/04	2.36		3157.87	
	03/04/04	3.19		3158.70	
	03/05/04	3.30		3158.81	
	03/06/04	3.16		3158.67	
	03/07/04	3.33		3158.84	
	03/08/04	3.31		3158.82	
	03/09/04	3.09		3158.60	
	03/10/04	2.91		3158.42	
	03/11/04	2.79		3158.30	
	03/12/04	2.68		3158.19	
	03/13/04	2.69		3158.20	
	03/14/04	2.74		3158.25	
	03/15/04	2.58		3158.09	
	03/16/04	2.47		3157.98	
	03/17/04	2.40		3157.91	
	03/18/04	2.32		3157.83	
	03/19/04	2.26		3157.77	
	03/20/04	2.21		3157.72	
	03/21/04	2.17		3157.68	
	03/22/04	2.17		3157.68	
	03/23/04	2.15		3157.66	
	03/24/04	2.13		3157.64	
	03/25/04	2.12		3157.63	
	03/26/04	2.11		3157.62	
	03/27/04	2.09		3157.60	
	03/28/04	2.07		3157.58	
	03/29/04	2.04		3157.55	
	03/30/04	2.03		3157.54	
	03/31/04	2.03		3157.54	
	04/01/04	2.02		3157.53	
	04/02/04	2.08		3157.59	
	04/03/04	2.86		3158.37	
	04/04/04	2.92		3158.43	
	04/05/04	2.88		3158.39	
	04/06/04	2.84		3158.35	
	04/07/04	2.85		3158.36	
	04/08/04	2.80		3158.31	
	04/09/04	2.67		3158.18	
	04/10/04	2.52		3158.03	
	04/11/04	2.43		3157.94	
	04/12/04	2.35		3157.86	
	04/13/04	2.25		3157.76	
	04/14/04	2.18		3157.69	
	04/15/04	2.12		3157.63	
	04/16/04	2.07		3157.58	
	04/17/04	2.04		3157.55	

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A [(1)]	04/18/04	2.01	3155.51	3157.52	
	04/19/04	1.99		3157.50	
	04/20/04	1.96		3157.47	
	04/21/04	1.95		3157.46	
	04/22/04	1.93		3157.44	
	04/23/04	1.92		3157.43	
	04/24/04	1.91		3157.42	
	04/25/04	1.91		3157.42	
	04/26/04	1.91		3157.42	
	04/27/04	1.91		3157.42	
	04/28/04	1.91		3157.42	
	04/29/04	1.91		3157.42	
	04/30/04	1.90		3157.41	
	05/01/04	1.90		3157.41	
	05/02/04	1.89		3157.40	
	05/03/04	1.89		3157.40	
	05/04/04	1.89		3157.40	
	05/05/04	1.89		3157.40	
	05/06/04	1.88		3157.39	
	05/07/04	1.88		3157.39	
	05/08/04	1.87		3157.38	
	05/09/04	1.87		3157.38	
	05/10/04	1.87		3157.38	
	05/11/04	1.86		3157.37	
	05/12/04	1.86		3157.37	
	05/13/04	1.86		3157.37	
	05/14/04	1.86		3157.37	
	05/15/04	1.85		3157.36	
	05/16/04	1.85		3157.36	
	05/17/04	1.84		3157.35	
	05/18/04	1.83		3157.34	
	05/19/04	1.82		3157.33	
	05/20/04	1.81		3157.32	
	05/21/04	1.81		3157.32	
	05/22/04	1.80		3157.31	
	05/23/04	1.80		3157.31	
	05/24/04	1.79		3157.30	
	05/25/04	1.78		3157.29	
	05/26/04	1.77		3157.28	
	05/27/04	1.76		3157.27	
	05/28/04	1.75		3157.26	
	05/29/04	1.74		3157.25	
	05/30/04	1.73		3157.24	
	05/31/04	1.72		3157.23	
	06/01/04	1.70		3157.21	
	06/02/04	1.69		3157.20	
	06/03/04	1.67		3157.18	
	06/04/04	1.65		3157.16	
	06/05/04	1.62		3157.13	
	06/06/04	1.58		3157.09	

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A (1)	06/07/04	1.53	3155.51	3157.04	
	06/08/04	1.49		3157.00	
	06/09/04	1.45		3156.96	
	06/10/04	1.41		3156.92	
	06/11/04	1.37		3156.88	
	06/12/04	1.32		3156.83	
	06/13/04	1.26		3156.77	
	06/14/04	1.21		3156.72	
	06/15/04	1.16		3156.67	
	06/16/04	1.09		3156.60	
	06/17/04	1.04		3156.55	
	06/18/04	0.97		3156.48	
	06/19/04	0.91		3156.42	
	06/20/04	0.84		3156.35	
	06/21/04	0.77		3156.28	
	06/22/04	0.71		3156.22	
	06/23/04	0.66		3156.17	
	06/24/04	0.60		3156.11	
	06/25/04	0.53		3156.04	
	06/26/04	0.47		3155.98	
	06/27/04	0.41		3155.92	
	06/28/04	0.36		3155.87	
	06/29/04	0.31		3155.82	
	06/30/04	0.25		3155.76	
	07/01/04	0.18		3155.69	
	07/02/04	0.13		3155.64	
	07/03/04	0.08		3155.59	
	07/04/04	0.03		3155.54	
	07/05/04	-0.01		---	
	07/06/04	-0.04		---	
	07/07/04	-0.04		---	
	07/08/04	-0.04		---	
	07/09/04	-0.04		---	
	07/10/04	-0.04		---	
	07/11/04	-0.04		---	
	07/12/04	-0.04		---	
	07/13/04	-0.04		---	
	07/14/04	-0.04		---	
	07/15/04	-0.04		---	
	07/16/04	-0.04		---	
	07/17/04	-0.04		---	
	07/18/04	-0.04		---	
	07/19/04	-0.04		---	
	07/20/04	-0.04		---	
	07/21/04	-0.04		---	
	07/22/04	-0.04		---	
	07/23/04	-0.04		---	
	07/24/04	-0.04		---	
	07/25/04	-0.04		---	
	07/26/04	-0.04		---	

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A (1)	07/27/04	-0.04	3155.51	---	
	07/28/04	-0.04		---	
	07/29/04	-0.04		---	
	07/30/04	-0.04		---	
	07/31/04	-0.04		---	
	08/01/04	-0.04		---	
	08/02/04	-0.04		---	
	08/03/04	-0.04		---	
	08/04/04	-0.04		---	
	08/05/04	0.24		3155.75	
	08/06/04	0.49		3156.00	
	08/07/04	-0.04		---	
	08/08/04	-0.04		---	
	08/09/04	-0.04		---	
	08/10/04	-0.04		---	
	08/11/04	-0.04		---	
	08/12/04	-0.04		---	
	08/13/04	-0.04		---	
	08/14/04	-0.04		---	
	08/15/04	-0.04		---	
	08/16/04	-0.04		---	
	08/17/04	-0.04		---	
	08/18/04	-0.04		---	
	08/19/04	-0.04		---	
	08/20/04	-0.04		---	
	08/21/04	-0.04		---	
	08/22/04	-0.04		---	
	08/23/04	-0.04		---	
	08/24/04	-0.04		---	
	08/25/04	-0.04		---	
	08/26/04	-0.04		---	
	08/27/04	-0.04		---	
	08/28/04	-0.04		---	
	08/29/04	-0.04		---	
	08/30/04	-0.04		---	
	08/31/04	-0.04		---	
	09/01/04	-0.04		---	
	09/02/04	-0.04		---	
	09/03/04	-0.04		---	
	09/04/04	-0.04		---	
	09/05/04	-0.04		---	
	09/06/04	-0.04		---	
	09/07/04	-0.04		---	
	09/08/04	-0.04		---	
	09/09/04	-0.04		---	
	09/10/04	-0.04		---	
	09/11/04	-0.04		---	
	09/12/04	-0.04		---	
	09/13/04	-0.04		---	
	09/14/04	-0.04		---	

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A [(1)]	09/15/04	-0.04	3155.51	---	
	09/16/04	-0.04		---	
	09/17/04	-0.04		---	
	09/18/04	-0.04		---	
	09/19/04	-0.04		---	
	09/20/04	-0.04		---	
	09/21/04	-0.04		---	
	09/22/04	-0.04		---	
	09/23/04	-0.04		---	
	09/24/04	-0.04		---	
	09/25/04	-0.04		---	
	09/26/04	-0.04		---	
	09/27/04	-0.04		---	
	09/28/04	-0.04		---	
	09/29/04	-0.04		---	
	09/30/04	-0.04		---	
	10/01/04	-0.04		---	
	10/02/04	-0.04		---	
	10/03/04	-0.04		---	
	10/04/04	-0.04		---	
	10/05/04	-0.04		---	
	10/06/04	-0.04		---	
	10/07/04	-0.04		---	
	10/08/04	-0.04		---	
	10/09/04	-0.04		---	
	10/10/04	-0.04		---	
	10/11/04	-0.04		---	
	10/12/04	-0.04		---	
	10/13/04	-0.04		---	
	10/14/04	-0.04		---	
	10/15/04	-0.04		---	
	10/16/04	-0.04		---	
	10/17/04	-0.04		---	
	10/18/04	-0.04		---	
	10/19/04	-0.04		---	
	10/20/04	-0.04		---	
	10/21/04	-0.04		---	
	10/22/04	-0.04		---	
	10/23/04	-0.04		---	
	10/24/04	-0.04		---	
	10/25/04	-0.04		---	
	10/26/04	-0.04		---	
	10/27/04	-0.04		---	
	10/28/04	-0.04		---	
	10/29/04	-0.04		---	
	10/30/04	-0.04		---	
	10/31/04	-0.04		---	
	11/01/04	-0.04		---	
	11/02/04	-0.04		---	
	11/03/04	-0.04		---	

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A [(1)]	11/04/04	-0.04	3155.51	---	
	11/05/04	-0.04		---	
	11/06/04	-0.04		---	
	11/07/04	-0.04		---	
	11/08/04	-0.04		---	
	11/09/04	-0.04		---	
	11/10/04	-0.04		---	
	11/11/04	-0.04		---	
	11/12/04	-0.04		---	
	11/13/04	-0.04		---	
	11/14/04	-0.04		---	
	11/15/04	-0.04		---	
	11/16/04	-0.04		---	
	11/17/04	-0.04		---	
	11/18/04	-0.04		---	
	11/19/04	-0.04		---	
	11/20/04	-0.04		---	
	11/21/04	-0.04		---	
	11/22/04	-0.04		---	
	11/23/04	-0.04		---	
	11/24/04	-0.04		---	
	11/25/04	-0.04		---	
	11/26/04	-0.04		---	
	11/27/04	-0.04		---	
	11/28/04	-0.04		---	
	11/29/04	-0.04		---	
	11/30/04	-0.04		---	
	12/01/04	-0.04		---	
	12/02/04	-0.04		---	
	12/03/04	-0.04		---	
	12/04/04	-0.04		---	
	12/05/04	-0.04		---	
	12/06/04	-0.04		---	
	12/07/04	-0.04		---	
	12/08/04	-0.04		---	
	12/09/04	-0.04		---	
	12/10/04	-0.04		---	
	12/11/04	-0.04		---	
	12/12/04	-0.04		---	
	12/13/04	-0.04		---	
	12/14/04	-0.04		---	
	12/15/04	-0.04		---	
	12/16/04	-0.04		---	
	12/17/04	-0.04		---	
	12/18/04	-0.04		---	
	12/19/04	-0.04		---	
	12/20/04	-0.04		---	
	12/21/04	-0.04		---	
	12/22/04	-0.04		---	
	12/23/04	-0.04		---	

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A (1)	12/24/04	-0.04	3155.51	---	
	12/25/04	-0.04		---	
	12/26/04	-0.04		---	
	12/27/04	-0.04		---	
	12/28/04	-0.04		---	
	12/29/04	-0.04		---	
	12/30/04	0.95		3156.46	
	12/31/04	2.13		3157.64	
	01/01/05	1.98		3157.49	
	01/02/05	1.90		3157.41	
	01/03/05	2.19		3157.70	
	01/04/05	3.57		3159.08	
	01/05/05	3.15		3158.66	
	01/06/05	2.78		3158.29	
	01/07/05	2.56		3158.07	
	01/08/05	2.44		3157.95	
	01/09/05	2.44		3157.95	
	01/10/05	2.44		3157.95	
	01/11/05	2.47		3157.98	
	01/12/05	2.39		3157.90	
	01/13/05	2.30		3157.81	
	01/14/05	2.23		3157.74	
	01/15/05	2.16		3157.67	
	01/16/05	2.11		3157.62	
	01/17/05	2.08		3157.59	
	01/18/05	2.05		3157.56	
	01/19/05	2.03		3157.54	
	01/20/05	2.02		3157.53	
	01/21/05	2.07		3157.58	
	01/22/05	2.46		3157.97	
	01/23/05	2.31		3157.82	
	01/24/05	2.24		3157.75	
	01/25/05	2.21		3157.72	
	01/26/05	2.18		3157.69	
	01/27/05	3.39		3158.90	
	01/28/05	3.03		3158.54	
	01/29/05	2.75		3158.26	
	01/30/05	2.58		3158.09	
	01/31/05	2.46		3157.97	
	02/01/05	2.36		3157.87	
	02/02/05	2.28		3157.79	
	02/03/05	2.22		3157.73	
	02/04/05	2.18		3157.69	
	02/05/05	2.16		3157.67	
	02/06/05	2.17		3157.68	
	02/07/05	2.17		3157.68	
	02/08/05	2.13		3157.64	
	02/09/05	2.10		3157.61	
	02/10/05	2.09		3157.60	
	02/11/05	2.60		3158.11	

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A [(1)]	02/12/05	5.11	3155.51	3160.62	
	02/13/05	3.73		3159.24	
	02/14/05	3.14		3158.65	
	02/15/05	2.85		3158.36	
	02/16/05	2.66		3158.17	
	02/17/05	2.54		3158.05	
	02/18/05	2.59		3158.10	
	02/19/05	2.52		3158.03	
	02/20/05	2.85		3158.36	
	02/21/05	2.79		3158.30	
	02/22/05	2.64		3158.15	
	02/23/05	2.53		3158.04	
	02/24/05	2.44		3157.95	
	02/25/05	2.38		3157.89	
	02/26/05	2.30		3157.81	
	02/27/05	2.24		3157.75	
	02/28/05	2.20		3157.71	
	03/01/05	2.15		3157.66	
	03/02/05	2.12		3157.63	
	03/03/05	2.09		3157.60	
	03/04/05	2.06		3157.57	
	03/05/05	2.04		3157.55	
	03/06/05	2.12		3157.63	
	03/07/05	2.18		3157.69	
	03/08/05	2.12		3157.63	
	03/09/05	2.08		3157.59	
	03/10/05	2.05		3157.56	
	03/11/05	2.02		3157.53	
	03/12/05	2.00		3157.51	
	03/13/05	1.98		3157.49	
	03/14/05	1.98		3157.49	
	03/15/05	1.96		3157.47	
	03/16/05	1.95		3157.46	
	03/17/05	1.95		3157.46	
	03/18/05	1.94		3157.45	
	03/19/05	1.94		3157.45	
	03/20/05	1.93		3157.44	
	03/21/05	1.92		3157.43	
	03/22/05	1.92		3157.43	
	03/23/05	1.92		3157.43	
	03/24/05	1.92		3157.43	
	03/25/05	1.92		3157.43	
	03/26/05	1.91		3157.42	
	03/27/05	1.91		3157.42	
	03/28/05	1.91		3157.42	
	03/29/05	1.90		3157.41	
	03/30/05	1.89		3157.40	
	03/31/05	1.88		3157.39	
	04/01/05	1.87		3157.38	
	04/02/05	1.87		3157.38	

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A [(1)]	04/03/05	1.88	3155.51	3157.39	
	04/04/05	1.87		3157.38	
	04/05/05	1.88		3157.39	
	04/06/05	1.87		3157.38	
	04/07/05	1.86		3157.37	
	04/08/05	1.85		3157.36	
	04/09/05	1.84		3157.35	
	04/10/05	1.83		3157.34	
	04/11/05	1.82		3157.33	
	04/12/05	1.81		3157.32	
	04/13/05	1.81		3157.32	
	04/14/05	1.81		3157.32	
	04/15/05	1.80		3157.31	
	04/16/05	1.80		3157.31	
	04/17/05	1.79		3157.30	
	04/18/05	1.79		3157.30	
	04/19/05	1.80		3157.31	
	04/20/05	1.80		3157.31	
	04/21/05	1.80		3157.31	
	04/22/05	1.80		3157.31	
	04/23/05	1.80		3157.31	
	04/24/05	1.82		3157.33	
	04/25/05	1.81		3157.32	
	04/26/05	1.81		3157.32	
	04/27/05	1.80		3157.31	
	04/28/05	1.80		3157.31	
	04/29/05	1.80		3157.31	
	04/30/05	1.80		3157.31	
	05/01/05	1.80		3157.31	
	05/02/05	1.80		3157.31	
	05/03/05	1.80		3157.31	
	05/04/05	1.80		3157.31	
	05/05/05	1.80		3157.31	
	05/06/05	1.80		3157.31	
	05/07/05	1.78		3157.29	
	05/08/05	1.78		3157.29	
	05/09/05	1.78		3157.29	
	05/10/05	1.78		3157.29	
	05/11/05	1.77		3157.28	
	05/12/05	1.77		3157.28	
	05/13/05	1.76		3157.27	
	05/14/05	1.76		3157.27	
	05/15/05	1.76		3157.27	
	05/16/05	1.74		3157.25	
	05/17/05	1.77		3157.28	
	05/18/05	1.76		3157.27	
	05/19/05	1.75		3157.26	
	05/20/05	1.74		3157.25	
	05/21/05	1.75		3157.26	
	05/22/05	1.74		3157.25	

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A [(1)]	05/23/05	1.73	3155.51	3157.24	
	05/24/05	1.70		3157.21	
	05/25/05	1.69		3157.20	
	05/26/05	1.68		3157.19	
	05/27/05	1.68		3157.19	
	05/28/05	1.67		3157.18	
	05/29/05	1.66		3157.17	
	05/30/05	1.63		3157.14	
	05/31/05	1.62		3157.13	
	06/01/05	1.60		3157.11	
	06/02/05	1.57		3157.08	
	06/03/05	1.54		3157.05	
	06/04/05	1.49		3157.00	
	06/05/05	1.44		3156.95	
	06/06/05	1.40		3156.91	
	06/07/05	1.37		3156.88	
	06/08/05	1.33		3156.84	
	06/09/05	1.29		3156.80	
	06/10/05	1.26		3156.77	
	06/11/05	1.22		3156.73	
	06/12/05	1.17		3156.68	
	06/13/05	1.12		3156.63	
	06/14/05	1.06		3156.57	
	06/15/05	1.00		3156.51	
	06/16/05	0.94		3156.45	
	06/17/05	0.88		3156.39	
	06/18/05	0.83		3156.34	
	06/19/05	0.77		3156.28	
	06/20/05	0.71		3156.22	
	06/21/05	0.64		3156.15	
	06/22/05	0.58		3156.09	
	06/23/05	0.51		3156.02	
	06/24/05	0.47		3155.98	
	06/25/05	0.42		3155.93	
	06/26/05	0.34		3155.85	
	06/27/05	0.29		3155.80	
	06/28/05	0.23		3155.74	
	06/29/05	0.17		3155.68	
	06/30/05	0.13		3155.64	
	07/01/05	0.07		3155.58	
	07/02/05	0.01		3155.52	
	07/03/05	-0.03		---	
	07/04/05	-0.04		---	
	07/05/05	-0.04		---	
	07/06/05	-0.04		---	
	07/07/05	-0.04		---	
	07/08/05	-0.04		---	
	07/09/05	-0.04		---	
	07/10/05	-0.04		---	
	07/11/05	-0.04		---	

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A [(1)]	07/12/05	-0.04	3155.51	---	
	07/13/05	-0.04		---	
	07/14/05	-0.04		---	
	07/15/05	-0.04		---	
	07/16/05	-0.04		---	
	07/17/05	-0.04		---	
	07/18/05	-0.04		---	
	07/19/05	-0.04		---	
	07/20/05	-0.04		---	
	07/21/05	-0.04		---	
	07/22/05	-0.04		---	
	07/23/05	-0.04		---	
	07/24/05	-0.04		---	
	07/25/05	-0.04		---	
	07/26/05	-0.04		---	
	07/27/05	-0.04		---	
	07/28/05	-0.04		---	
	07/29/05	-0.04		---	
	07/30/05	-0.04		---	
	07/31/05	-0.04		---	
	08/01/05	-0.04		---	
	08/02/05	-0.04		---	
	08/03/05	-0.04		---	
	08/04/05	-0.04		---	
	08/05/05	-0.04		---	
	08/06/05	-0.04		---	
	08/07/05	-0.04		---	
	08/08/05	-0.04		---	
	08/09/05	-0.04		---	
	08/10/05	-0.04		---	
	08/11/05	-0.04		---	
	08/12/05	-0.04		---	
	08/13/05	-0.04		---	
	08/14/05	-0.04		---	
	08/15/05	-0.04		---	
	08/16/05	-0.04		---	
	08/17/05	-0.04		---	
	08/18/05	-0.04		---	
	08/19/05	-0.04		---	
	08/20/05	-0.04		---	
	08/21/05	-0.04		---	
	08/22/05	-0.04		---	
	08/23/05	-0.04		---	
	08/24/05	-0.04		---	
	08/25/05	-0.04		---	
	08/26/05	-0.04		---	
	08/27/05	-0.04		---	
	08/28/05	-0.04		---	
	08/29/05	-0.04		---	
	08/30/05	-0.04		---	

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool A (1)	08/31/05	-0.04	3155.51	---	
	09/01/05	-0.04		---	
	09/02/05	-0.04		---	
	09/03/05	-0.04		---	
	09/04/05	-0.04		---	
	09/05/05	-0.04		---	
	09/06/05	-0.04		---	
	09/07/05	-0.04		---	
	09/08/05	-0.04		---	
	09/09/05	-0.04		---	
	09/10/05	-0.04		---	
	09/11/05	-0.04		---	
	09/12/05	-0.04		---	
	09/13/05	-0.04		---	
	09/14/05	-0.04		---	
	09/15/05	-0.04		---	
	09/16/05	-0.04		---	
	09/17/05	-0.04		---	
	09/18/05	-0.04		---	
	09/19/05	-0.04		---	
	09/20/05	-0.04		---	
	09/21/05	-0.04		---	
	09/22/05	-0.04		---	
	09/23/05	-0.04		---	
	09/24/05	-0.04		---	
	09/25/05	-0.04		---	
	09/26/05	-0.04		---	
	09/27/05	-0.04		---	
	09/28/05	-0.04		---	
	09/29/05	-0.04		---	
	09/30/05	-0.04		---	
Pool B (2)	02/04/04	< AL	3144.52	---	dry
	02/18/04	< AL		---	dry/ flow
	03/03/04	2.12		3146.64	flow
	03/17/04	2.30		3146.82	flow
	03/18/04	2.16		3146.68	flow
	03/31/04	1.66		3146.18	flow
	04/14/04	2.04		3146.56	flow
	04/28/04	1.60		3146.12	flow
	05/12/04	1.50		3146.02	flow
	05/26/04	1.46		3145.98	flow
	06/09/04	1.36		3145.88	pool
	06/23/04	1.30		3145.82	pool
	07/07/04	0.74		3145.26	pool
	07/21/04	0.12		3144.64	pool
	08/04/04	0.88		3145.40	pool
	08/18/04	0.48		3145.00	pool
	09/01/04	< AL		---	wet
	09/15/04	< AL		---	wet
	09/29/04	< AL		---	dry

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool B [(2)]	10/13/04	< AL	3144.52	---	dry
	10/27/04	< AL		---	dry
	11/10/04	< AL		---	dry
	11/24/04	< AL		---	dry
	12/08/04	< AL		---	dry
	12/22/04	< AL		---	dry
	01/04/05	3.50		3148.02	flow
	01/08/05	2.25		3146.77	flow
	01/12/05	2.24		3146.76	flow
	01/26/05	1.98		3146.50	flow
	02/09/05	1.91		3146.43	flow
	02/23/05	ND		---	flow
	03/09/05	ND		---	flow
	03/23/05	ND		---	flow
	04/06/05	ND		---	flow
	04/20/05	ND		---	flow
	05/04/05	ND		---	flow
	05/18/05	ND		---	flow
	05/25/05	1.70		3146.22	flow
	06/01/05	1.68		3146.20	flow
	06/15/05	1.42		3145.94	pool
	06/29/05	0.94		3145.46	pool
	07/13/05	< 0.18		---	pool*
	07/27/05	< 0.18		---	dry
	08/10/05	< AL		---	dry
	08/24/05	< 0.14		---	dry
	09/07/05	< 0.14		---	dry
	09/21/05	< 0.12		---	dry
Pool C	06/11/03	1.26	3145.62	3146.88	flow or pool
	06/13/03	1.16		3146.78	pool
	06/18/03	0.89		3146.51	pool
	06/25/03	0.42		3146.04	pool
	07/09/03	ND		---	pool or wet
	07/18/03	< AL		---	dry
	07/23/03	< AL		---	dry
	07/30/03	1.10		3146.72	pool
	08/06/03	< AL		---	wet
	08/20/03	< AL		---	wet
	09/03/03	< AL		---	wet
	09/17/03	< AL		---	dry
	10/01/03	< AL		---	wet
	10/15/03	< AL		---	wet
	10/29/03	< AL		---	dry
	11/12/03	< AL		---	dry
	11/26/03	< AL		---	dry
	12/10/03	< AL		---	dry
	12/24/03	< AL		---	dry
	01/07/04	< AL		---	dry
	01/21/04	< AL		---	dry
	02/04/04	< AL		---	dry

See last page of Table VIII for notes and abbreviations.

TABLE VIII
POOL ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Pool	Date	Staff Plate (ft)	Zero Elevation Plate (ft, MSL)	Water Surface Elevation (ft, MSL)	Notes
Pool C	02/18/04	< AL	3145.62	---	dry / flow
	03/03/04	1.86		3147.48	flow
	03/17/04	1.98		3147.60	flow
	03/18/04	1.89		3147.51	flow
	03/31/04	1.58		3147.20	flow
	04/14/04	1.80		3147.42	flow
	04/28/04	1.54		3147.16	flow
	05/12/04	1.52		3147.14	flow
	05/26/04	1.50		3147.12	flow
	06/09/04	1.42		3147.04	flow
	06/23/04	0.72		3146.34	pool
	07/07/04	< AL		---	wet
	07/21/04	< AL		---	wet
	08/04/04	< AL		---	wet
	08/18/04	< AL		---	wet
	09/01/04	< AL		---	dry
	09/15/04	< AL		---	wet
	09/29/04	< AL		---	dry
	10/13/04	< AL		---	dry
	10/27/04	< AL		---	dry
	11/10/04	< AL		---	dry
	11/24/04	< AL		---	dry
	12/08/04	< AL		---	dry
	12/22/04	< AL		---	dry
	01/04/05	3.10		3148.72	flow
	01/08/05	1.99		3147.61	flow
	01/12/05	1.98		3147.60	flow
	01/26/05	1.80		3147.42	flow
	02/09/05	1.73		3147.35	flow
	02/23/05	2.10		3147.72	flow
	03/09/05	1.60		3147.22	flow
	03/16/05	1.50		3147.12	flow
	03/23/05	1.46		3147.08	flow
	04/06/05	1.40		3147.02	flow
	04/20/05	1.36		3146.98	flow
	05/04/05	1.36		3146.98	flow
	05/18/05	1.33		3146.95	flow
	05/25/05	1.31		3146.93	flow
	06/01/05	1.29		3146.91	flow
	06/15/05	1.20		3146.82	pool
	06/29/05	< 0.72		---	wet
	07/13/05	< 0.72		---	wet
	07/27/05	< 0.72		---	dry
	08/10/05	< AL		---	dry
	08/24/05	< 0.70		---	dry
	09/07/05	< 0.70		---	dry
	09/21/05	< 0.70		---	dry

See last page of Table VIII for notes and abbreviations.

TABLE VIII
NOTES AND ABBREVIATIONS

1. ft, MSL = feet above mean sea level.
2. flow = Creek is still flowing (flow into and/or out of pool is evident)
3. pool = Creek has stopped flowing but there is water in the Pool at the listed staff plate reading
4. wet = There is still water in the pool but is not recordable by the staff plate (lower than the staff plate or aggradation line).
5. dry = Pool is completely dry.
6. < AL = Water level not measureable. Number reflects the lowest number readable on the staff plate (the aggradation line or AL) preceded by a less than (<) sign.
7. ND = No Data; Pool B staff gage damaged in high flows.
8. * = Tape Down Elevation
   Note for Pool B when a tape down stage measurement is collected. The tape down measurement is measured from a line that crosses above the deepest section of the pool to water surface elevation. A horizontal line is strung between the bolt on the staff plate and the rock bolt on the downstream left bank. The datum for the tape down measurement is 2.28 feet.
9. (1) = Pool A staff plate measurement is a daily mean value which represents the mean of of depth to water measurements recorded at 15-minute intervals.
10. (2) = Zero plate elevation for the Pool B staff gage is estimated. Staff B gage was not present during April 2007 survey.
11. Pool A = NPS Rincon Creek Gage Surface Water Station 320745110365701.

TABLE IX

SHALLOW MONITOR WELL GROUNDWATER ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Monitor Well ID	Property Owner	Well Location	ADWR 55-Registry No.	Date	Measuring Point Elevation (ft, MSL)	Depth to Water (from MPE, feet)	Water Level Elevation (ft, MSL)	Footnote
RC-1	Weil	D(15-17) 16ACB	206881	04/29/05	3161.66	5.92	3155.74	
				05/04/05	3161.66	5.99	3155.67	
				06/03/05	3161.66	6.77	3154.89	daily mean value
				07/08/05	3161.66	8.44	3153.22	daily mean value
				08/05/05	3161.66	8.95	3152.71	daily mean value
				09/02/05	3161.66	8.27	3153.39	daily mean value
RC-2	Weil	D(15-17) 16ACB	206882	04/29/05	3163.65	7.79	3155.86	
				05/04/05	3163.65	7.85	3155.80	
				06/03/05	3163.65	8.65	3155.00	
				07/08/05	3163.65	10.50	3153.15	daily mean value
				08/05/05	3163.65	11.33	3152.32	daily mean value
				09/02/05	3163.65	11.86	3151.79	daily mean value
RC-3	Weil	D(15-17) 16ACB	206883	04/29/05	3167.87	12.13	3155.74	
				05/04/05	3167.87	12.15	3155.72	
				06/03/05	3167.87	12.90	3154.97	daily mean value
				07/08/05	3167.87	15.13	3152.74	daily mean value
				08/05/05	3167.87	15.95	3151.92	daily mean value
				09/02/05	3167.87	16.30	3151.57	daily mean value
RC-4	Lunt	D(15-17) 17ADB	206880	04/29/05	3152.99	8.50	3144.49	
				05/04/05	3152.99	8.50	3144.49	
				06/01/05	3152.99	9.14	3143.85	
				07/08/05	3152.99	10.63	3142.36	
				08/05/05	3152.99	dry	---	
				08/23/05	3152.99	dry	---	
				09/02/05	3152.99	dry	---	
				09/07/05	3152.99	dry	---	
				09/21/05	3152.99	dry	---	
RC-5	Lunt	D(15-17) 17ADB	206879	04/29/05	3155.02	10.44	3144.58	
				05/04/05	3155.02	10.58	3144.44	
				06/01/05	3155.02	11.12	3143.90	
				07/08/05	3155.02	12.75	3142.27	
				08/05/05	3155.02	dry	---	
				08/23/05	3155.02	dry	---	
				09/02/05	3155.02	dry	---	
				09/07/05	3155.02	dry	---	
				09/21/05	3155.02	dry	---	
RC-6	Lunt	D(15-17) 17ADB	206878	04/29/05	3156.37	12.17	3144.20	
				05/04/05	3156.37	12.33	3144.04	
				06/01/05	3156.37	12.93	3143.44	
				07/08/05	3156.37	14.44	3141.93	
				08/05/05	3156.37	15.37	3141.00	
				08/23/05	3156.37	dry	---	
				09/02/05	3156.37	dry	---	
				09/07/05	3156.37	dry	---	
				09/21/05	3156.37	dry	---	

TABLE IX
SHALLOW MONITOR WELL GROUNDWATER ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Monitor Well ID	Property Owner	Well Location	ADWR 55-Registry No.	Date	Measuring Point Elevation (ft, MSL)	Depth to Water (from MPE, feet)	Water Level Elevation (ft, MSL)	Footnote
RC-7	Lunt	D(15-17) 17ACA	206877	04/29/05	3147.41	10.75	3136.66	
				05/04/05	3147.41	10.75	3136.66	
				06/01/05	3147.41	dry	---	
				07/08/05	3147.41	dry	---	
				08/05/05	3147.41	dry	---	
				08/23/05	3147.41	dry	---	
				09/02/05	3147.41	dry	---	
				09/07/05	3147.41	dry	---	
				09/21/05	3147.41	dry	---	

NOTES AND ABBREVIATIONS:
1. ft, MSL = feet above mean sea level.
2. MPE = measuring point elevation.
3. Daily mean value represents the mean of depth to water measurements recorded at 15-minute intervals.

TABLE X
WELL INVENTORY SUMMARY
RINCON CREEK, PIMA COUNTY, ARIZONA

Well Location	Original Well Location	Well Name	ADWR Well Registry No.	Date Completed	Well Depth (ft)	Depth to Water at Time of Construction (ft bls)	Water Use	Borehole		Casing			Open/ Screened Interval (ft)	Cement Interval (ft bls)	Lithology Available Yes/No?	Pump Rate (gpm)	Owner	Location Field Checked?
								Diameter (in)	*Interval (ft bls)*	*Diameter (in)*	*Depth (ft)*	*Type*						
D(15-17)8cda		M-13 Leon windmill		prior to 1959	96	82											National Park Service	Yes
D(15-17)8cdd			55-636173	~ 1925	92	15	Stock watering			3	87	Galvanized pipe				15	National Park Service	Couldn't find
D(15-17)16aad			55-086417	12/28/1980	325	285	domestic			6	0-325	PVC	285-325		y	25	Webster & Caroline Slate	No
D(15-17)16acb		RC-1	55-206881	4/20/2005	8	3.52		8.25	0-8.5	4	+2.4-8	PVC	3-8	0-2	y	0	Andrew T. Weil	Yes
D(15-17)16acb		RC-2	55-206882	4/20/2005	12.3	5.99		8.25	0-13	4	+1.8-12.3	PVC	5-12.3	0-3	y	0	Andrew T. Weil	Yes
D(15-17)16acb		RC-3	55-206883	4/19/2005	16.4	10.23		8.25	0-17	4	+1.9-16.4	PVC	9-16.4	0-5	y	0	Andrew T. Weil	Yes
D(15-17)16acc	D(15-17)16acd	M-1, RWC 1	55-607532	Mar-62	286	79	Water company, domestic uses, stockwatering, truckload sales to Nat'l Park Service			16 12	0-18 18-280	Depth of casing 280'/ID line pipe welded	68-262		y	1500	Rincon Water Company	Yes
D(15-17)16acd	D(15-17)16aca	HA-8, Bixler	55-537373	9/23/1993	255	hit water at 230' then water rose to 65'	domestic			8	0-255	Steel	195-255		y		Ruth M. Bixler	Yes
D(15-17)16adc		M-8, RWC 8	55-607531	Summer 1968	335	64	Water company, domestic uses, stockwatering, truckload sales to Nat'l Park Service			10 12	0 - 335 286	Steel	65-335			1000	Rincon Water Company	Yes
D(15-17)16bad		M-12 Jackson cistern	55-633107	~ 1925	38	12	Domestic use/stockwater				32	Cement lined				35	Andrew T. Weil	Yes
D(15-17)16bda	D(15-17)16bad	HA-9, Weil	55-564266	2/6/1998	440	67				6 4.5	1 - 19 1.2 - 438	Steel	388 - 428	+1 - 19	y		Andrew T. Weil	Yes
D(15-17)16bda		Weil #2			13.5	13.39 (09/03/2004)						Steel					Andrew T. Weil	Yes
D(15-17)16ccc		M-6		Jun-65	181	dry									y		Philip Ward, Jo Kubran	No
D(15-17)16dab			55-592604	Jul-02	345	93	household and garden	12 6.5	0-20 0-345	7 5	1-20 0-345	steel PVC	slotted int. 145-165 205-225 245-265 285-305 325-345	0-20	y		Ronnie Hilliard Living Trust	No
D(15-17)16dbb	D(15-17)16bac	HA-10 Mallien	55-516967	2/18/1987	350	135				8 5 9/16	12 - 21 13 - 350	Steel	190 - 210 330 - 350	+1 - 21	y	30	James Mallien	Yes
D(15-17)17aca		RC-7	55-206877	4/22/2005	9	8.25		8.25	0-9	4	+2.5-9	PVC	4-9	0-3	y	0	Anthony Lunt	Yes
D(15-17)17acb		M-3	55-633108	Jun-65	152	12				16	12-24		26-152		y	60	Mathew McKenzie	No
D(15-17)17ada	D(15-17)17adc	M-2, Lunt	55-633106	7/18/1964	455	14	stockwater			16	0-10	0.250 wall surface pipe	none		y	3	Anthony Lunt	Yes
D(15-17)17adb		RC-4	55-206880	4/21/2005	8.5	7.00		8.25	0-9	4	+2-8.5	PVC	4.5-8.5	0-2.5	y	0	Anthony Lunt	Yes
D(15-17)17adb		RC-5	55-206879	4/21/2005	11.5	8.64		8.25	0-11.5	4	+1.8-11.5	PVC	6.5-11.5	0-3.5	y	0	Anthony Lunt	Yes
D(15-17)17adb		RC-6	55-206878	4/21/2005	13	9.57		8.25	0-13	4	+2.6-13	PVC	5.5-13	0-3	y	0	Anthony Lunt	Yes
D(15-17)17b			55-636265	~1965	NA	NA	domestic, stockwater, non-commercial irrigation										Natalie E. Crable Tr	No
D(15-17)17bbd	D(15-17)17bbc	M-4	55-636171	5/6/1964	204	12	stockwatering			12 3/4	0-205	steel line pipe	12-205		y	35	Mathew McKenzie	Yes
D(15-17)17bba		M-7, RWC 7	55-636172	1968	315	11				12					y	50	Mathew McKenzie	No
D(15-17)17bbb		M-14 Leon cistern		prior to 1959		15											National Park Service	Couldn't find
D(15-17)18aad			55-591244	7/16/2002	560	37	domestic	12 1/4 8	0-20 20-560	8 5 5	0-20 0-500 500-560	steel PVC PVC	500-560	0-20	y	20	Mathew McKenzie	No
D(15-17)18aad			55-551981	6/21/1996	690	350	domestic			8 6	0-20 0-690	steel	350-370 650-690		y		Mathew McKenzie	No
D(15-17)18aad	D(15-17)17bbc	M-5		Jun-65	98	11				16			open hole		y		Mathew McKenzie	No
D(15-17)18ad			55-635186	NA	300	165	stockwater-domestic			6	26	steel				13	Gilbert Acosta	No
D(15-17)18ad			55-804470	prior to 9/14/75	15	6-15	domestic & irrigation of garden			48	15	rock				35	Gilbert Acosta	No
D(15-17)18adc			55-574835	6/27/1999	500	85	domestic			8 5	0-20 0-500	steel & PVC	440-500		y		Mathew McKenzie	No

NOTE: Well names prefixed with "HA" (eg., HA-9) have been monitored by Haley & Aldrich (2003).
Well names prefixed with "M" (eg., M-1) were reported by Turner and Manera (1961) and Manera (1982, 1983, 1984).
Well names prefixed with "RC" (eg., RC-1) were installed by Haley & Aldrich (2005).

TABLE XI
PRIVATE WELL GROUNDWATER ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Well Owner	Well Location	ADWR 55-Registry No.	Date	Measuring Point Elevation (ft, MSL)	Depth to Water (feet)	Water Level Elevation (ft, MSL)	Footnote
Bixler	D (15-17) 16ACD	537373	01/31/03	3186*	UTM	---	
Bixler			02/28/03		76.01	3109.99	
Bixler			03/28/03		79.04	3106.96	P
Bixler			04/30/03		76.20	3109.80	
Bixler			05/23/03		77.03	3108.97	P
Bixler			06/27/03		76.89	3109.11	
Bixler			08/01/03		77.14	3108.86	
Bixler			08/29/03		77.19	3108.81	
Bixler			09/26/03		77.38	3108.62	
Bixler			10/24/03		77.57	3108.43	
Bixler			11/24/03		77.38	3108.62	
Bixler			12/19/03		77.88	3108.12	
Bixler			01/23/04		77.88	3108.12	
Bixler			03/05/04		78.13	3107.87	
Bixler			03/26/04		77.89	3108.11	
Bixler			04/30/04		78.30	3107.70	
Bixler			06/04/04		78.42	3107.58	
Bixler			07/02/04		78.81	3107.19	
Bixler			07/30/04		UTM	---	
Bixler			09/03/04		79.15	3106.85	
Bixler			10/01/04		79.27	3106.73	
Bixler			10/29/04		79.45	3106.55	
Bixler			12/03/04		79.64	3106.36	
Bixler			01/14/05		79.75	3106.25	
Bixler			02/11/05		79.65	3106.35	
Bixler			03/25/05		79.76	3106.24	
Bixler			04/29/05		79.72	3106.28	
Bixler			06/01/05		79.99	3106.01	
Bixler			07/08/05		80.50	3105.50	
Bixler			08/05/05		UTM	---	
Bixler			09/02/05		80.90	3105.10	
Bixler			10/07/05		81.35	3104.65	
Bixler			11/07/05		81.46	3104.54	
Bixler			12/09/05		81.65	3104.35	
Bixler			01/06/06		81.75	3104.25	
Bixler			02/10/06		81.69	3104.31	
Bixler			03/10/06		81.88	3104.12	
Bixler			04/07/06		82.16	3103.84	
Weil	D (15-17) 16BDA	564266	09/27/02	3181.40	70.35	3111.05	
Weil			10/30/02		73.56	3107.84	
Weil			11/22/02		70.75	3110.65	
Weil			12/20/02		70.61	3110.79	
Weil			01/31/03		69.40	3112.00	
Weil			02/28/03		70.87	3110.53	
Weil			03/28/03		70.98	3110.42	
Weil			04/30/03		73.93	3107.47	P
Weil			05/23/03		71.34	3110.06	
Weil			06/27/03		71.78	3109.62	

TABLE XI
PRIVATE WELL GROUNDWATER ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

Well Owner	Well Location	ADWR 55-Registry No.	Date	Measuring Point Elevation (ft, MSL)	Depth to Water (feet)	Water Level Elevation (ft, MSL)	Footnote
Weil			08/01/03		71.80	3109.60	
Weil			08/29/03		72.12	3109.28	P
Weil			09/26/03		72.21	3109.19	
Weil			10/24/03		72.47	3108.93	
Weil			11/24/03		75.67	3105.73	
Weil			12/19/03		72.67	3108.73	
Weil			01/23/04		72.65	3108.75	
Weil			03/05/04		72.92	3108.48	
Weil			03/26/04		72.80	3108.60	
Weil			04/30/04		73.25	3108.15	
Weil			06/04/04		73.76	3107.64	
Weil			07/02/04		77.43	3103.97	
Weil			07/30/04		77.37	3104.03	
Weil			09/03/04		78.77	3102.63	P
Weil			10/01/04		79.17	3102.23	
Weil			10/29/04		78.78	3102.62	
Weil			12/03/04		74.50	3106.90	
Weil			01/14/05		74.77	3106.63	
Weil			02/11/05		74.51	3106.89	
Weil			03/25/05		74.58	3106.82	
Weil			04/29/05		79.47	3101.93	P
Weil			06/01/05		70.88	3110.52	
Weil			07/08/05		80.23	3101.17	P
Weil			08/05/05		80.37	3101.03	P
Weil			09/02/05		75.72	3105.68	
Weil			10/07/05		81.67	3099.73	P
Weil			11/07/05		76.24	3105.16	
Weil			12/09/05		76.52	3104.88	
Weil			01/06/06		80.07	3101.33	P
Weil			02/10/06		80.86	3100.54	P
Weil			03/10/06		76.67	3104.73	
Weil			04/07/06		76.95	3104.45	
Lunt	D (15-17) 17ADA	633106	04/30/03	3155.17	9.72	3145.45	
Lunt			04/23/04		9.33	3145.84	
Lunt			06/04/04		10.30	3144.87	
Lunt			07/02/04		11.13	3144.04	
Lunt			07/30/04		12.86	3142.31	
Lunt			09/03/04		14.35	3140.82	
Lunt			10/01/04		16.37	3138.80	
Lunt			10/29/04		18.39	3136.78	
Lunt			12/03/04		19.48	3135.69	
Lunt			01/14/05		16.38	3138.79	
Lunt			02/11/05		9.94	3145.23	
Lunt			03/25/05		9.27	3145.90	
Lunt			04/29/05		9.64	3145.53	
Lunt			06/01/05		10.30	3144.87	
Lunt			07/08/05		11.30	3143.87	
Lunt			08/05/05		13.59	3141.58	

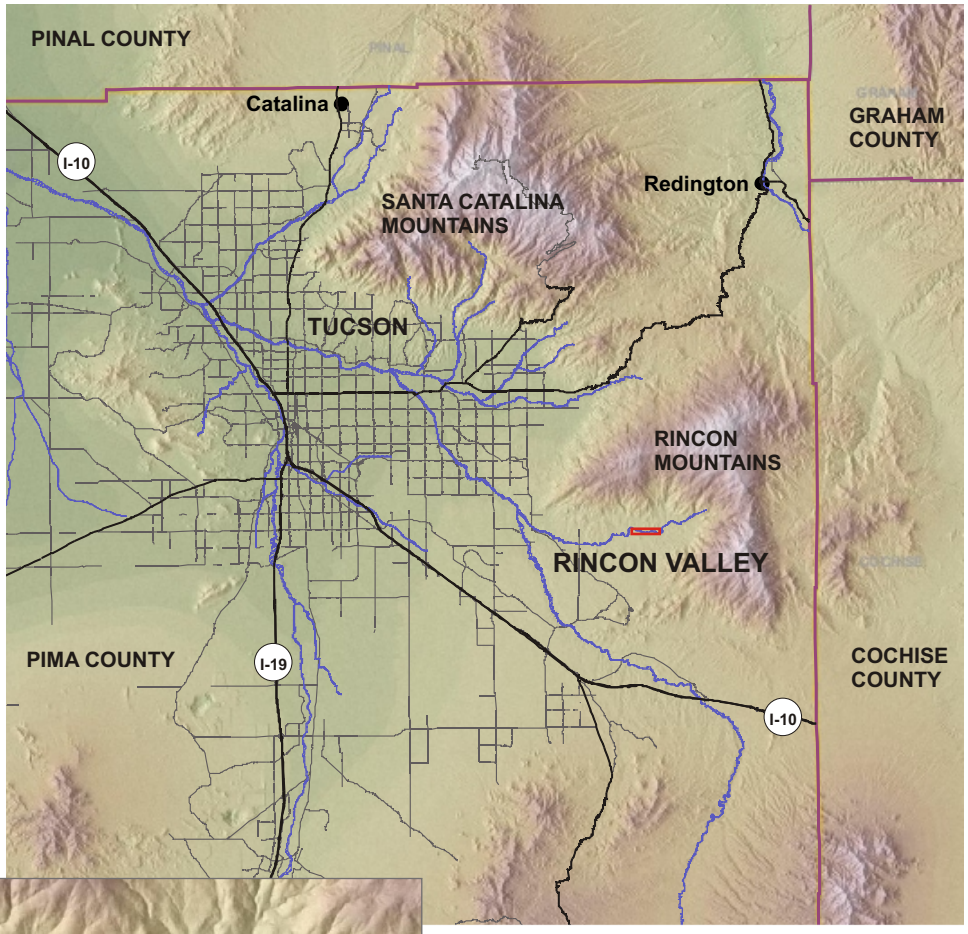
TABLE XI
PRIVATE WELL GROUNDWATER ELEVATIONS
RINCON CREEK
PIMA COUNTY, ARIZONA

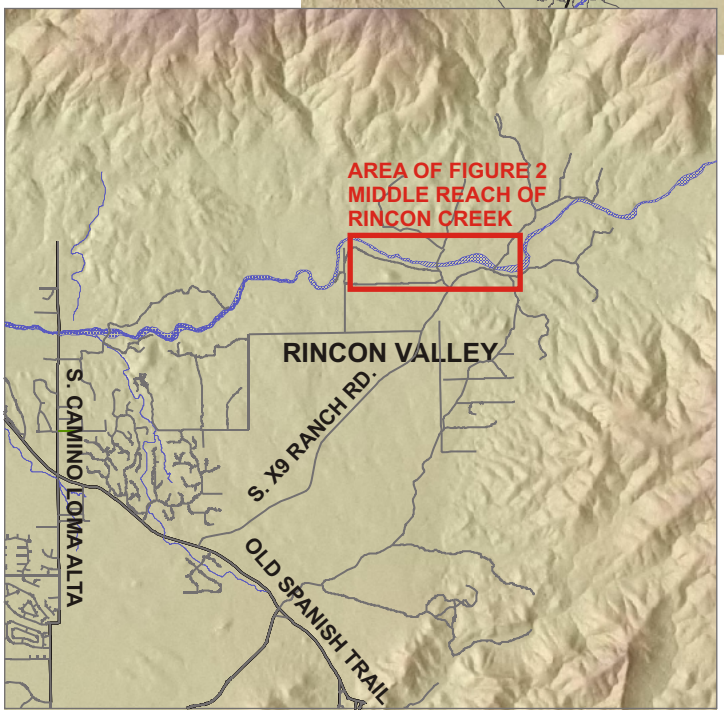
Well Owner	Well Location	ADWR 55-Registry No.	Date	Measuring Point Elevation (ft, MSL)	Depth to Water (feet)	Water Level Elevation (ft, MSL)	Footnote
Lunt			09/02/05		14.67	3140.50	
Lunt			10/07/05		17.41	3137.76	
Lunt			11/07/05		19.55	3135.62	
Lunt			12/09/05		20.47	3134.70	
Lunt			01/06/06		20.90	3134.27	
Lunt			02/10/06		21.13	3134.04	
Lunt			03/10/06		21.48	3133.69	
Lunt			04/07/06		21.55	3133.62	

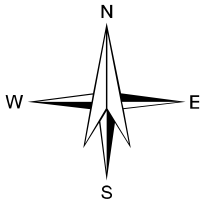
NOTES AND ABBREVIATIONS:
1. P = Pumping
2. UTM = Unable to measure
3. (*) = Measuring point elevation estimated from Pima County GIS map topography.

TABLE XII
RINCON WATER COMPANY PUMPAGE DATA
RINCON CREEK
PIMA COUNTY, ARIZONA

Year	Water Provider	Well Name	ADWR Well Registration Number	Location	Groundwater Withdrawn (acre-feet)
1986	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	14.52
1986	Rincon Water Co.	RWC 10	55-607533	D(15-17) 10CAA	3.46
1987	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	17.34
1988	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	21.03
1989	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	24.66
1990	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	27.06
1991	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	32.28
1992	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	29.73
1993	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	22.09
1994	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	31.60
1995	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	28.15
1996	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	33.84
1997	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	29.58
1998	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	25.92
1999	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	21.12
2000	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	18.96
2001	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	33.42
2002	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	20.86
2003	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	14.58
2004	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	16.55
2005	Rincon Water Co.	RWC 1	55-607532	D(15-17) 16ACC	24.87
Average Annual Groundwater Withdrawal					**24.58**







HALEY & ALDRICH

RINCON CREEK PROJECT
PIMA COUNTY, ARIZONA

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LOCATION MAP OF THE RINCON VALLEY AND THE MIDDLE REACH OF RINCON CREEK

SCALE: AS SHOWN
NOVEMBER 2007

FIGURE 1

G:\GRAPHICS\PROJECTS\29983-111\M02_M03_CDR_Files\A14_RINCON_CREEK1_M03_REV.CDR

LEGEND

STUDIES

- Turner & Manera, 1961; Manera, 1962, 1982, 1983, 1984
- Halpenny and Halpenny, 1985; Halpenny, 1986
- Baird et al., 2001
- Haley & Aldrich, 2003
- MacLeod et al., 2003
- Pima Association of Governments, 2004
- Current Investigation, Middle Reach of Rincon Creek

- FLOODPLAIN
- TERRACE BOUNDARY
- SECTION LINE
- ROAD
- RMD BOUNDARY
- WATERSHED

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SCALE IN METERS

HALEY & ALDRICH

RINCON CREEK PROJECT
PIMA COUNTY, ARIZONA

DRAFT FINAL

INDEX MAP OF PREVIOUS INVESTIGATIONS AND CURRENT INVESTIGATION

SCALE: AS SHOWN
NOVEMBER 2007

FIGURE 2

G:\29983-111\RINCONCREEKHA-29983-131-Watershed3.MXD

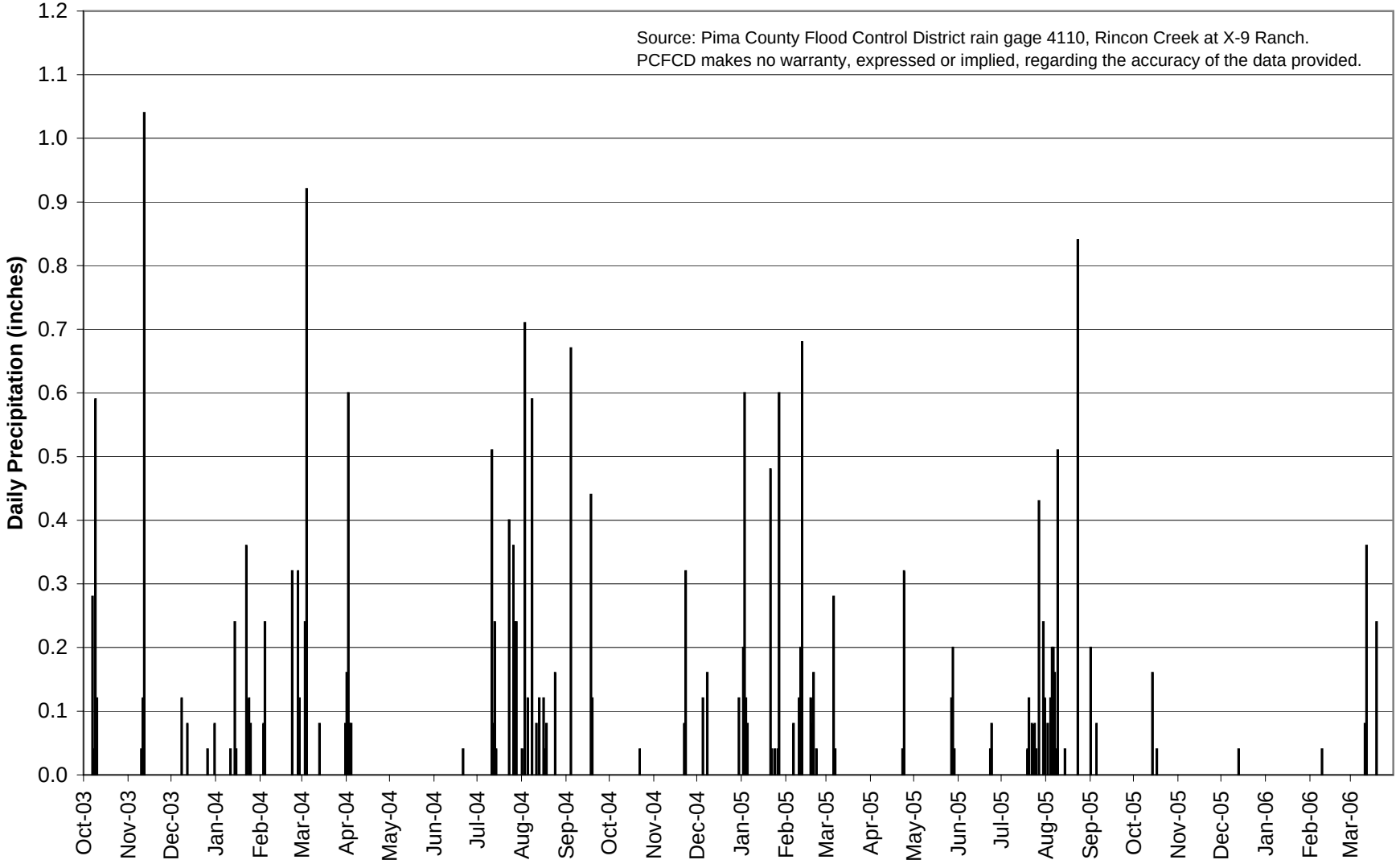


Figure 3. Rincon Creek Daily Precipitation, October 2003 through April 2006.
Rincon Creek
Pima County, Arizona

Geology modified from "Geologic Map of the Rincon Valley Area, Pima County, Arizona", Arizona Geological Survey Digital Geologic Map 44 (DGM-44), version 1.0, February 2005, Scale 1:24,000.

SECTION 07 SECTION 08 SECTION 09 SECTION 10 SECTION 15 SECTION 16 SECTION 17 SECTION 18 SECTION 20 SECTION 21 SECTION 22

Catalina Detachment Fault

Catalina Detachment Fault

MAP UNITS	DESCRIPTION
d	Disturbed ground (< 100 years)
Qs	Undivided surficial deposits (Quaternary)
Qc	Colluvium and talus (Quaternary)
Qy2	Late Holocene alluvium (<~2 ka)
Qy1	Older Holocene alluvium (~2 to 10 ka)
Qy	Undifferentiated Holocene alluvium (0 to ~10 ka)
Qi3	Late Pleistocene alluvium (~10 to 130 ka)
Qi2	Middle Pleistocene alluvium (~130 to 500 ka)
Qi1	Middle to early Pleistocene alluvium (~500 ka to 1 Ma)
Tcb	Chloritic breccia (Late Oligocene or early Miocene)
Tx(Cb)	Breccia derived from Bolsa Quartzite (Late Oligocene or early Miocene)
sTc	Silicified Pantano Formation (Late Oligocene or early Miocene)
Tp	Pantano Formation (Oligocene or early Miocene)
Tpcc	Carbonate-clast conglomerate facies
TKd	Mafic dikes (Cretaceous or Tertiary)
Kbu	Bisbee Group, undivided
Pzc	Undivided carbonate rocks (Paleozoic)
Ca	Abrigo Formation (Cambrian)
Cb	Bolsa Quartzite (Cambrian)
Yd	Diabase (Middle Proterozoic)
Yp	Pioneer Shale (Middle Proterozoic)
Xgt	Rincon Valley Granodiorite and coarse-grained granitoid undifferentiated
Xg	Coarse-grained granitoid
Xgd	Rincon Valley Granodiorite
	Footwall of the Catalina Detachment Fault
TPm	Marble, quartzite and calcsilicate metamorphic rocks (Middle Proterozoic, Paleozoic, Cretaceous, and Tertiary)
TXmy	Heterogeneous gneiss and mylonite near detachment fault (Proterozoic, Paleozoic, Cretaceous, and Tertiary)
TXg	Mixed ganitoid and gneiss (Proterozoic, Cretaceous, and Tertiary)
TKlg	Leucogranite (Early Tertiary or Late Cretaceous)
TXgn	Schist and gneiss (Proterozoic or Cretaceous)

LEGEND

Faults
- Fault, accurate
- Fault, approximate
- Fault, concealed
- Fault, low-angle, accurate
- Fault, low-angle, approximate
- Fault, low-angle, concealed
- Fault, detachment, accurate
- Fault, detachment, concealed

Contacts
- Gradational Contact
- Approximate Contact
- Concealed Contact
- Accurate Contact
- Scratch Contact
- Depositional Contact Exposed

Veins
- Vein
- Vein, approximate

Miscellaneous
- RMD Boundary
- Terrace Boundary
- Floodplain
- Section Line

N W E S

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SCALE IN METERS

HALEY & ALDRICH

RINCON CREEK PROJECT
PIMA COUNTY, ARIZONA

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GEOLOGIC MAP OF THE RINCON CREEK AREA

SCALE: AS SHOWN
NOVEMBER 2007

FIGURE 4

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SECTION 07
SECTION 08
SECTION 09
SECTION 10
SECTION 18
SECTION 17
SECTION 16
SECTION 15
SECTION 19
SECTION 20
SECTION 21
SECTION 22

D(15-17)8cda
D(15-17)8cdd
636173
D(15-17)10cca
POOL 8
D(15-17)17bbb
D(15-17)17bba
636172
D(15-17)17b
636265
D(15-17)17bbd
636171
D(15-17)18aad
551981
D(15-17)18aad
591244
D(15-17)17bbc
POOL7
USGS GAGE
POOL D(6)
POOL C(4)
POOL 3
POOL B(FP)
POOL B(2)
POOL 5
TRIBUTARY
RC-7
RC-4
RC-5
RC-6
D(15-17)17acb
633108
LUNT WELL
D(15-17)17ada
633106
POOL B GAGE
POOL C GAGE
D(15-17)18ad
635186
D(15-17)18adc
574835
CONFLUENCE RHINEVER CREEK
POOL A(1)
RC-1
RC-2
RC-3
BRIDGE
POOL A GAGE
WEIL WELL
D(15-17)16bda
564266
X-9 RANCH
D(15-17)16bad
633107
D(15-17)16bda
D(15-17)16aad
086417
BIXLER
D(15-17)16acd
537373
RWC 8
D(15-17)16adc
607531
RWC 1
D(15-17)16acc
607532
D(15-17)16dbb
516967
D(15-17)16dab
585559
D(15-17)16ccc

LEGEND

WELL LOCATIONS
- ESTIMATED FROM PIMA COUNTY GIS
- VERIFIED BY FIELD CHECK
- RC WELL
- WEIL WELL / LUNT WELL

- POOL LOCATION
- STAFF GAGE
- USGS GAGE
- MONITORING LOCATION

- FLOODPLAIN
- TERRACE BOUNDARY
- SECTION LINE
- RMD BOUNDARY

633106 ARIZONA DEPARTMENT OF WATER RESOURCES WELL-55 REGISTRY NUMBER

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SCALE IN METERS

HALEY & ALDRICH

RINCON CREEK PROJECT
PIMA COUNTY, ARIZONA

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LOCATION OF WELLS, STREAM GAGES, STREAM POOLS, AND MONITORING LOCATIONS

SCALE: AS SHOWN
NOVEMBER 2007

FIGURE 5

G:\29983-111\RINCON\CREEK\HA-29983-131-RINCONHWELLS M03.MXD

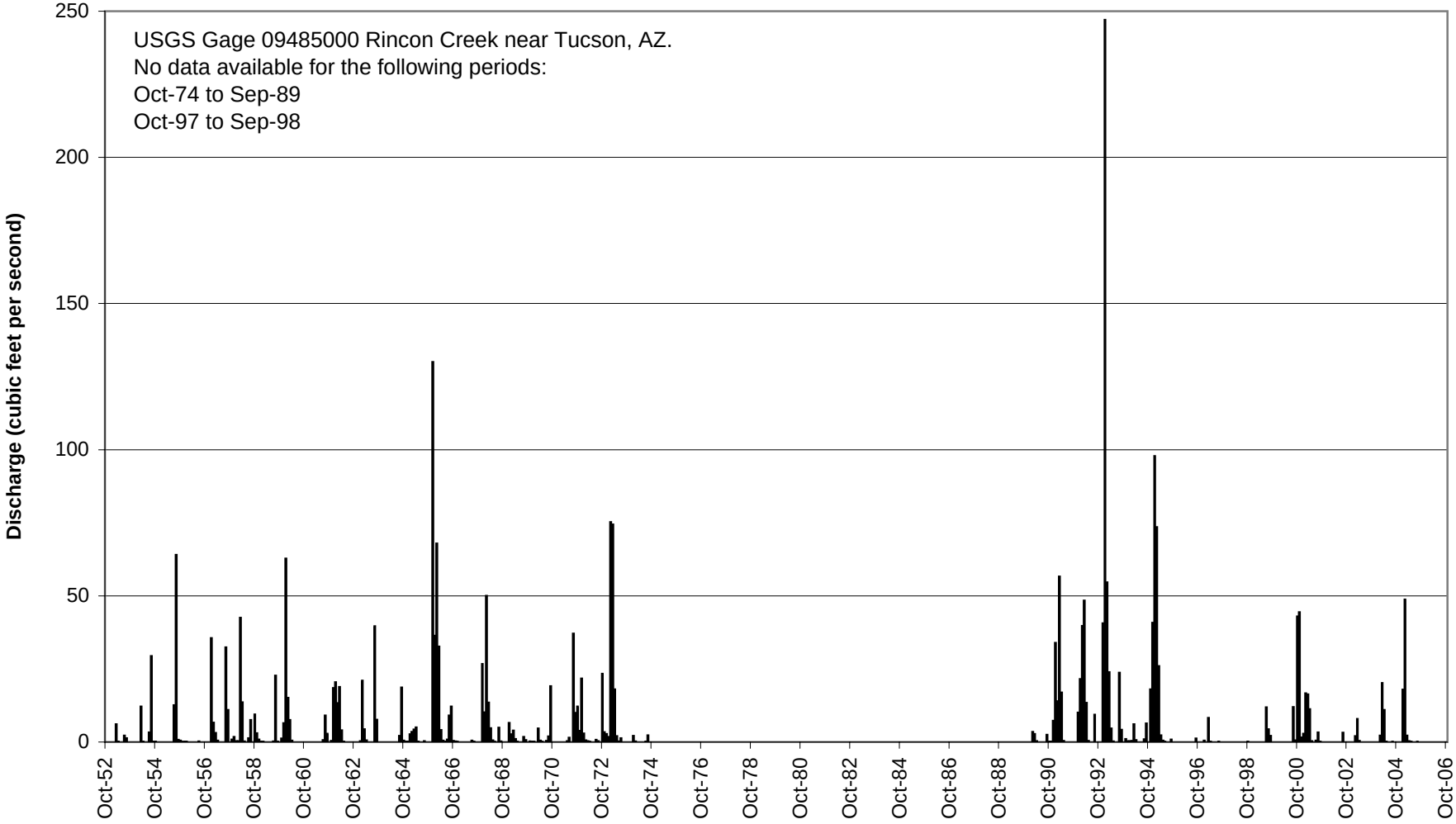


Figure 6. Rincon Creek Mean Monthly Discharge at USGS Gage, Water Years 1953-2005.
Rincon Creek
Pima County, Arizona

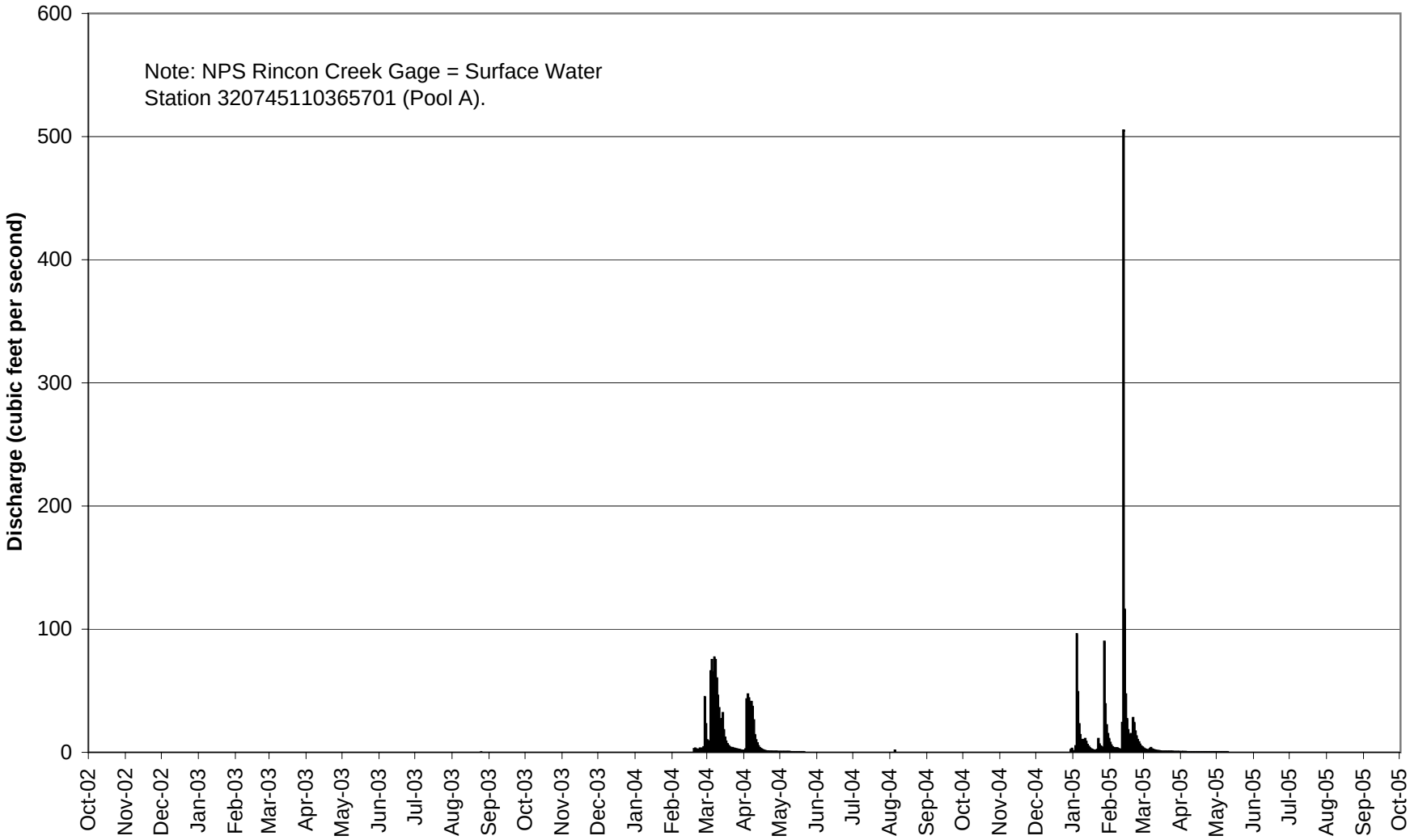


Figure 7. Rincon Creek Discharge at NPS Pool A Gage, Water Years 2003-2005.
Rincon Creek
Pima County, Arizona

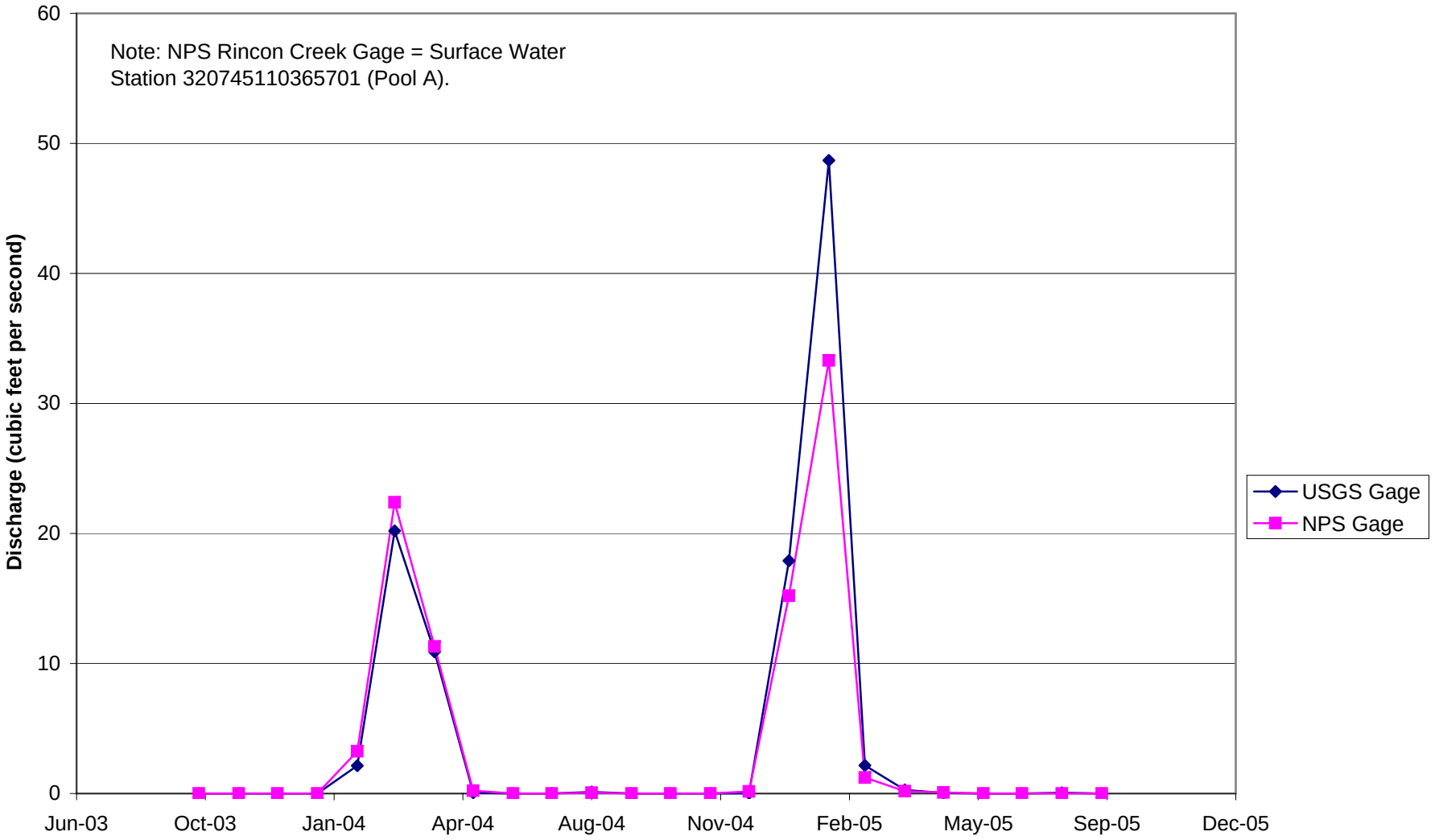
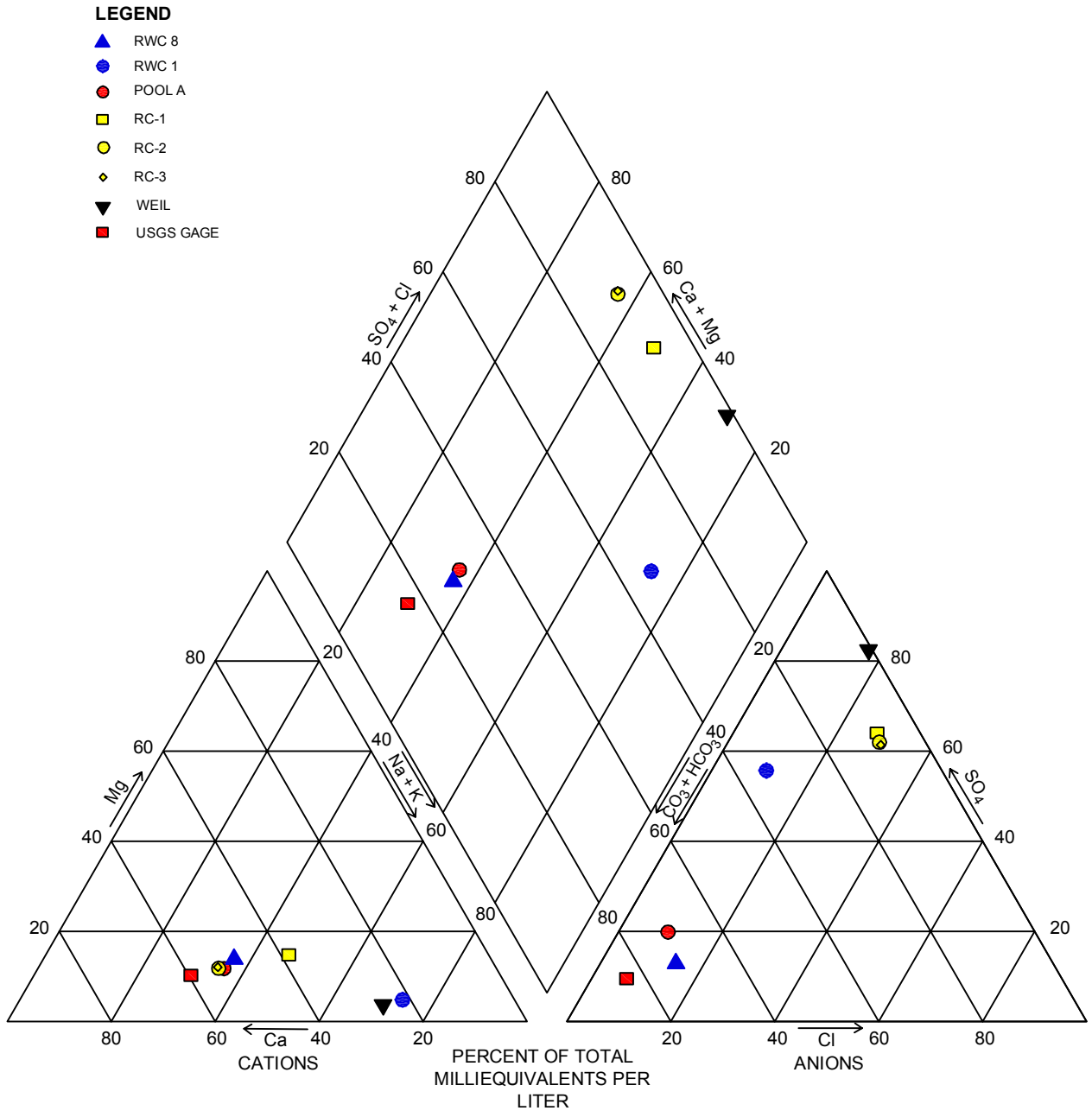


Figure 8. Rincon Creek Mean Monthly Discharge
at USGS Gage and NPS Pool A Gage, Water Years 2004-2005.
Rincon Creek
Pima County, Arizona



HALEY & ALDRICH

RINCON CREEK PROJECT
PIMA COUNTY, ARIZONA

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RINCON CREEK SURFACE WATER AND GROUNDWATER TRILINEAR DIAGRAM

SCALE: AS SHOWN
NOVEMBER 2007

FIGURE 9

G:\GRAPHICS\PROJECTS\29983-111\CAD_FIGURES\29983-132-0009-TRILINEAR.DWG

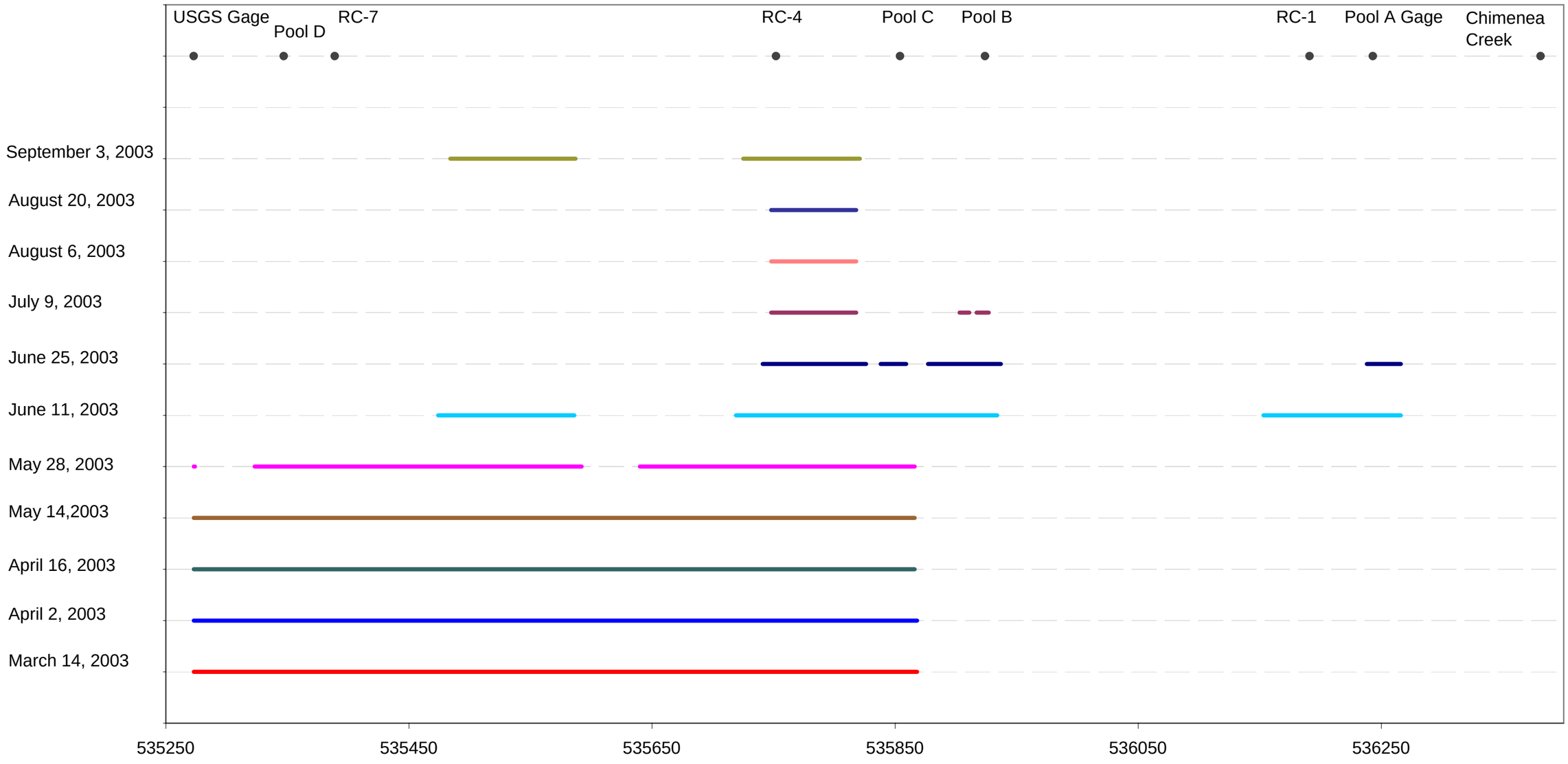


Figure 10. Rincon Creek Wetted Reaches, 2003

Note: This information represents the start and end points of wetted reaches between the USGS Gage and Chimenea Creek using only Easting coordinates. Actual lengths of the wetted reaches are compressed where the Creek deviates North or South of due East.

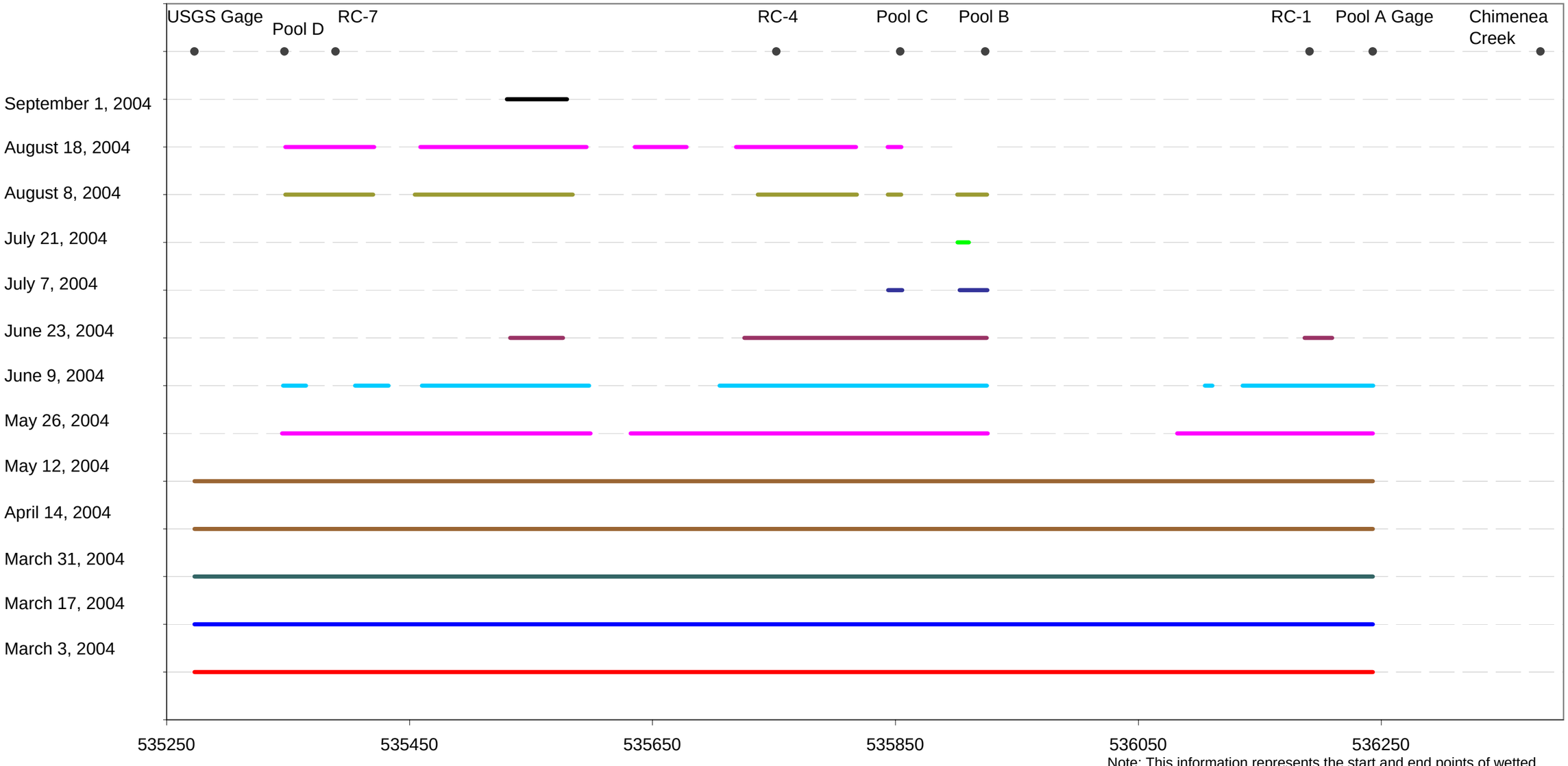


Figure 11. Rincon Creek Wetted Reaches, 2004

Note: This information represents the start and end points of wetted reaches between the USGS Gage and Chimenea Creek using only Easting coordinates. Actual lengths of the wetted reaches are compressed where the Creek deviates North or South of due East.

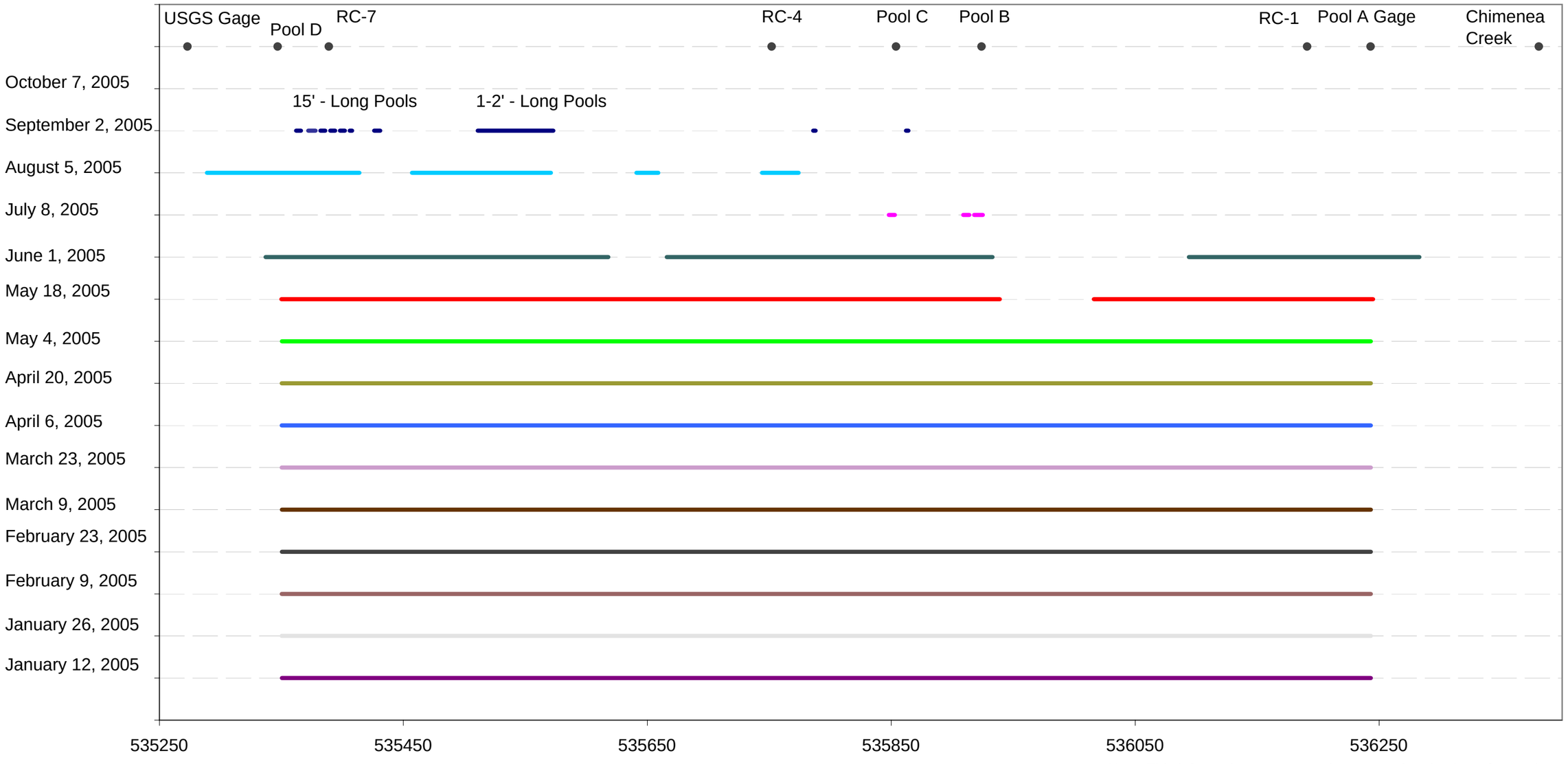


Figure 12. Rincon Creek Wetted Reaches, 2005

Note: This information represents the start and end points of wetted reaches between the USGS Gage and Chimenea Creek using only Easting coordinates. Actual lengths of the wetted reaches are compressed where the Creek deviates North or South of due East.

SECTION 07
SECTION 08
SECTION 09
SECTION 10
SECTION 18
SECTION 17
SECTION 16
SECTION 15
SECTION 19
SECTION 20
SECTION 21
SECTION 22

A
A'
B
B'
C
C'

D(15-17)8cda
D(15-17)8cdd
636173
D(15-17)10cca
D(15-17)17bbb
D(15-17)17bba
636172
D(15-17)17b
636265
D(15-17)17bbd
636171
D(15-17)18aad
551981
D(15-17)18aad
591244
D(15-17)17bbc
D(15-17)17acb
633108
RC-7
RC-4
RC-5
RC-6
LUNT WELL
D(15-17)17ada
633106
RC-1
RC-2
RC-3
X-9 RANCH
D(15-17)16bad
633107
D(15-17)16bda
D(15-17)16aad
086417
WEIL WELL
D(15-17)16bda
564266
BIXLER
D(15-17)16acd
537373
RWC 8
D(15-17)16adc
607531
RWC 1
D(15-17)16acc
607532
D(15-17)16dbb
516967
D(15-17)16dab
585559
D(15-17)18ad
635186
D(15-17)18adc
574835
D(15-17)16ccc

LEGEND

WELL LOCATIONS
- ESTIMATED FROM PIMA COUNTY GIS
- VERIFIED BY FIELD CHECK
- RC WELL
- WEIL WELL / LUNT WELL

- FLOODPLAIN
- TERRACE BOUNDARY
- SECTION LINE
- RMD BOUNDARY
- CROSS SECTION LINE

633106 ARIZONA DEPARTMENT OF WATER RESOURCES WELL-55 REGISTRY NUMBER

N
W
E
S

0 400 800
SCALE IN METERS

HALEY & ALDRICH

RINCON CREEK PROJECT
PIMA COUNTY, ARIZONA

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FINAL

LOCATION OF HYDROGEOLOGIC CROSS-SECTIONS

SCALE: AS SHOWN
NOVEMBER 2007

FIGURE 13

G:\29983-111\RINCON\CREEK\HA-29983-131-RINCON-CROSS-SEC-LOC.MXD

NORTHWEST

A

SOUTHEAST

A’

ELEVATION, FEET MSL

3250
3200
3150
3100
3050
3000
2950
2900
2850
2800

551981 (proj. 75’)
591244 (proj. 80’)
636172 (proj. 10’)
636171 (proj. 15’)
633108 (proj. 15’)
RC-7
RC-6 (proj. 20’)
RC-5 (proj. 4’)
RC-4
633106 Lunt (proj. 12’)
RC-1
RC-2 (proj. 10’)
RC-3 (proj. 20’)
633107 (proj. 15’)
564266 Weil (proj. 28’)
516967 (proj. 78’)
607532 RWC 1 (proj. 18’)
537373 Bixler (proj. 5’)
607531(proj. 5’)

Qal
Qal?
Tp
Xgd
FAULT
1965
1964
1982
10
13
11
9
8.5
13
17
38
152
204
315
455
439
690
560
255
280
350
335
?

EXPLANATION

- Water Level Elevation, Feet Above Mean Sea Level Measured 4/29/2005 or in Year Indicated
- Fault
- Geologic Contact
- Qal — Quaternary Alluvium, undifferentiated
- Tp — Tertiary Pantano Formation
- Xgd — Precambrian Granodiorite

Wells of Interest:

633106 = Lunt inactive well
564266 = Weil active well
607532 = RWC 1 active well
537373 = Bixler active well

proj. = projected, lateral distance between well and cross-section line

References: Geologic Map of the Rincon Valley Area, Pima County, Arizona, AGS Digital Geologic Map DGM-44, Version 1.0, February 2005; Evaluation of the Ground Water Supply Available to the Rincon Water Company, Vail, Pima County, Arizona, Manera, Inc., 1982 and Driller’s Logs, Arizona Department of Water Resources

0 500 1000
HORIZONTAL SCALE IN FEET

0 25 50
VERTICAL SCALE IN FEET

HALEY & ALDRICH

RINCON CREEK PROJECT
PIMA COUNTY, ARIZONA

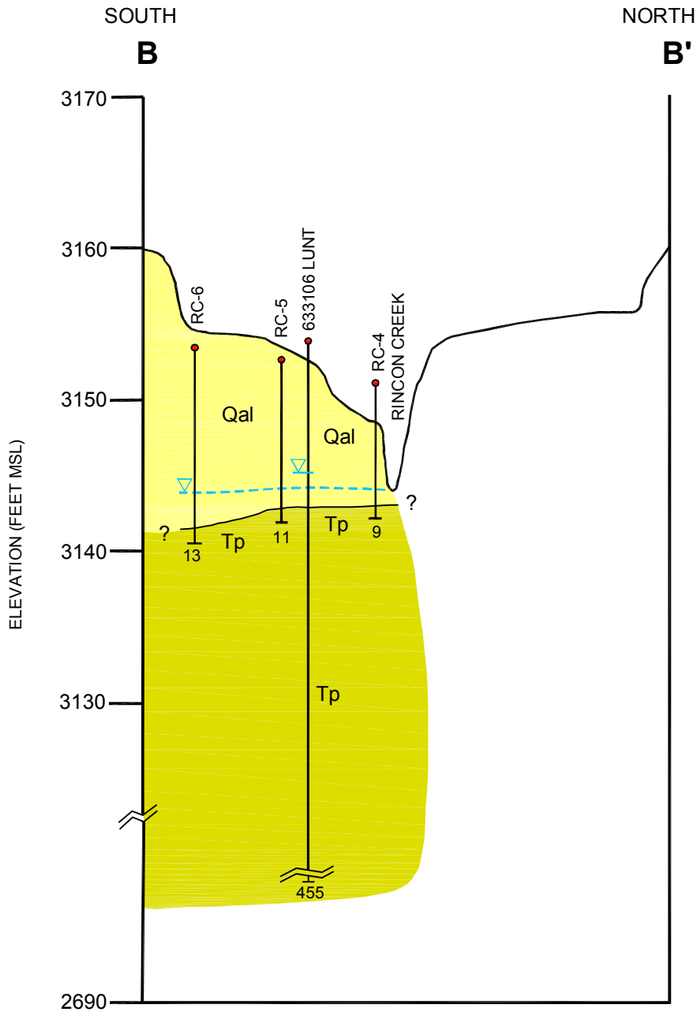
HYDROGEOLOGIC CROSS-SECTION
A - A’

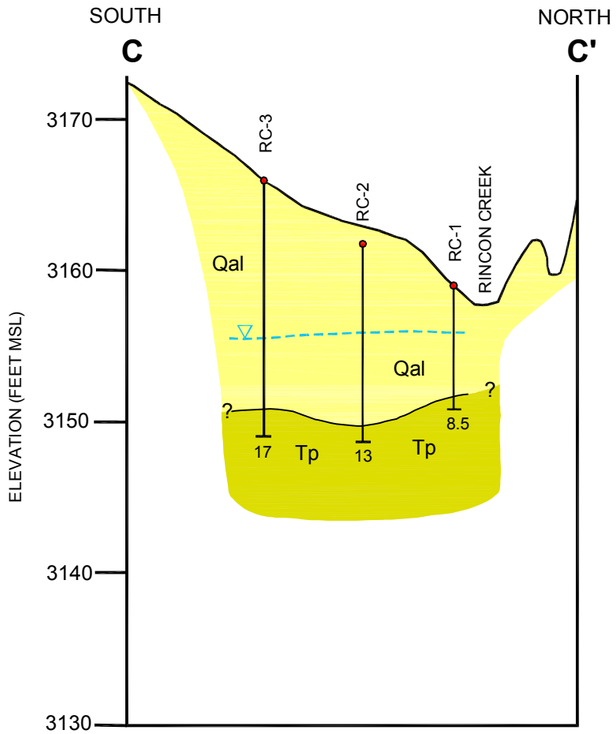
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SCALE: AS SHOWN
NOVEMBER 2007

FIGURE 14

G:\GRAPHICS\PROJECTS\29983-111\M02_M03_CDR_Files\HA_29983-111-CS_Rincon_Creek-A.cdr





LEGEND

RC-1 — Well ID

8.5 — Total Depth (Feet)

Water Level Elevation (Feet Above Mean Sea Level) Measured 4/29/2005

Geologic Contact

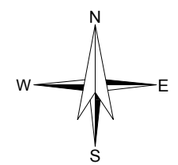
Qal — Quaternary Alluvium, undifferentiated

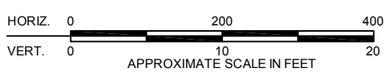
Tp — Tertiary Pantano Formation

Wells of Interest:

633106 Lunt Inactive Well

References: Geologic Map of the Rincon Valley Area, Pima County, Arizona, AGS Digital Geologic Map DGM-44, Version 1.0, February 2005; Evaluation of the Ground Water Supply Available to the Rincon Water Company, Vail, Pima County, Arizona, Manera, Inc., 1982 and Driller's Logs, Arizona Department of Water Resources





HALEY & ALDRICH

RINCON CREEK PROJECT
PIMA COUNTY, ARIZONA

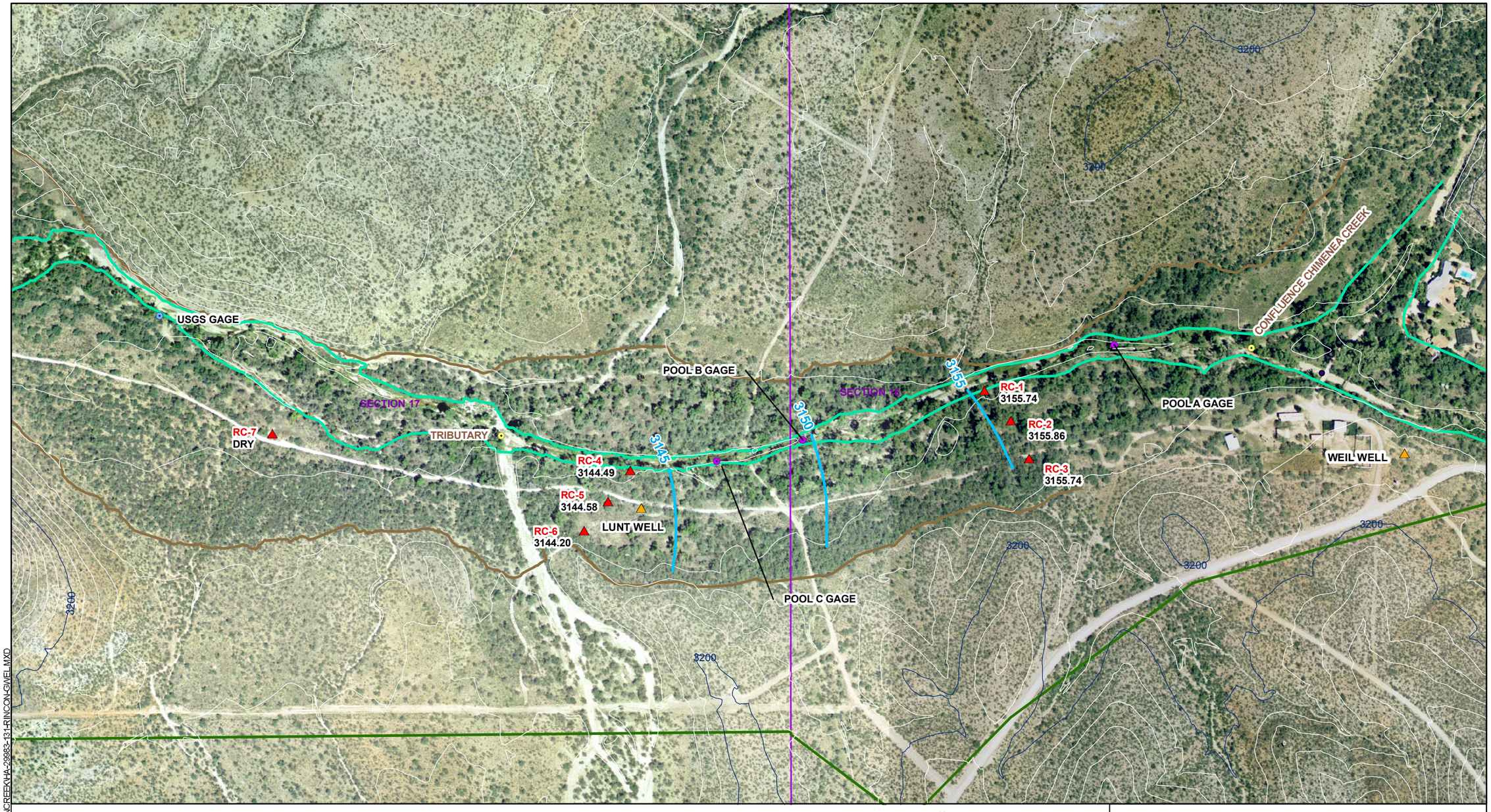
DRAFT
FINAL

HYDROGEOLOGIC CROSS-SECTIONS, B-B', C-C'

SCALE: AS SHOWN
NOVEMBER 2007

FIGURE 15

G:\GRAPHICS\PROJECTS\29983-111\CAD_FIGURES\29983-RINCON-CREEK_FIG15_FROM_CDR_FILE.DWG



LEGEND

- RC WELL
- WEIL WELL / LUNT WELL
- STAFF GAGE
- USGS GAGE
- MONITORING LOCATION
- FLOODPLAIN
- TERRACE BOUNDARY
- SECTION LINE
- RMD BOUNDARY
- 3150 — CONTOUR OF EQUAL GROUNDWATER ELEVATION (FEET ABOVE MEAN SEA LEVEL)
- 3144.20 — GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL

N / W / E / S

0 100 200
SCALE IN METERS

HALEY & ALDRICH

RINCON CREEK PROJECT
PIMA COUNTY, ARIZONA

DRAFT FINAL

GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER 29 APRIL 2005

SCALE: AS SHOWN
NOVEMBER 2007

FIGURE 16

G:\Graphics\Projects\29983-111\RINCONCREEK\HA-29983-131-RINCON-GWEL.MXD

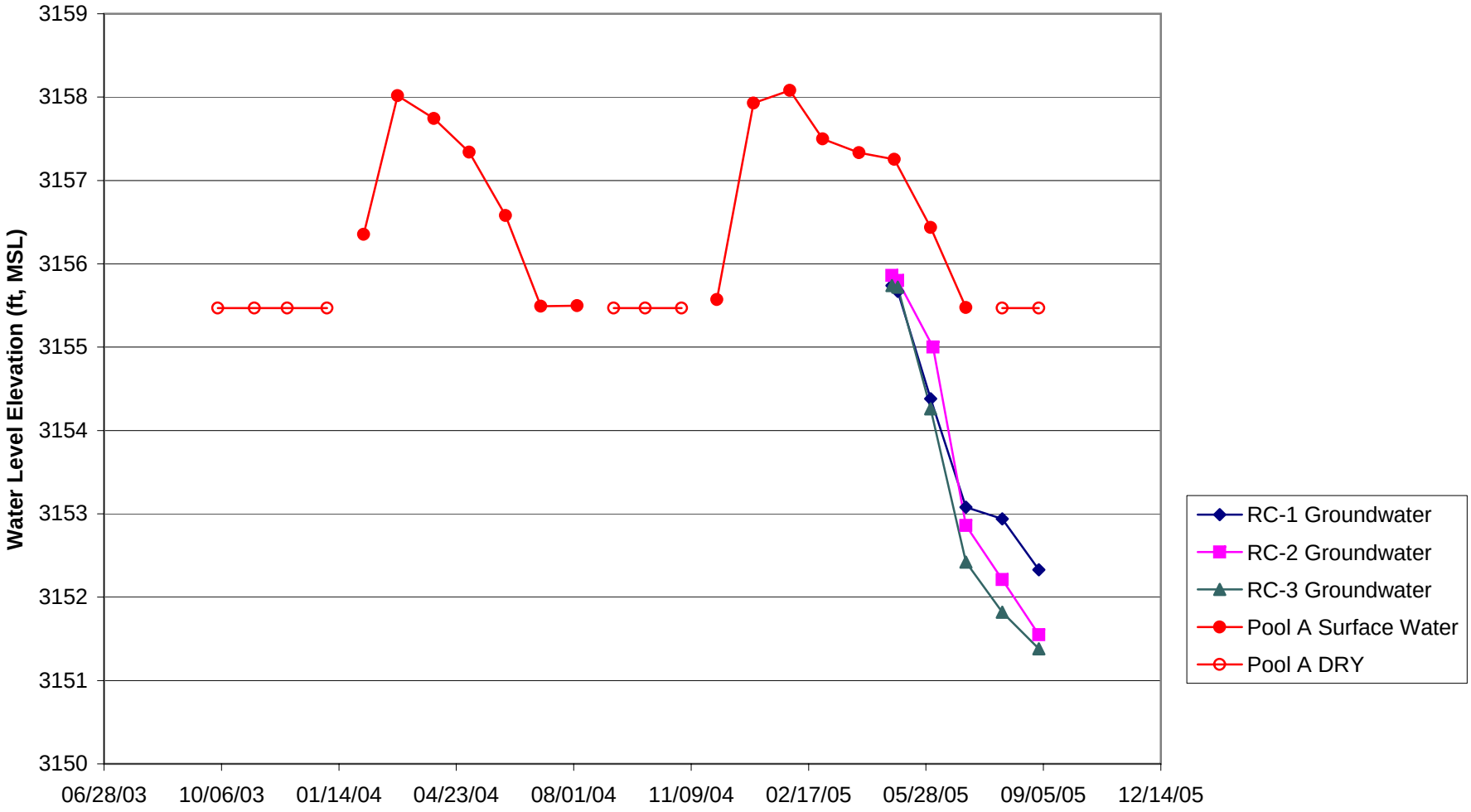


Figure 17. Surface Water vs. Groundwater Elevation Hydrograph for Pool A and Wells RC-1, RC-2, and RC-3, Water Years 2004-2005.
Rincon Creek
Pima County, Arizona

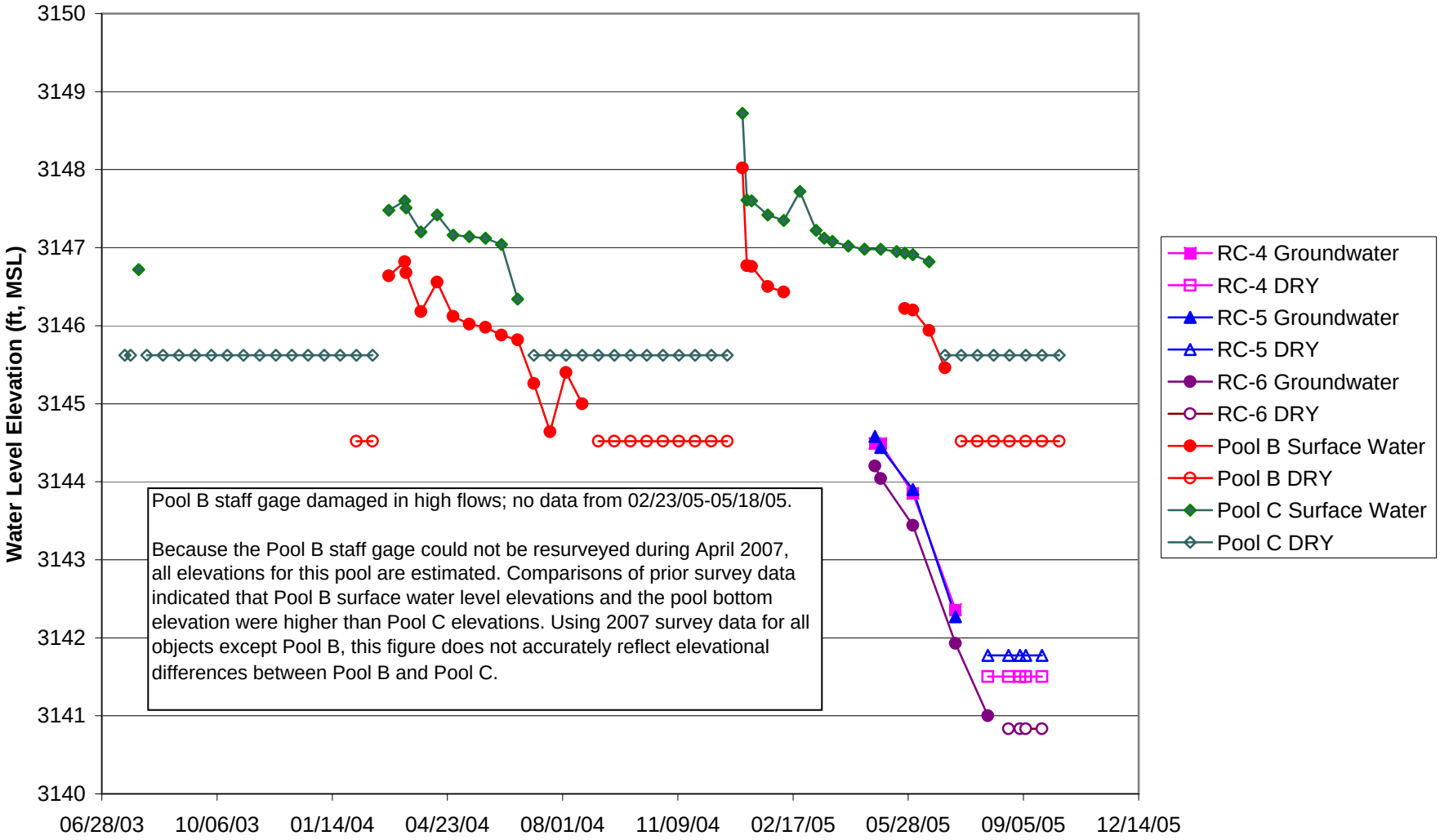


Figure 18. Surface Water vs. Groundwater Hydrograph for Pools B and C, and Wells RC-4, RC-5, and RC-6, Water Years 2004-2005.
Rincon Creek
Pima County, Arizona

POOL D(6)
USGS GAGE
RC-7
15S17E17
POOL A(1)
POOL A GAGE
RC-1
RC-2
RC-3
POOL B(2)
POOL C(4)
POOL 3
POOL B GAGE
15S17E18
POOL 5
POOL C GAGE
RC-4
LUNT WELL
RC-5
RC-6

LEGEND

- RC WELL
- LUNT WELL
- POOL LOCATION
- STAFF GAUGE
- USGS GAUGE

ALLUVIAL AQUIFER GROUNDWATER EXTENT

- MAY 2005
- JUNE 2005
- JULY 2005
- AUGUST 2005
- SEPTEMBER 2005

- FLOODPLAIN
- TERRACE BOUNDARY
- ALLUVIAL AQUIFER EXTENT BETWEEN POOL A AND USGS GAGE
- SECTION LINE
- RMD BOUNDARY

N
W
E
S

0 100 200
SCALE IN METERS

HALEY & ALDRICH

RINCON CREEK PROJECT
PIMA COUNTY, ARIZONA

DRAFT FINAL

ALLUVIAL AQUIFER GROUNDWATER LATERAL EXTENT, MAY - SEPTEMBER 2005

SCALE: AS SHOWN
NOVEMBER 2007

FIGURE 19

G:\29983-111\RINCONCREEK\HA-29983-131-RINCONHWATER_BUDGET2.MXD

APPENDIX A

Precipitation

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
07/02/90	0.35	
07/03/90	0.04	
07/04/90	0.04	
07/06/90	0.08	
07/07/90	0.47	
07/08/90	0.24	
07/09/90	0.24	
07/11/90	0.79	
07/15/90	0.94	
07/16/90	0.04	
07/19/90	0.16	
07/20/90	1.10	
07/23/90	0.59	
07/24/90	1.18	
07/31/90	0.47	
08/01/90	0.59	
08/02/90	0.04	
08/03/90	0.51	
08/09/90	0.08	
08/12/90	0.31	
08/13/90	0.39	
08/14/90	0.20	
08/15/90	0.04	
08/30/90	0.08	
08/31/90	0.39	
09/01/90	0.08	
09/02/90	0.31	
09/04/90	0.04	
09/30/90	0.24	
10/01/90	0.08	
10/02/90	0.12	
11/02/90	0.20	
12/16/90	0.35	
12/20/90	0.16	
12/21/90	0.75	
12/22/90	0.12	
12/23/90	0.04	
12/27/90	0.24	
12/28/90	0.12	
01/04/91	0.16	
01/05/91	0.79	
01/06/91	0.04	
01/16/91	0.04	
01/17/91	0.04	
01/23/91	0.04	
02/11/91	0.04	
02/12/91	0.79	
02/17/91	0.04	

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
02/18/91	0.28	
02/19/91	0.04	
02/28/91	0.28	
03/01/91	0.31	
03/02/91	0.04	
03/16/91	0.16	
03/20/91	0.20	
03/21/91	0.79	
03/25/91	*	0.04" between 9:06 3/23/91 - 11:14 3/26/91
03/27/91	0.12	
03/28/91	0.12	
07/26/91	0.79	
07/29/91	0.16	
07/30/91	0.16	
08/08/91	0.20	
08/09/91	0.20	
08/10/91	0.04	
08/14/91	0.04	
08/19/91	0.16	
08/22/91	0.28	
08/28/91	0.04	
08/30/91	0.47	
09/09/91	0.31	
09/18/91	0.20	
10/21/91	0.04	
10/27/91	0.24	
10/30/91	0.16	
11/10/91	0.08	
11/14/91	0.04	
11/15/91	0.24	
11/30/91	0.20	
12/01/91	*	0.20" between 10:38 11/30/91 - 6:36 12/2/91
12/11/91	0.43	
12/17/91	0.12	
12/18/91	0.63	
12/19/91	0.43	
12/20/91	0.16	
12/25/91	0.04	
01/26/92	*	1.46" between 22:08 12/31/91 - 10:05 1/7/92
02/02/92	0.04	
02/07/92	0.43	
02/08/92	0.31	
02/11/92	0.04	
02/13/92	0.67	
03/01/92	0.04	
03/02/92	0.31	
03/03/92	0.24	
03/07/92	0.16	

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
03/08/92	0.12	
03/09/92	0.12	
03/27/92	0.67	
03/28/92	0.59	
03/29/92	0.04	
03/31/92	0.08	
04/01/92	0.24	
04/02/92	0.04	
05/05/92	0.31	
05/09/92	0.04	
05/18/92	0.75	
05/19/92	0.04	
05/21/92	0.94	
05/25/92	*	0.28" between 3:23 5/22/92 - 12:51 5/26/92
05/27/92	0.39	
05/28/92	0.24	
07/08/92	0.04	
07/10/92	0.47	
07/11/92	0.08	
07/21/92	0.28	
07/22/92	0.31	
07/23/92	0.08	
07/24/92	0.04	
07/26/92	0.31	
07/29/92	0.08	
08/06/92	0.20	
08/07/92	0.20	
08/08/92	0.28	
08/11/92	0.16	
08/17/92	0.08	
08/23/92	0.91	
08/24/92	0.08	
08/29/92	0.08	
09/13/92	0.28	
09/16/92	0.28	
10/24/92	0.04	
10/29/92	0.04	
11/23/92	0.12	
12/03/92	1.02	
12/04/92	1.14	
12/05/92	0.24	
12/08/92	0.24	
12/12/92	0.08	
12/19/92	0.12	
12/28/92	0.71	
02/08/93	0.12	
02/09/93	0.20	
02/10/93	0.12	

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
02/14/93	0.51	
02/15/93	0.04	
02/18/93	0.16	
02/19/93	0.20	
02/28/93	0.35	
03/04/93	0.08	
03/26/93	0.12	
03/27/93	0.24	
03/29/93	0.28	
08/31/93	0.08	
09/01/93	*	0.04" between 8:46 8/31/93 - 4:36 9/2/93
09/10/93	*	0.04" between 17:11 9/3/93 - 19:15 9/11/93
09/11/93	0.04	
09/12/93	0.20	
10/07/93	*	0.20" between 21:00 10/4/93 - 1:06 10/8/93
11/04/93	*	0.55" between 1:06 10/8/93 - 7:59 11/5/93
11/14/93	*	1.10" between 7:55 11/5/93 - 9:55 11/15/93
12/12/93	*	0.08" between 17:43 12/7/93 - 2:08 12/13/93
12/27/93	*	0.08" between 12:36 12/19/93 - 20:59 12/28/93
01/28/94	0.08	
02/07/94	0.08	
02/08/94	0.87	
02/09/94	0.08	
03/07/94	0.08	
03/18/94	0.08	
03/19/94	0.51	
03/20/94	0.31	
03/26/94	0.35	
05/12/94	0.04	
05/24/94	0.12	
05/26/94	0.24	
06/19/94	0.24	
06/21/94	0.04	
06/28/94	0.28	
07/17/94	0.08	
07/18/94	0.04	
07/23/94	0.24	
07/24/94	0.12	
07/28/94	0.28	
07/30/94	0.20	
08/07/94	0.04	
08/08/94	0.12	
08/13/94	0.04	
08/14/94	0.24	
08/16/94	0.08	
08/19/94	1.30	
08/21/94	0.16	
08/30/94	0.63	

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
09/02/94	0.08	
09/03/94	1.38	
09/10/94	0.16	
09/11/94	0.51	
10/14/94	*	0.08" between 20:37 10/13/94 - 21:31 10/15/94
10/16/94	0.51	
10/17/94	*	0.08" between 9:43 10/16/94 - 10:53 10/18/94
11/06/94	*	0.16" between 5:00 11/3/94 - 20:07 11/7/94
11/07/94	0.04	
11/11/94	1.10	
11/12/94	0.63	
12/01/94	*	1.26" between 20:59 12/1/94 - 9:11 12/2/94
12/04/94	*	0.67" between 9:11 12/2/94 - 23:36 12/5/94
12/06/94	0.31	
08/09/95	*	0.04" between 14:41 8/9/95 - 15:05 8/10/95
08/10/95	*	0.08" between 15:05 8/10/95 - 16:21 8/11/95
08/11/95	0.43	
08/12/95	*	0.16" between 16:37 8/11/95 - 4:04 8/13/95
08/14/95	0.59	
08/15/95	0.63	
08/18/95	0.16	
08/20/95	0.12	
08/21/95	0.12	
08/23/95	*	0.04" between 20:27 8/22/95 - 21:44 8/24/95
08/24/95	0.24	
08/25/95	*	0.08" between 22:04 8/24/95 - 22:02 8/26/95
08/30/95	0.04	
08/31/95	0.04	
09/05/95	*	0.04" between 13:47 9/5/95 - 15:41 9/6/95
09/09/95	*	0.04" between 15:22 9/9/95 - 15:46 9/10/95
09/27/95	0.59	
09/28/95	0.51	
10/30/95	0.40	
10/31/95	0.04	
11/02/95	0.12	
11/05/95	0.31	
11/06/95	0.16	
11/09/95	*	0.04" between 14:48 11/6/95 - 16:23 11/10/95
12/20/95	*	0.51" between 18:20 12/7/95 - 13:42 12/21/95
01/31/96	*	0.08" between 15:28 1/23/96 - 5:31 2/1/96
02/01/96	0.28	
02/04/96	*	0.32" between 14:49 2/1/96 - 11:16 2/5/96
02/13/96	*	0.08" between 12:54 2/9/96 - 14:53 2/14/96
03/12/96	*	0.47" between 20:01 2/25/96 - 16:32 3/13/96
03/19/96	*	0.12" between 16:32 3/13/96 - 7:30 3/20/96
03/25/96	*	0.04" between 7:30 3/20/96 - 10:13 3/26/96
06/29/96	0.04	
07/02/96	0.39	

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
07/06/96	0.04	
07/09/96	0.08	
07/12/96	0.08	
07/13/96	0.91	
07/14/96	0.83	
07/15/96	0.16	
07/25/96	0.24	
07/26/96	0.04	
07/27/96	0.12	
08/01/96	0.20	
08/02/96	0.31	
08/14/96	0.04	
08/16/96	0.12	
08/18/96	0.08	
08/19/96	0.04	
08/21/96	0.28	
08/22/96	0.12	
08/25/96	0.04	
08/26/96	0.04	
08/27/96	0.39	
08/28/96	0.08	
08/29/96	0.59	
09/01/96	0.51	
09/03/96	0.43	
09/04/96	0.08	
09/10/96	0.20	
09/22/96	*	0.08" between 2:14 9/20/96 - 9:02 9/24/96
09/24/96	0.31	
09/25/96	0.35	
10/14/96	0.08	
10/26/96	1.18	
10/27/96	0.04	
11/30/96	*	0.12" between 4:16 11/12/96 - 11:47 12/1/96
12/02/96	0.00	
01/03/97	0.63	
01/06/97	0.43	
01/07/97	0.08	
01/13/97	0.28	
01/14/97	0.08	
02/11/97	0.08	
02/13/97	0.04	
02/28/97	0.87	
03/01/97	0.08	
03/31/97	0.04	
04/03/97	0.47	
05/10/97	0.04	
05/16/97	0.04	
05/17/97	0.20	

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
05/18/97	0.04	
05/20/97	0.20	
07/21/97	0.31	
07/29/97	0.04	
08/01/97	0.55	
08/02/97	0.04	
08/03/97	0.04	
08/05/97	0.12	
08/07/97	0.12	
08/08/97	0.28	
08/09/97	0.04	
08/14/97	0.71	
08/17/97	0.12	
08/28/97	0.04	
08/29/97	0.04	
09/05/97	0.12	
09/07/97	0.51	
09/08/97	0.28	
09/11/97	0.39	
09/13/97	0.55	
09/20/97	0.12	
09/21/97	0.08	
10/07/97	0.04	
10/22/97	0.55	
11/15/97	*	0.59" between 10:26 11/12/97 - 4:08 11/15/97
12/01/97	0.47	
12/02/97	0.71	
12/06/97	0.08	
12/07/97	1.22	
12/08/97	0.31	
12/19/97	0.20	
12/20/97	0.08	
12/22/97	0.55	
12/24/97	0.31	
12/25/97	0.04	
01/10/98	0.08	
01/11/98	0.04	
01/30/98	0.04	
02/03/98	0.08	
02/04/98	1.26	
02/05/98	0.24	
02/08/98	0.20	
02/09/98	0.47	
02/15/98	0.43	
02/16/98	0.04	
02/17/98	0.12	
02/18/98	0.47	
02/19/98	0.28	

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
02/20/98	0.04	
02/21/98	0.08	
02/24/98	0.16	
02/25/98	0.20	
03/07/98	0.16	
03/14/98	0.08	
03/15/98	0.08	
03/17/98	0.59	
03/26/98	0.59	
03/29/98	0.55	
03/30/98	0.28	
04/01/98	0.31	
04/27/98	0.08	
07/13/98	*	0.47" between 3:01 6/26/98 - 22:15 7/13/98
07/18/98	0.28	
07/19/98	0.08	
07/21/98	0.35	
07/27/98	*	1.14" between 22:16 7/21/98 - 22:16 7/27/98
07/31/98	0.28	
08/01/98	0.35	
08/02/98	0.08	
08/03/98	0.04	
08/09/98	0.71	
08/11/98	0.08	
08/13/98	0.51	
08/20/98	0.08	
08/24/98	0.04	
08/28/98	0.24	
09/04/98	0.59	
09/05/98	0.04	
09/11/98	0.20	
10/21/98	0.16	
10/22/98	0.04	
11/09/98	0.31	
11/28/98	0.20	
11/29/98	0.31	
12/05/98	0.16	
12/06/98	0.16	
01/26/99	0.12	
01/28/99	0.08	
03/17/99	0.20	
04/01/99	0.94	
04/02/99	0.20	
04/04/99	0.24	
06/18/99	0.04	
07/02/99	0.04	
07/03/99	0.12	
07/06/99	0.39	

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
07/07/99	0.16	
07/10/99	0.87	
07/12/99	0.04	
07/13/99	0.28	
07/14/99	0.67	
07/15/99	0.59	
07/20/99	0.24	
07/23/99	0.04	
07/27/99	*	0.55" between 12:32 7/24/99 - 12:32 7/28/99
07/28/99	0.04	
08/10/99	0.12	
08/14/99	0.43	
08/16/99	0.12	
08/19/99	0.43	
08/20/99	0.16	
08/23/99	0.04	
08/24/99	0.04	
08/27/99	0.35	
08/28/99	0.04	
08/29/99	0.04	
08/31/99	0.16	
09/09/99	0.08	
09/13/99	0.16	
09/15/99	0.35	
09/19/99	0.04	
09/21/99	0.04	
09/22/99	*	0.08" between 12:57 9/21/03 - 00:31 2/23/03
09/23/99	0.08	
11/04/99	0.71	
01/02/00	0.12	
02/21/00	0.12	
02/22/00	0.04	
02/24/00	0.04	
03/05/00	0.08	
03/06/00	0.47	
03/07/00	0.43	
03/20/00	0.04	
03/27/00	0.04	
04/01/00	0.04	
06/19/00	0.04	
06/20/00	0.04	
06/22/00	0.31	
06/23/00	0.04	
06/27/00	0.43	
06/28/00	0.20	
06/29/00	0.63	
06/30/00	0.04	
07/07/00	0.59	

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
07/15/00	0.08	
07/22/00	0.16	
07/23/00	0.04	
07/27/00	0.04	
07/28/00	0.12	
07/29/00	0.08	
07/31/00	0.04	
08/03/00	0.04	
08/05/00	0.20	
08/06/00	0.20	
08/07/00	0.59	
08/09/00	0.20	
08/11/00	0.24	
08/13/00	0.04	
08/14/00	0.08	
08/17/00	0.98	
08/18/00	0.04	
08/20/00	0.12	
08/21/00	0.08	
08/22/00	0.12	
08/25/00	0.04	
08/27/00	0.51	
08/28/00	1.10	
08/29/00	0.28	
08/30/00	0.08	
09/10/00	0.12	
09/28/00	0.08	
09/29/00	0.04	
10/03/00	0.55	
10/10/00	0.20	
10/11/00	1.57	
10/12/00	0.28	
10/19/00	0.55	
10/20/00	0.04	
10/21/00	0.16	
10/22/00	0.98	
10/23/00	0.04	
10/27/00	0.55	
10/28/00	0.20	
10/31/00	0.28	
11/03/00	0.08	
11/04/00	0.63	
11/06/00	0.87	
11/07/00	0.16	
11/10/00	0.24	
11/11/00	0.31	
11/12/00	0.04	
01/08/01	0.08	

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
01/09/01	0.28	
01/12/01	0.35	
01/16/01	0.16	
01/27/01	0.31	
01/28/01	0.16	
01/29/01	0.04	
02/08/01	0.16	
02/09/01	0.12	
02/14/01	0.04	
02/15/01	0.12	
02/27/01	0.28	
02/28/01	0.08	
03/07/01	0.94	
03/11/01	0.04	
04/05/01	0.43	
04/06/01	0.59	
04/10/01	0.20	
04/21/01	0.08	
04/22/01	0.04	
05/19/01	0.08	
06/22/01	0.08	
07/05/01	0.71	
07/06/01	0.04	
07/16/01	0.98	
07/17/01	0.16	
07/20/01	1.65	
07/21/01	0.12	
07/25/01	1.02	
07/28/01	0.35	
07/29/01	0.08	
07/31/01	0.04	
08/02/01	0.28	
08/04/01	0.55	
08/05/01	1.10	
08/11/01	0.24	
08/13/01	0.28	
08/14/01	0.04	
08/16/01	0.55	
08/29/01	1.18	
09/04/01	0.04	
09/12/01	0.12	
09/14/01	0.31	
09/15/01	0.04	
10/02/01	0.04	
10/03/01	0.12	
10/04/01	0.04	
10/06/01	0.04	
10/08/01	0.04	

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
12/05/01	*	0.20 inches between 22:24 11/30 - 10:24 12/5/01, added to 12/2001 monthly total
12/11/01	0.63	
12/13/01	0.04	
12/15/01	0.16	
01/23/02	0.04	
01/30/02	0.20	
01/31/02	0.24	
02/04/02	0.04	
03/08/02	0.08	
03/18/02	0.08	
07/09/02	0.04	
07/10/02	1.02	
07/14/02	0.47	
07/20/02	0.08	
07/22/02	0.16	
07/24/02	0.04	
07/28/02	*	0.24 inches between 11:38 7/25 - 11:38 7/29/02
08/03/02	0.04	
08/05/02	0.32	
08/08/02	0.94	
08/28/02	0.35	
09/03/02	0.08	
09/06/02	0.32	
09/08/02	0.51	
09/09/02	0.16	
09/10/02	0.43	
10/26/02	0.04	
10/27/02	0.08	
11/26/02	0.04	
11/29/02	0.35	
12/02/02	0.31	
12/03/02	0.12	
12/17/02	0.55	
12/18/02	0.24	
12/22/02	0.16	
12/23/02	0.39	
12/24/02	0.04	
01/20/03	0.04	
02/08/03	0.08	
02/13/03	0.71	
02/14/03	0.08	
02/20/03	0.08	
02/21/03	0.12	
02/25/03	0.28	
02/26/03	0.24	
02/27/03	0.04	
03/02/03	0.16	

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
03/17/03	0.47	
03/18/03	0.20	
04/15/03	0.08	
05/29/03	0.16	
05/30/03	0.16	
07/12/03	0.16	
07/18/03	0.04	
07/20/03	0.16	
07/22/03	0.04	
07/23/03	0.04	
07/25/03	0.12	
07/28/03	0.04	
07/29/03	0.59	
08/01/03	0.04	
08/07/03	0.36	
08/08/03	0.67	
08/10/03	0.04	
08/13/03	0.12	
08/15/03	0.28	
08/22/03	0.04	
08/24/03	0.32	
08/25/03	0.95	
09/23/03	0.04	
09/24/03	1.56	
09/25/03	0.04	
10/07/03	0.28	
10/08/03	0.04	
10/09/03	0.59	
10/10/03	0.12	
11/10/03	0.04	
11/11/03	0.12	
11/12/03	1.04	
12/08/03	0.12	
12/12/03	0.08	
12/26/03	0.04	
12/31/03	0.08	
01/11/04	0.04	
01/14/04	0.24	
01/15/04	0.04	
01/22/04	0.36	
01/24/04	0.12	
01/25/04	0.08	
02/03/04	0.08	
02/04/04	0.24	
02/23/04	0.32	
02/27/04	0.32	
02/28/04	0.12	
03/03/04	0.24	

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
03/04/04	0.92	
03/13/04	0.08	
03/31/04	0.08	
04/01/04	0.16	
04/02/04	0.60	
04/03/04	0.08	
04/04/04	0.08	
06/21/04	0.04	
07/11/04	0.51	
07/12/04	0.08	
07/13/04	0.24	
07/14/04	0.04	
07/23/04	0.40	
07/26/04	0.36	
07/27/04	0.24	
07/28/04	0.24	
08/01/04	0.04	
08/03/04	0.71	
08/05/04	0.12	
08/08/04	0.59	
08/11/04	0.08	
08/13/04	0.12	
08/16/04	0.12	
08/17/04	0.04	
08/18/04	0.08	
08/24/04	0.16	
09/04/04	0.67	
09/18/04	0.44	
09/19/04	0.12	
10/22/04	0.04	
11/22/04	0.08	
11/23/04	0.32	
12/05/04	0.12	
12/08/04	0.16	
12/30/04	0.12	
01/02/05	0.20	
01/03/05	0.60	
01/04/05	0.12	
01/05/05	0.08	
01/21/05	0.48	
01/22/05	0.04	
01/24/05	0.04	
01/26/05	0.04	
01/27/05	0.60	
02/06/05	0.08	
02/10/05	0.12	
02/11/05	0.20	
02/12/05	0.68	

TABLE A-I
PRECIPITATION EVENTS, 1990 THROUGH APRIL 2006
PIMA COUNTY FLOOD CONTROL DISTRICT GAGE 4110
RINCON CREEK
PIMA COUNTY, ARIZONA

Date of Precipitation	Precipitation (inches)	Data Status
02/18/05	0.12	
02/19/05	0.08	
02/20/05	0.16	
02/22/05	0.04	
03/06/05	0.28	
03/07/05	0.04	
04/24/05	0.36	
05/27/05	0.12	
05/28/05	0.20	
05/29/05	0.04	
06/23/05	0.04	
06/24/05	0.08	
07/19/05	0.04	
07/20/05	0.12	
07/23/05	0.12	
07/24/05	0.08	
07/25/05	0.04	
07/27/05	0.43	
07/30/05	0.24	
07/31/05	0.12	
08/02/05	0.08	
08/04/05	0.12	
08/06/05	0.20	
08/07/05	0.08	
08/08/05	0.12	
08/09/05	0.51	
08/14/05	0.04	
08/23/05	0.84	
09/01/05	0.20	
09/07/05	0.08	
10/14/05	0.16	
10/17/05	0.04	
12/13/05	0.04	
02/09/06	0.04	
03/11/06	0.08	
03/12/06	0.36	
03/19/06	0.24	

NOTES AND ABBREVIATIONS:

1. Source: Pima County Flood Control District rain gage 4110, Rincon Creek at X-9 Ranch.
   PCFCD makes no warranty, expressed or implied, regarding the accuracy of the data provided.

APPENDIX B

NPS Pool A Discharge Data
Water Years 2003 - 2005

APPENDIX B
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NPS POOL A DISCHARGE DATA, WATER YEARS 2003-2005 ……B-1

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B-I 2003 Daily Mean Discharge

B-II 2004 Daily Mean Discharge

B-III 2005 Daily Mean Discharge

APPENDIX B

NPS POOL A DISCHARGE DATA, WATER YEARS 2003-2005

Tables B-I through B-III were prepared by the National Park Service.

TABLE B-I
2003 DAILY MEAN DISCHARGE

NATIONAL PARK SERVICE
Saguaro National Park – Water Year 2003
320745110365701 Rincon Creek Near Madrona Ranger Station, AZ

LOCATION. – Latitude 32°07'45" Longitude 110°36'57″ (NAD83) just east of Tucson in Pima County, Arizona (NE ¼ SW ¼ NW ¼ Section 16, T15S, R17E). The station is located along the middle reach of Rincon Creek on the southern boundary of the eastern district of Saguaro National Park (hydrologic unit code 1505032).
DRAINAGE AREA. – 40 square miles.
PERIOD OF RECORD. – June 2003 to current year.
GAGE. – Water-stage recorder. The elevation of zero feet on the station's staff gage is 3155.51 feet above mean sea level determined from an elevation survey.
REMARKS. –The gage was installed on June 11, 2003, no flow was recorded in the creek for the remaining of the water year with the exception of a monsoon event on August 25, 2003. The record is considered good.

Discharge, cubic feet per second
WATER YEAR OCTOBER 2002 TO SEPTEMBER 2003
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	---	---	---	0.00	0.00	0.00
2	---	---	---	---	---	---	---	---	---	0.00	0.00	0.00
3	---	---	---	---	---	---	---	---	---	0.00	0.00	0.00
4	---	---	---	---	---	---	---	---	---	0.00	0.00	0.00
5	---	---	---	---	---	---	---	---	---	0.00	0.00	0.00
6	---	---	---	---	---	---	---	---	---	0.00	0.00	0.00
7	---	---	---	---	---	---	---	---	---	0.00	0.00	0.00
8	---	---	---	---	---	---	---	---	---	0.00	0.00	0.00
9	---	---	---	---	---	---	---	---	---	0.00	0.00	0.00
10	---	---	---	---	---	---	---	---	---	0.00	0.00	0.00
11	---	---	---	---	---	---	---	---	---	0.00	0.00	0.00
12	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
13	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
14	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
15	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
16	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
17	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
18	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
19	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
20	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
21	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
22	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
23	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
24	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
25	---	---	---	---	---	---	---	---	0.00	0.00	0.24	0.00
26	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
27	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
28	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
29	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
30	---	---	---	---	---	---	---	---	0.00	0.00	0.00	0.00
31	---	---	---	---	---	---	---	---	---	0.00	0.00	---
TOTAL	---	---	---	---	---	---	---	---	---	0.00	0.24	0.00
MEAN	---	---	---	---	---	---	---	---	---	0.00	0.01	0.00
MAX	---	---	---	---	---	---	---	---	---	0.00	0.24	0.00
MIN	---	---	---	---	---	---	---	---	---	0.00	0.00	0.00
AC-FT	---	---	---	---	---	---	---	---	---	0.00	0.5	0.00

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 2003 - 2003, BY WATER YEAR (WY)

MEAN	---	---	---	---	---	---	---	---	---	0.00	0.01	0.00
MAX	---	---	---	---	---	---	---	---	---	0.00	0.01	0.00
(WY)	---	---	---	---	---	---	---	---	---	2003	2003	2003
MIN	---	---	---	---	---	---	---	---	---	0.00	0.01	0.00
(WY)	---	---	---	---	---	---	---	---	---	2003	2003	2003

TABLE B-II
2004 DAILY MEAN DISCHARGE

NATIONAL PARK SERVICE
Saguaro National Park – Water Year 2004
320745110365701 Rincon Creek Near Madrona Ranger Station, AZ

LOCATION. – Latitude 32°07'45" Longitude 110°36'57" (NAD83) just east of Tucson in Pima County, Arizona (NE ¼ SW ¼ NW ¼ Section 16, T15S, R17E). The station is located along the middle reach of Rincon Creek on the southern boundary of the eastern district of Saguaro National Park (hydrologic unit code 1505032).
DRAINAGE AREA. – 40 square miles.
PERIOD OF RECORD. – June 2003 to current year.
GAGE. – Water-stage recorder. The elevation of zero feet on the station's staff gage is 3155.51 feet above mean sea level determined from an elevation survey.
REMARKS. –The record is considered good.

Discharge, cubic feet per second
WATER YEAR OCTOBER 2003 TO SEPTEMBER 2004
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	0.00	0.00	9.9	1.4	0.45	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	7.1	2.6	0.42	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	9.0	43	0.39	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	66	47	0.40	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	75	44	0.40	0.00	0.00	1.5	0.00
6	0.00	0.00	0.00	0.00	0.00	65	41	0.38	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	77	41	0.36	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	75	37	0.33	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	60	26	0.33	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	46	14	0.29	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	36	9.9	0.29	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	26	7.4	0.29	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	27	5.0	0.29	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	32	3.6	0.26	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	18	2.7	0.25	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	12	2.0	0.22	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	8.9	1.6	0.20	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.02	6.7	1.3	0.16	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	2.8	5.2	1.1	0.14	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	3.2	4.2	0.89	0.12	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	2.6	3.6	0.77	0.11	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	2.1	3.5	0.64	0.09	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	2.4	3.2	0.56	0.08	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	3.1	2.9	0.55	0.07	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	2.3	2.6	0.53	0.04	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	3.2	2.5	0.51	0.04	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	4.2	2.2	0.53	0.03	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	45	2.0	0.53	0.02	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00	23	1.7	0.50	0.02	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00	---	1.5	0.48	0.01	0.00	0.00	0.00	0.00
31	0.00	---	0.00	0.00	---	1.5	---	0.01	---	0.00	0.00	---
TOTAL	0.00	0.00	0.00	0.00	93.92	693.2	338.09	6.49	0.00	0.00	1.50	0.00
MEAN	0.00	0.00	0.00	0.00	3.24	22.4	11.3	0.21	0.00	0.00	0.05	0.00
MAX	0.00	0.00	0.00	0.00	45	77	47	0.45	0.00	0.00	1.5	0.00
MIN	0.00	0.00	0.00	0.00	0.00	1.5	0.48	0.01	0.00	0.00	0.00	0.00
AC-FT	0.00	0.00	0.00	0.00	186	1370	671	13	0.00	0.00	3.0	0.00

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 2003 - 2004, BY WATER YEAR (WY)

MEAN	0.00	0.00	0.00	0.00	3.24	22.4	11.3	0.21	0.00	0.00	0.03	0.00
MAX	0.00	0.00	0.00	0.00	3.24	22.4	11.3	0.21	0.00	0.00	0.05	0.00
(WY)	2004	2004	2004	2004	2004	2004	2004	2004	2004	2003	2004	2003
MIN	0.00	0.00	0.00	0.00	3.24	22.4	11.3	0.21	0.00	0.00	0.01	0.00
(WY)	2004	2004	2004	2004	2004	2004	2004	2004	2004	2003	2003	2003

SUMMARY STATISTICS	FOR 2004 WATER YEAR		WATER YEARS 2003 - 2004	
ANNUAL TOTAL	1133.20			
ANNUAL MEAN	3.10		3.10	
HIGHEST ANNUAL MEAN			3.10	2004
LOWEST ANNUAL MEAN			3.10	2004
HIGHEST DAILY MEAN	77	Mar 7	77	Mar 7 2004
LOWEST DAILY MEAN	0.00	Oct 1	0.00	Jun 12 2003
ANNUAL SEVEN-DAY MINIMUM	0.00	Oct 1	0.00	Jun 12 2003
ANNUAL RUNOFF (AC-FT)	2250		2240	
10 PERCENT EXCEEDS	3.5		3.5	
50 PERCENT EXCEEDS	0.00		0.00	
90 PERCENT EXCEEDS	0.00		0.00	

TABLE B-III
2005 DAILY MEAN DISCHARGE

NATIONAL PARK SERVICE
Saguaro National Park – Water Year 2005
320745110365701 Rincon Creek Near Madrona Ranger Station, AZ

LOCATION. – Latitude 32°07'45" Longitude 110°36'57" (NAD83) just east of Tucson in Pima County, Arizona (NE ¼ SW ¼ NW ¼ Section 16, T15S, R17E). The station is located along the middle reach of Rincon Creek on the southern boundary of the eastern district of Saguaro National Park (hydrologic unit code 1505032).
DRAINAGE AREA. – 40 square miles.
PERIOD OF RECORD. – June 2003 to current year.
GAGE. – Water-stage recorder. The elevation of zero feet on the station's staff gage is 3155.51 feet above mean sea level determined from an elevation survey.
REMARKS. –The record is considered good.

Discharge, cubic feet per second
WATER YEAR OCTOBER 2004 TO SEPTEMBER 2005
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	1.0	7.7	3.1	0.31	0.14	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.46	5.7	2.6	0.32	0.14	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	5.1	4.3	2.1	0.33	0.13	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	96	3.6	1.8	0.31	0.13	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	49	3.2	1.6	0.33	0.13	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	23	3.3	2.7	0.30	0.13	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	14	3.4	3.6	0.27	0.11	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	10	2.8	2.5	0.25	0.11	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	10	2.4	2.1	0.21	0.11	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	10	2.1	1.7	0.18	0.11	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	11	24	1.4	0.16	0.10	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	8.6	505	1.2	0.15	0.10	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	6.1	116	1.0	0.15	0.10	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	4.6	47	0.95	0.14	0.09	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	3.3	27	0.82	0.13	0.09	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	2.5	18	0.73	0.13	0.09	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	2.0	13	0.73	0.12	0.10	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	1.6	15	0.69	0.12	0.10	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	1.4	13	0.65	0.13	0.09	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	1.3	28	0.59	0.13	0.09	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	2.2	24	0.56	0.12	0.09	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	11	17	0.56	0.13	0.08	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	6.5	13	0.55	0.13	0.08	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	4.8	10	0.53	0.16	0.03	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	4.1	8.2	0.54	0.15	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	3.5	6.2	0.50	0.14	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	90	4.8	0.48	0.14	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	39	3.9	0.46	0.14	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	22	---	0.41	0.13	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	2.1	15	---	0.37	0.13	0.00	0.00	0.00	0.00	0.00
31	0.00	---	2.9	11	---	0.34	---	0.00	---	0.00	0.00	---
TOTAL	0.00	0.00	5.00	470.06	931.6	37.86	5.54	2.47	0.00	0.00	0.00	0.00
MEAN	0.00	0.00	0.16	15.2	33.3	1.22	0.18	0.08	0.00	0.00	0.00	0.00
MAX	0.00	0.00	2.9	96	505	3.6	0.33	0.14	0.00	0.00	0.00	0.00
MIN	0.00	0.00	0.00	0.46	2.1	0.34	0.12	0.00	0.00	0.00	0.00	0.00
AC-FT	0.00	0.00	9.9	932	1850	75	11	4.9	0.00	0.00	0.00	0.00

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 2003 - 2005, BY WATER YEAR (WY)

MEAN	0.00	0.00	0.08	7.58	18.0	11.8	5.73	0.14	0.00	0.00	0.02	0.00
MAX	0.00	0.00	0.16	15.2	33.3	22.4	11.3	0.21	0.00	0.00	0.05	0.00
(WY)	2004	2004	2005	2005	2005	2004	2004	2004	2004	2003	2004	2003
MIN	0.00	0.00	0.00	0.00	3.24	1.22	0.18	0.08	0.00	0.00	0.00	0.00
(WY)	2004	2004	2004	2004	2004	2005	2005	2005	2004	2003	2005	2003

SUMMARY STATISTICS	FOR 2004 CALENDAR YEAR		FOR 2005 WATER YEAR		WATER YEARS 2003 - 2005	
ANNUAL TOTAL	1138.20		1452.53			
ANNUAL MEAN	3.11		3.98		3.54	
HIGHEST ANNUAL MEAN					3.98	2005
LOWEST ANNUAL MEAN					3.10	2004
HIGHEST DAILY MEAN	77	Mar 7	505	Feb 12	505	Feb 12 2005
LOWEST DAILY MEAN	0.00	Jan 1	0.00	Oct 1	0.00	Jun 12 2003
ANNUAL SEVEN-DAY MINIMUM	0.00	Jan 1	0.00	Oct 1	0.00	Jun 12 2003
ANNUAL RUNOFF (AC-FT)	2260		2880		2560	
10 PERCENT EXCEEDS	3.5		4.9		4.2	
50 PERCENT EXCEEDS	0.00		0.00		0.00	
90 PERCENT EXCEEDS	0.00		0.00		0.00	

APPENDIX C

Water Level Hydrographs

APPENDIX C
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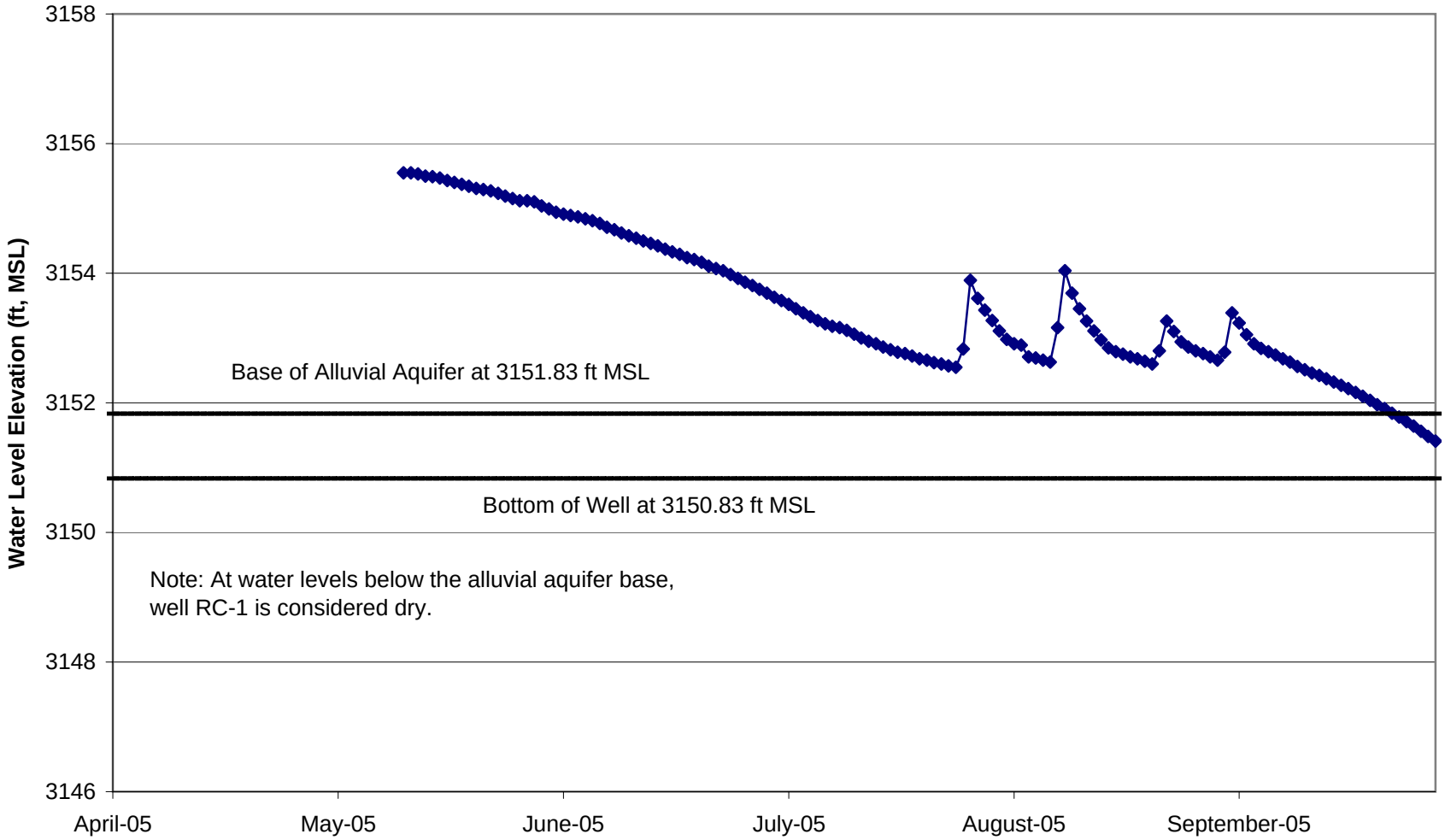


Figure C-1. RC-1 Daily Mean Groundwater Elevation.
Rincon Creek
Pima County, Arizona

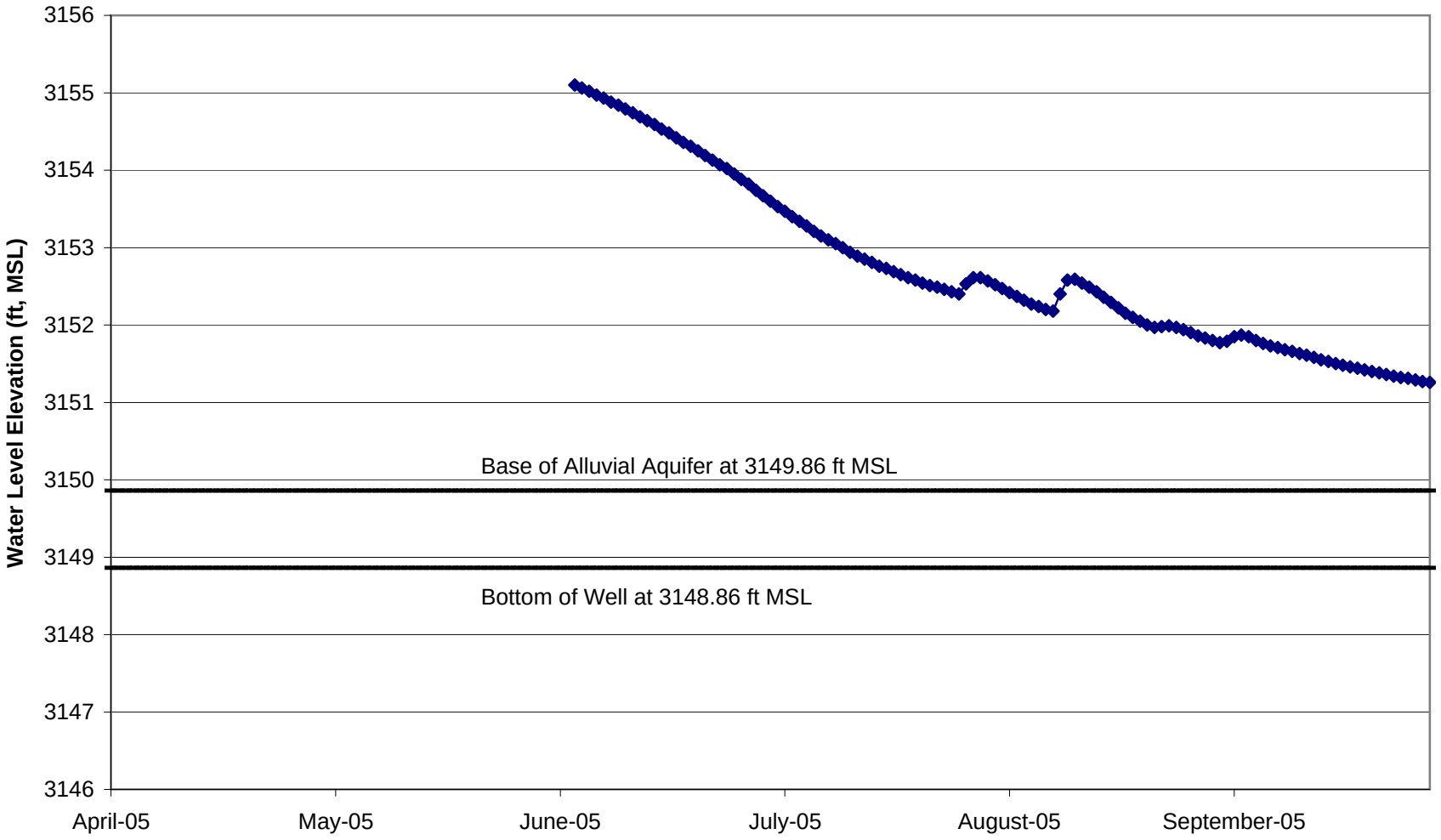


Figure C-2. RC-2 Daily Mean Groundwater Elevation.
Rincon Creek
Pima County, Arizona

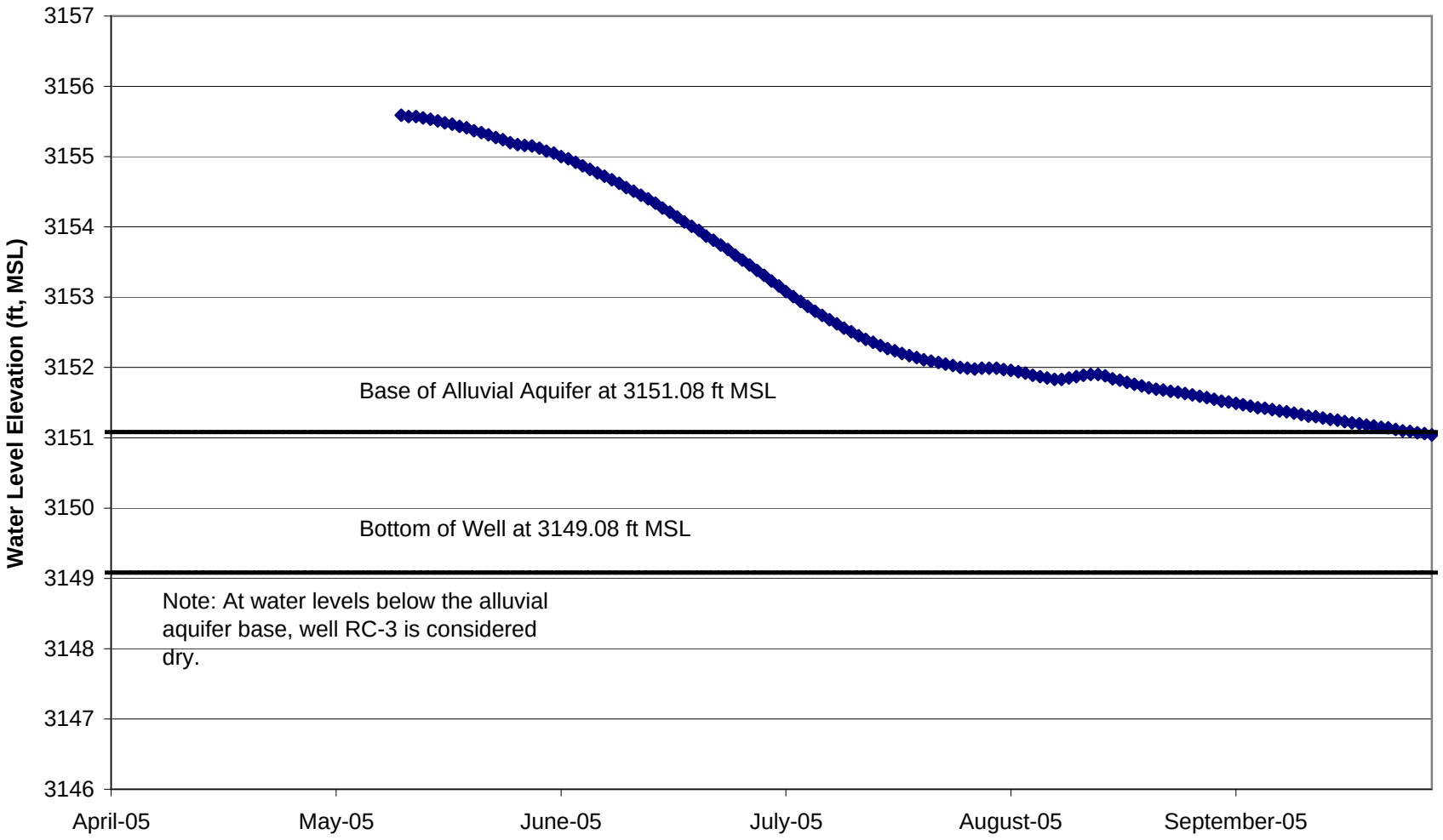


Figure C-3. RC-3 Daily Mean Groundwater Elevation.
Rincon Creek
Pima County, Arizona

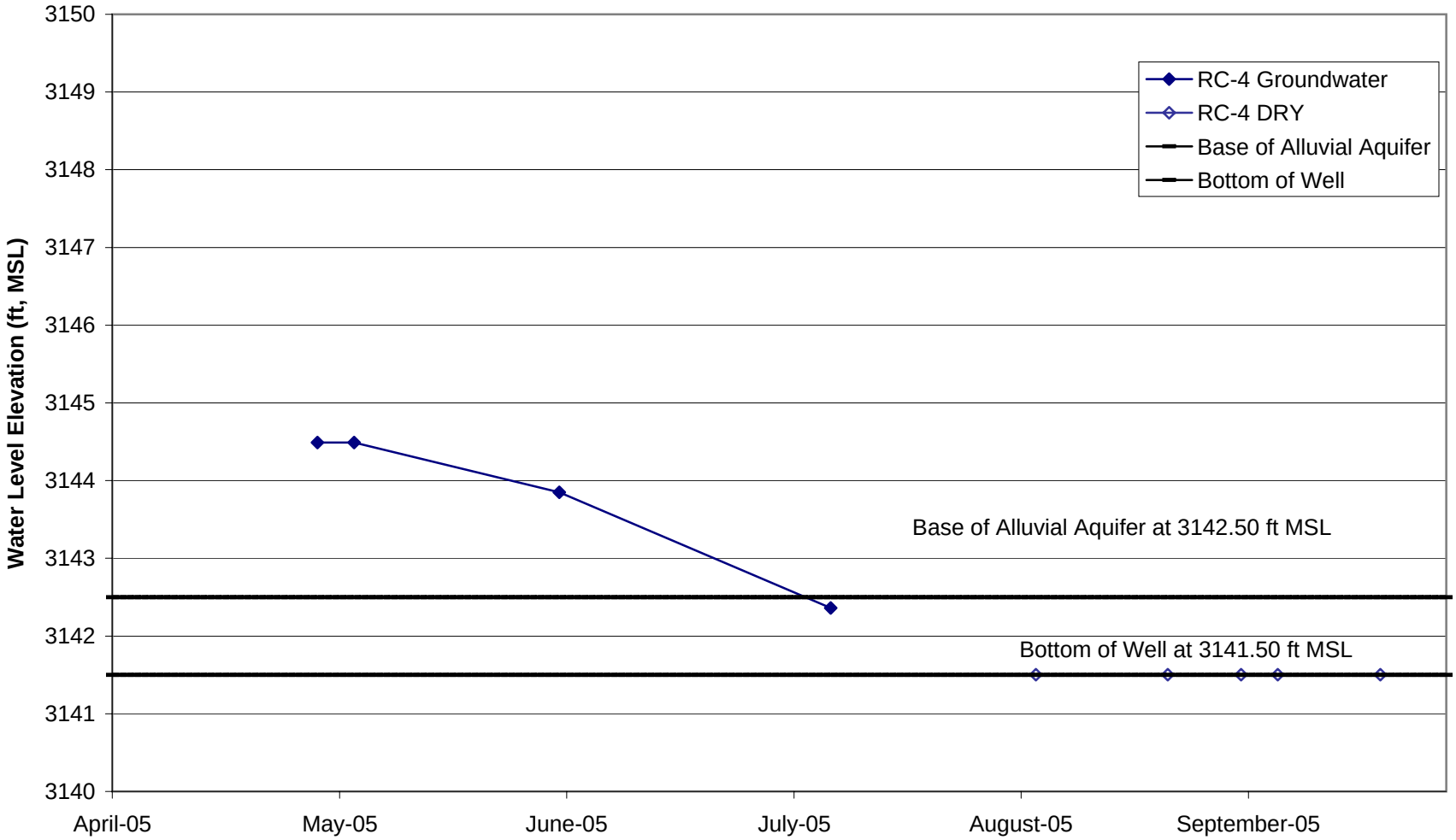


Figure C-4. RC-4 Groundwater Elevation.
Rincon Creek
Pima County, Arizona

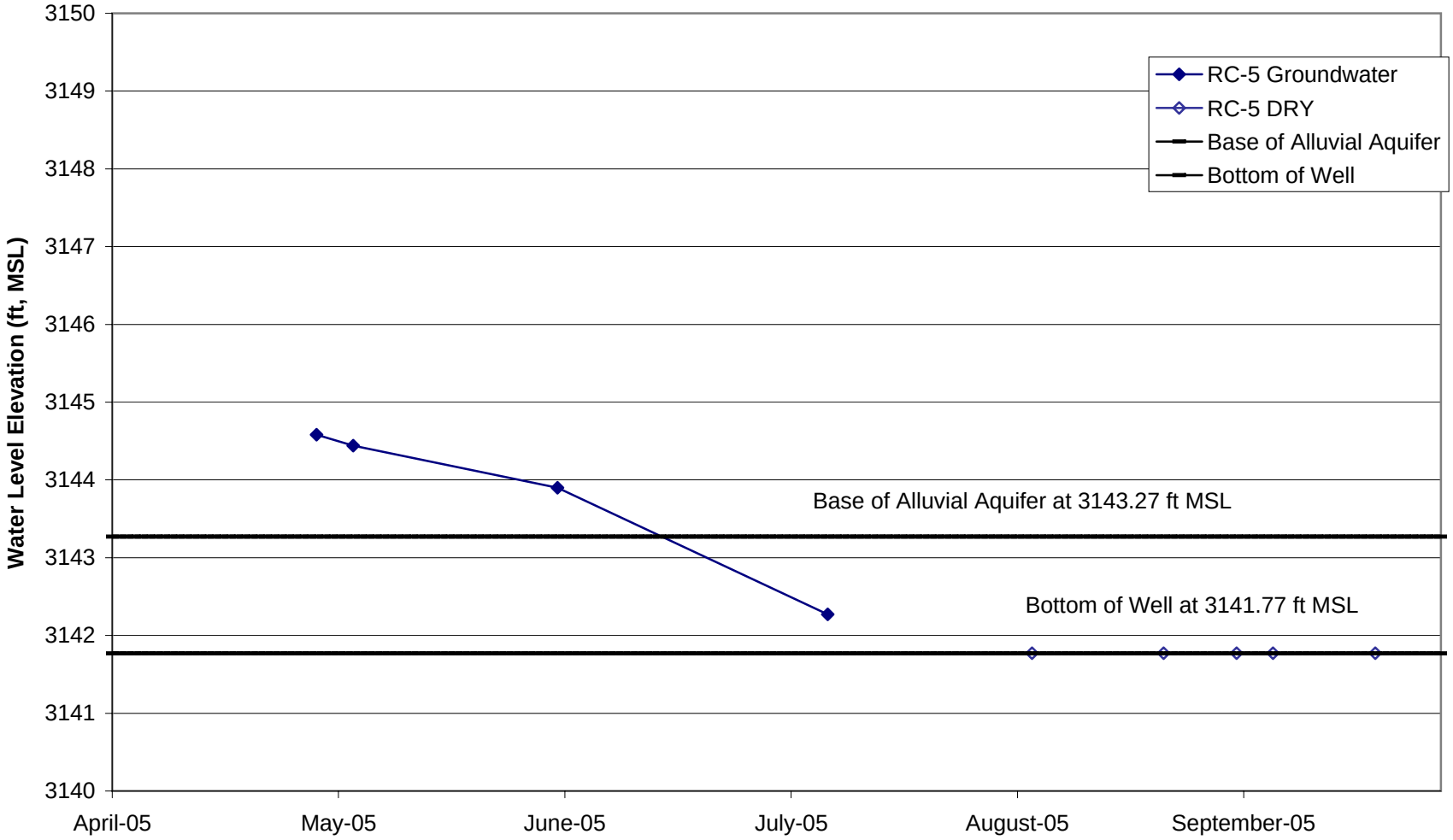


Figure C-5. RC-5 Groundwater Elevation.
Rincon Creek
Pima County, Arizona

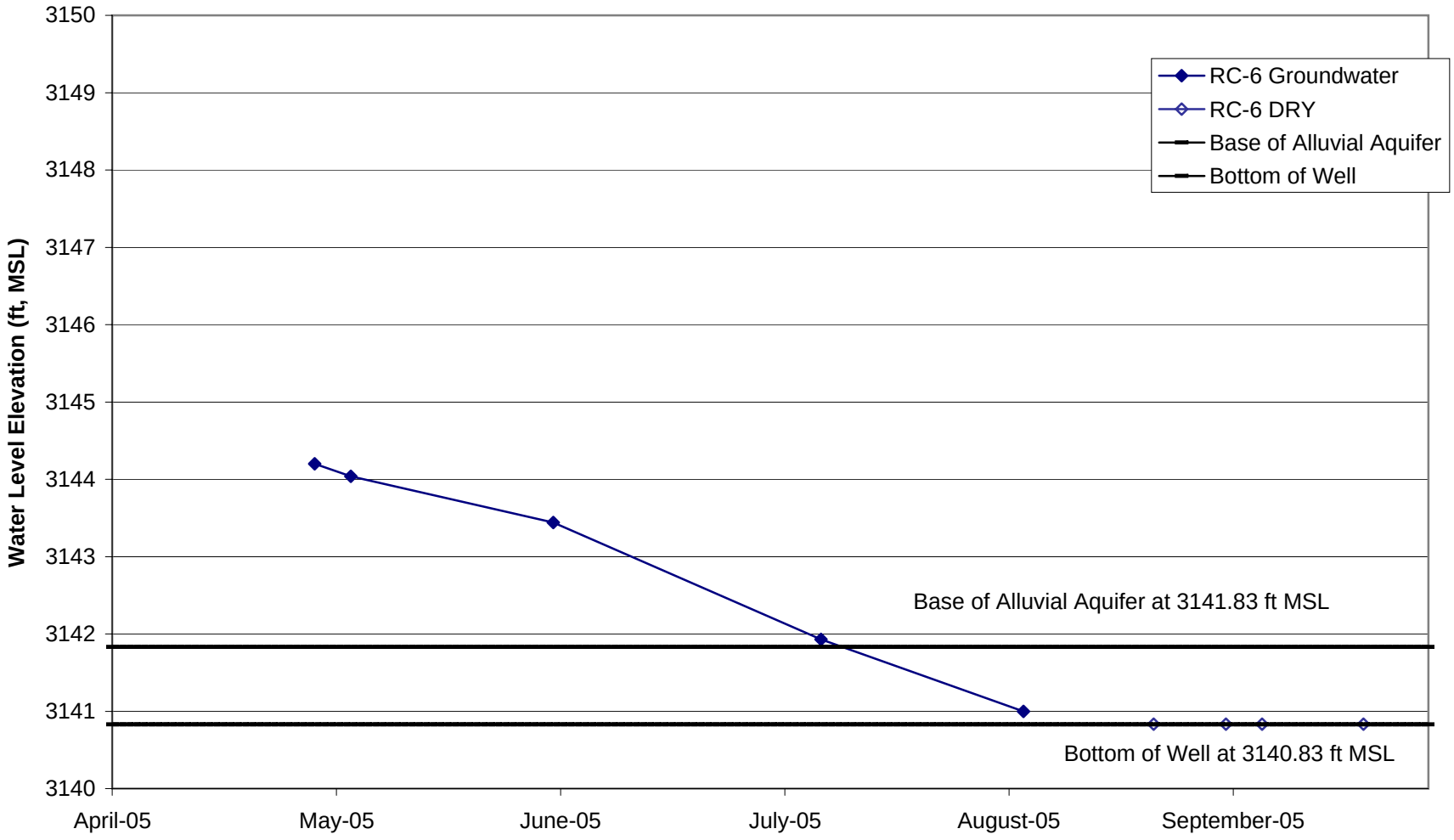


Figure C-6. RC-6 Groundwater Elevation.
Rincon Creek
Pima County, Arizona

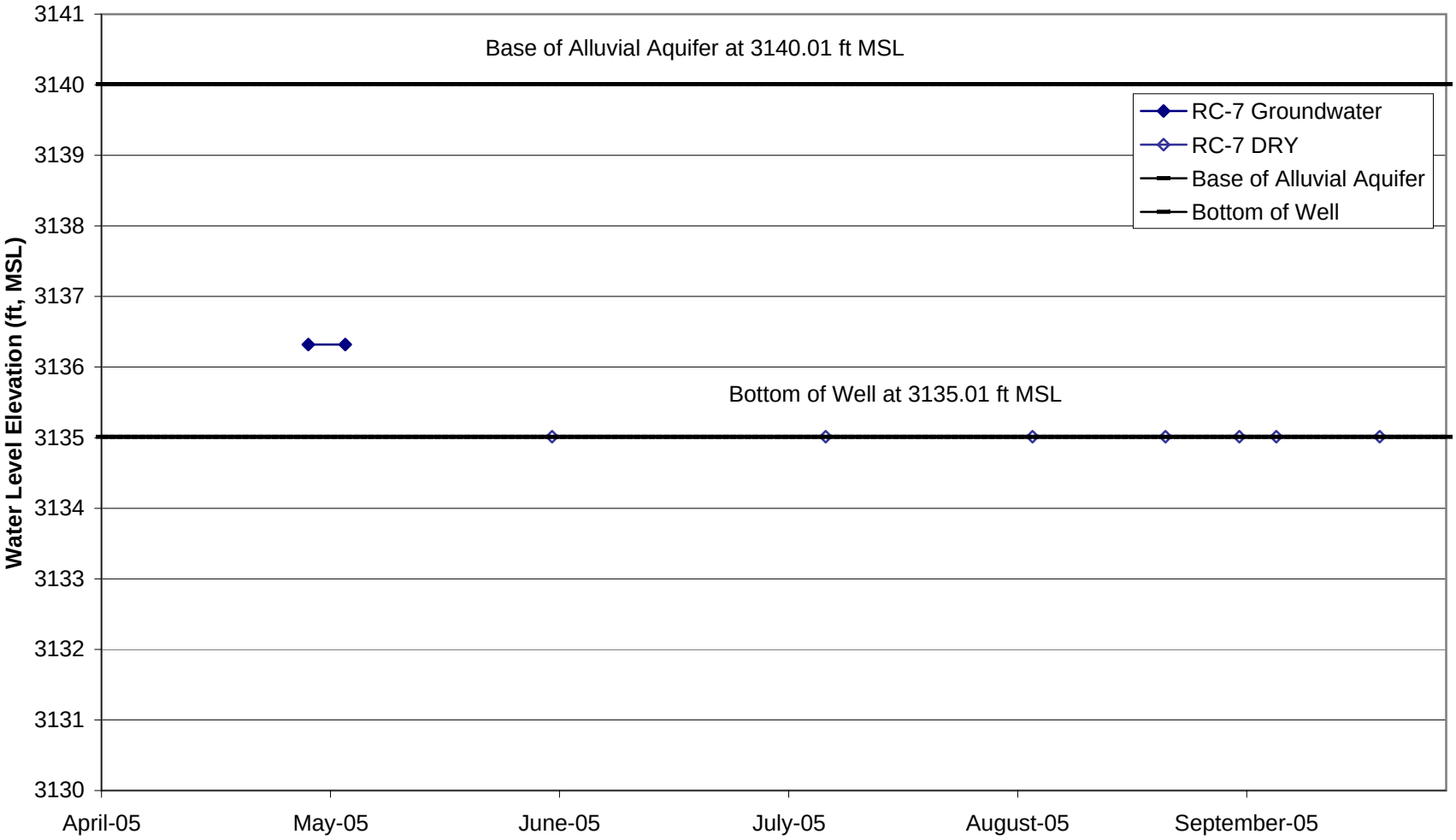


Figure C-7. RC-7 Groundwater Elevation.
Rincon Creek
Pima County, Arizona

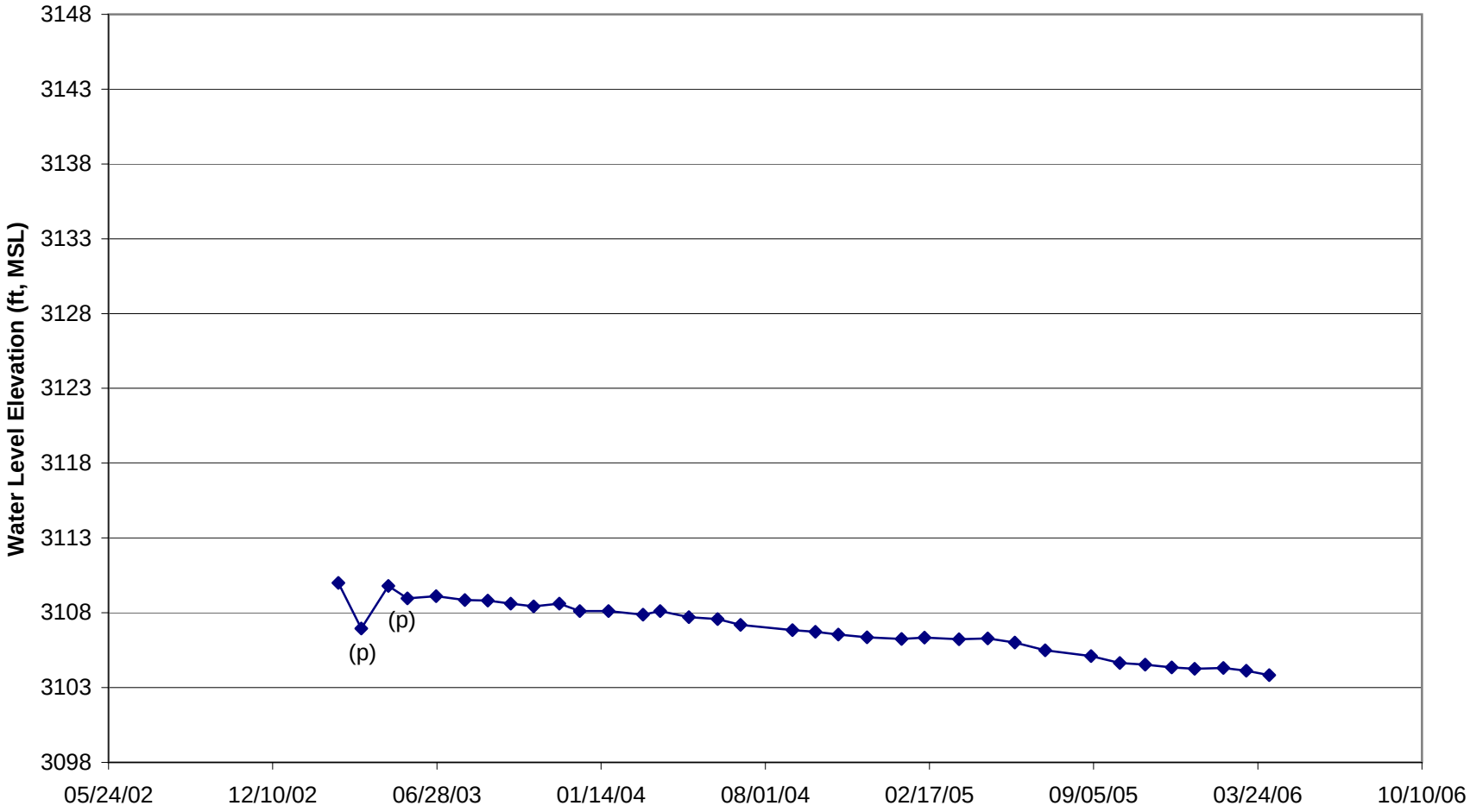


Figure C-8. Groundwater Elevations for Active Private Well D(15-17)16acd, Bixler.
Rincon Creek
Pima County, Arizona

Note: (p) represents a pumping water level.

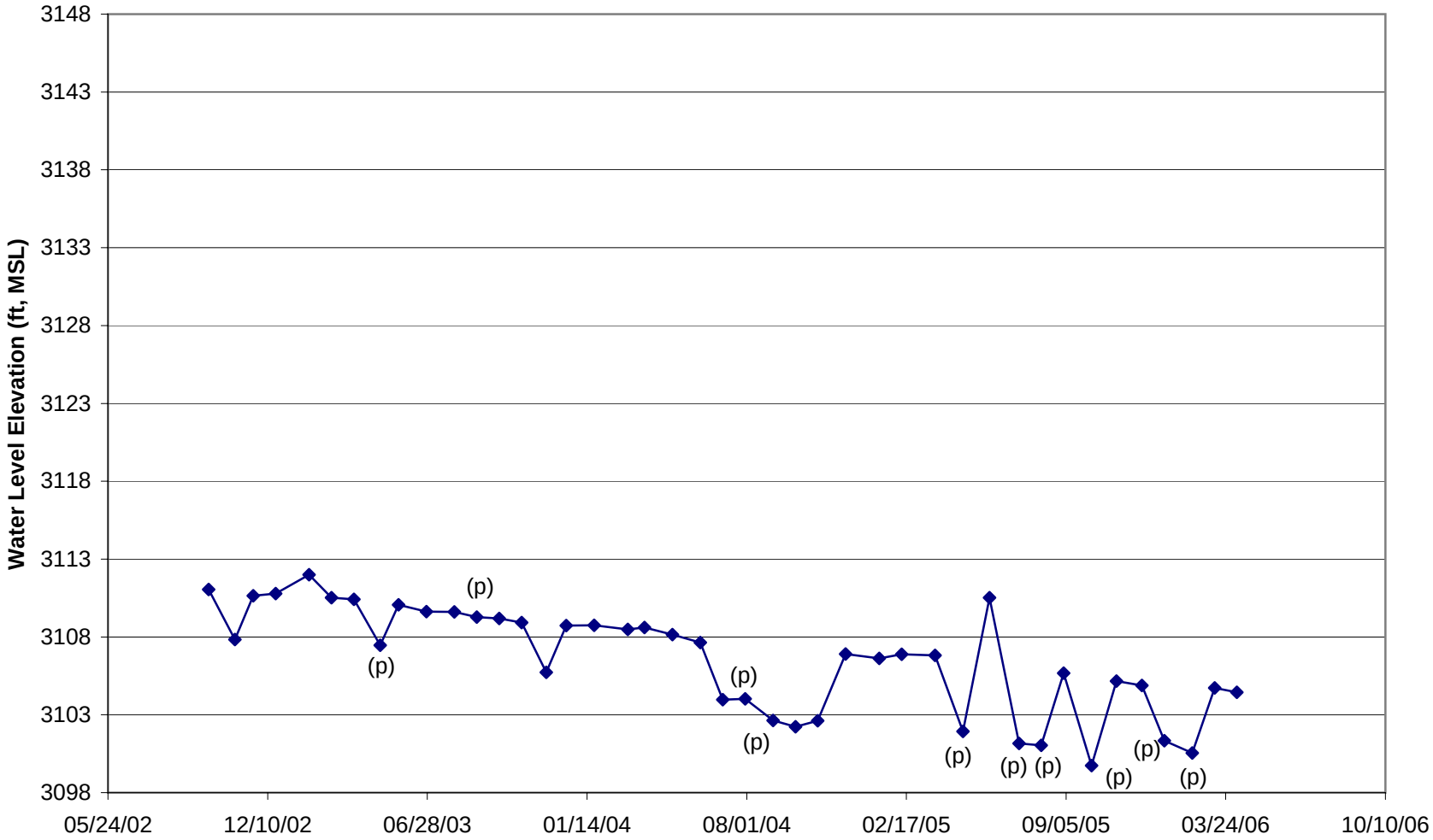


Figure C-9. Groundwater Elevations for Active Private Well D(15-17)16bda, Weil.
Rincon Creek
Pima County, Arizona

Note: (p) represents a pumping water level.
Haley & Aldrich, Inc.
G:\Projects\29983 Rincon Creek Instream Flow\reports\M02 Hydrogeology\Appendices\App C\
2007-1130-HAI-Rincon.M02.AppC.F.xls

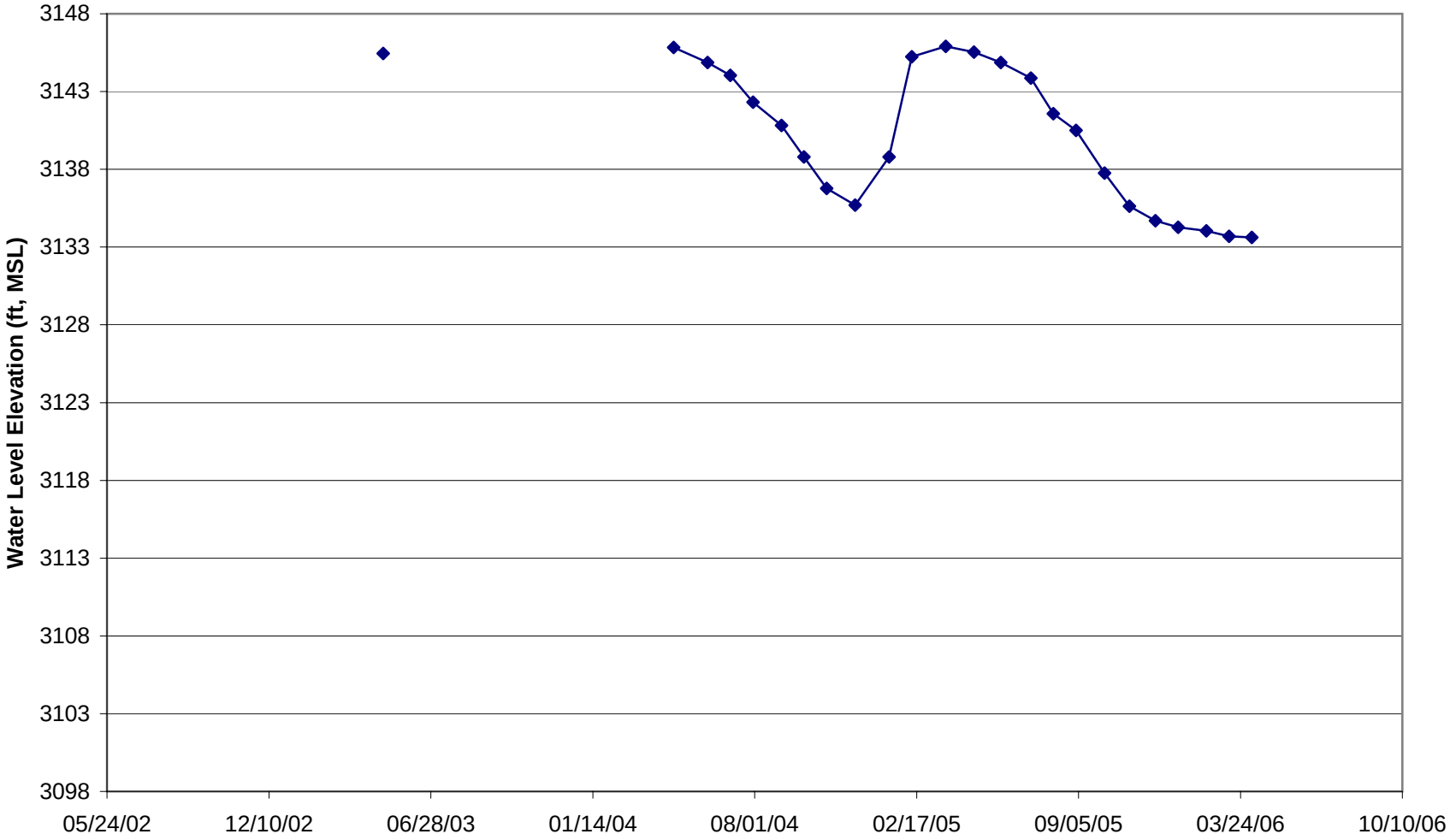


Figure C-10. Groundwater Elevations for Inactive Private Well D(15-17)17ada, Lunt.
Rincon Creek
Pima County, Arizona

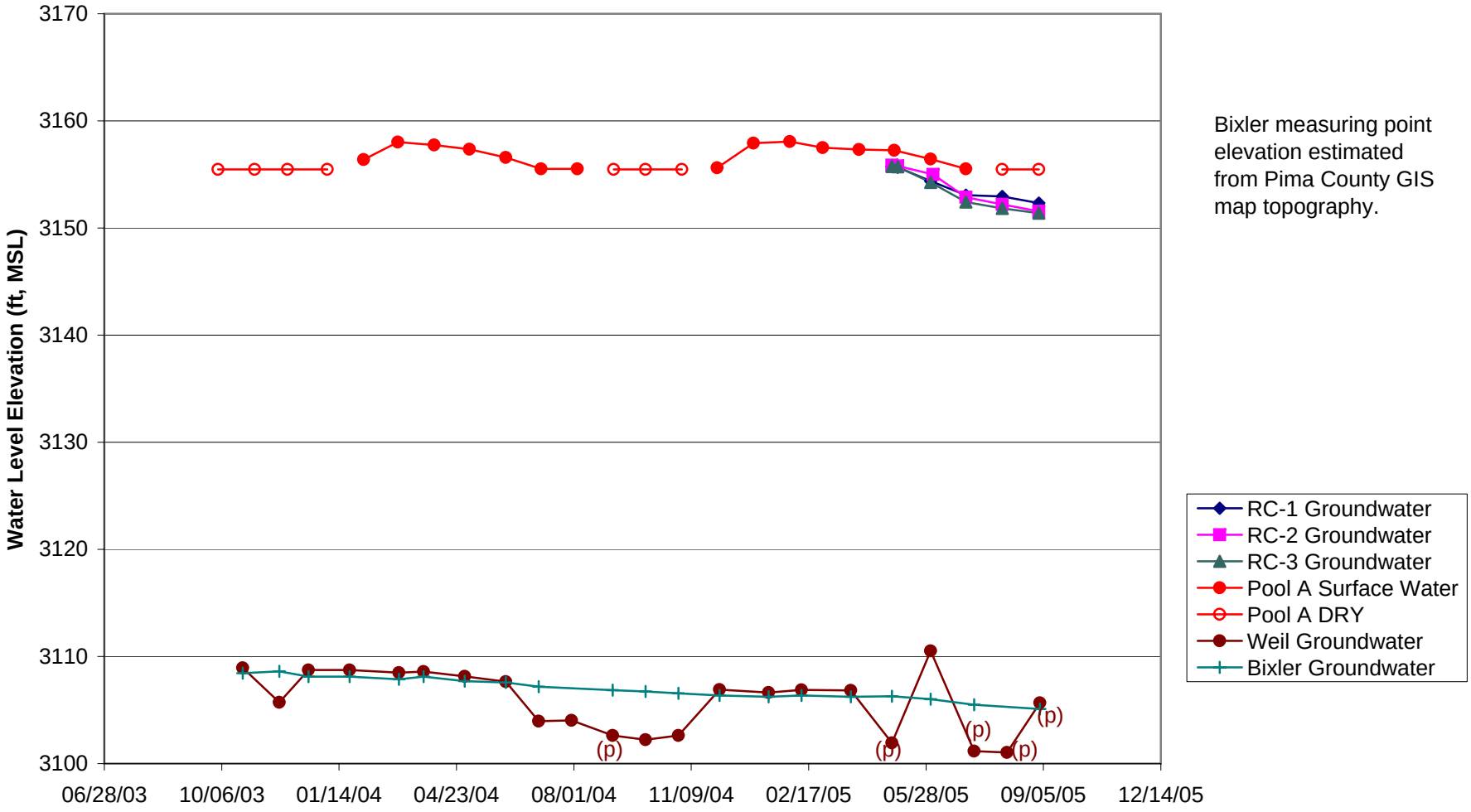


Figure C-11. Surface Water vs. Groundwater Elevation Hydrograph for Pool A and Wells RC-1, RC-2, RC-3, Weil, and Bixler, Water Years 2004-2005.
Rincon Creek
Pima County, Arizona

Note: (p) represents a pumping water level.
Haley & Aldrich, Inc.
G:\Projects\29983 Rincon Creek Instream Flow\reports\M02 Hydrogeology\Appendices\App C\
2007-1130-HAI-Rincon.M02.C-11.F.xls

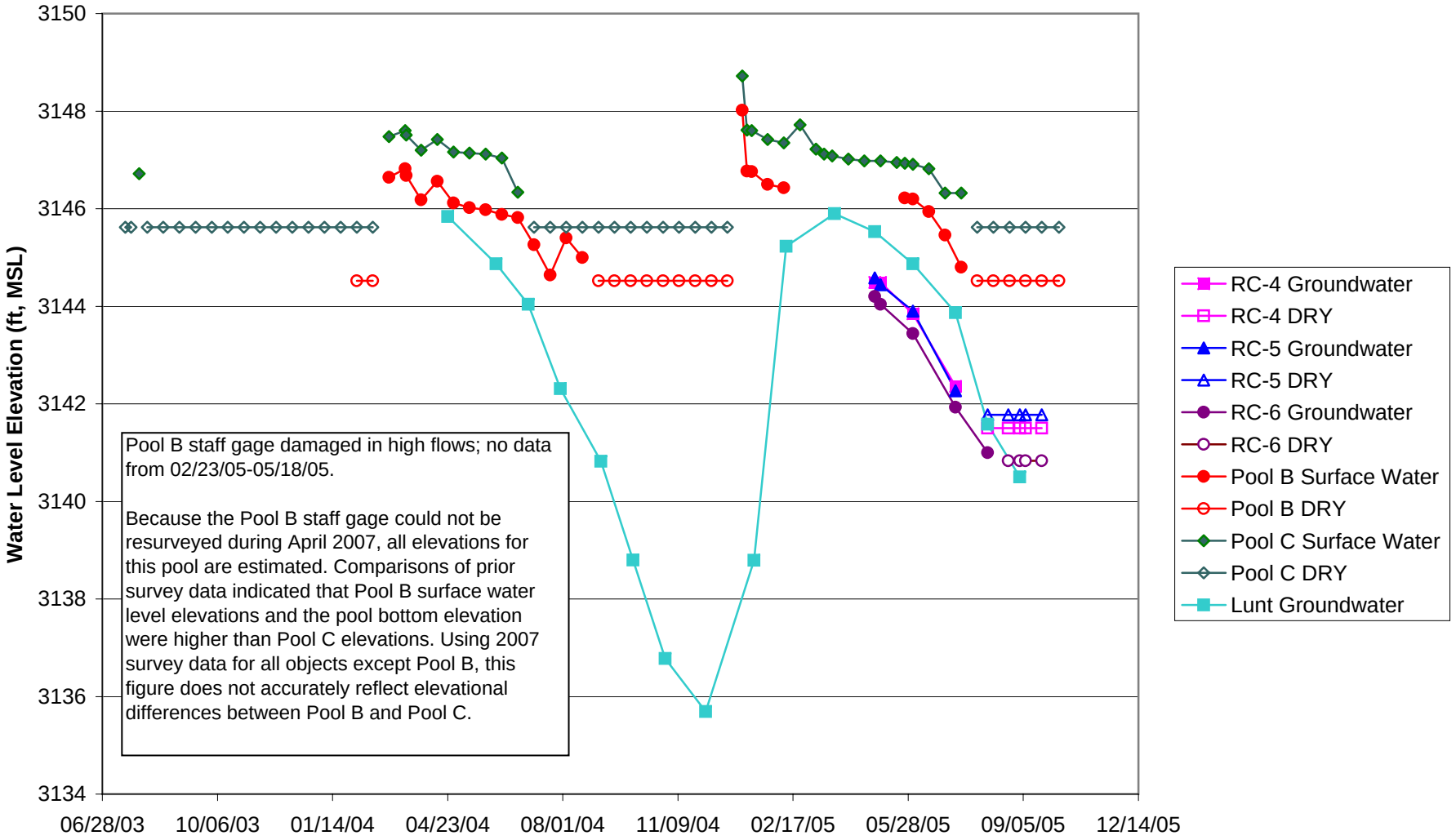


Figure C-12. Surface Water vs. Groundwater Hydrograph for Pools B and C, and Wells RC-4, RC-5, RC-6, and Lunt, Water Years 2004-2005.
Rincon Creek
Pima County, Arizona

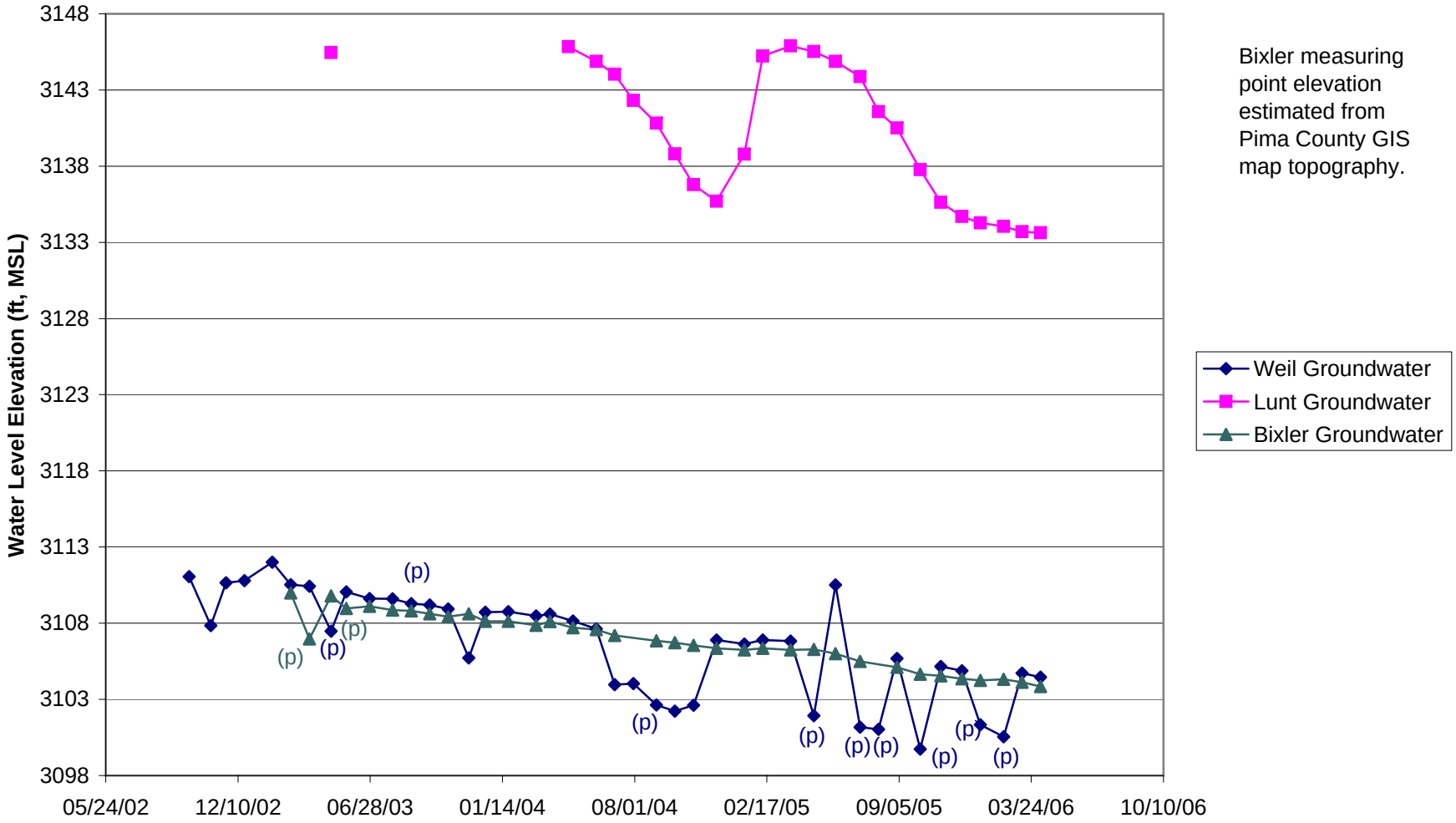


Figure C-13. Groundwater Elevations for Active Private Wells D(15-17)16bda/Weil and D(15-17)16acd/Bixler and Inactive Private Well D(15-17)17ada/Lunt.
Rincon Creek
Pima County, Arizona

Note: (p) represents a pumping water level.
Haley & Aldrich, Inc.
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DRAFT FINAL
November 2007

APPENDIX D

Pump Test Data and RC Monitor Well Construction Data

APPENDIX D
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D-I Summary of Short-term Aquifer Test Details

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APPENDIX D

DATA SOURCE

Data reported in this appendix was originally reported by Haley & Aldrich, 2005, "Construction of Monitor Wells RC-1, RC-2, RC-3, RC-4, RC-5, RC-6, and RC-7 at Rincon Creek, Pima County, Arizona."

TABLE D-I
SUMMARY OF SHORT-TERM AQUIFER TEST DETAILS
RINCON CREEK
PIMA COUNTY, ARIZONA

Monitor Well	Date of Test	Method of Extraction	Static Water Level (ft bmp)	Average Pumping Rate (gpm)	Duration of Pumping (minutes)	Volume of Water Removed (gallons)	Final Water Level [(1)] (ft bmp)
RC-1	5/11/2005	Pump continuously	5.95	38	30	1,140	8.01
RC-2	5/11/2005	Pump continuously	7.82	33	45	1,485	10.73
RC-3	5/11/2005	Pump continuously	12.18	33	30	990	14.89

NOTES AND ABBREVIATIONS:
1. ft bmp = feet below measuring point.
2. gpm = gallons per minute.
3. [(1)] = water level at the completion of pumping.

TABLE D-II
SUMMARY OF SHORT-TERM AQUIFER TEST RESULTS
RINCON CREEK
PIMA COUNTY, ARIZONA

Well	Estimated Transmissivity (gallons per day/foot)	Estimated Hydraulic Conductivity (feet/day)	Method of Analysis
RC-1	21,000	1,800	Cooper-Jacob drawdown
	22,500	1,900	Cooper-Jacob recovery
RC-2	17,250	630	Cooper-Jacob drawdown
	27,750	1,000	Cooper-Jacob recovery
RC-3	24,750	870	Cooper-Jacob drawdown
	21,750	770	Cooper-Jacob recovery

TABLE D-III
SUMMARY OF RC MONITOR WELL CONSTRUCTION DATA
RINCON CREEK
PIMA COUNTY, ARIZONA

Monitor Well	Effective Borehole Depth (ft bgs)	Borehole Diameter (inches)	Casing				Gravel Pack Interval (ft bgs)	Bentonite Seal Interval (ft bgs)	Cement Interval (ft bgs)	Measuring Point Elevation[(1)] (ft above MSL)	Ground Surface Elevation (ft above MSL)	Drilling Completion Date
			Diameter (inches)	Interval (ft bgs)	Type	Perforated Interval (ft bgs)						
RC-1	8.5	8.25	4	+2.4 - 8	PVC	3 - 8	3 - 8.5	2 - 3	0 - 2	3,161.66	3,159.25	04/20/2005
RC-2	13	8.25	4	+1.8 - 12.3	PVC	5 - 12.3	4 - 13	3 - 4	0 - 3	3,163.65	3,161.78	04/20/2005
RC-3	17	8.25	4	+1.9 - 16.4	PVC	9 - 16.4	8 - 17	5 - 8	0 - 5	3,167.87	3,166.00	04/19/2005
RC-4	9	8.25	4	+2 - 8.5	PVC	4.5 - 8.5	3.5 - 9	2.5 - 3.5	0 - 2.5	3,152.99	3,150.42	04/21/2005
RC-5	11.5	8.25	4	+1.8 - 11.5	PVC	6.5 - 11.5	4.5 - 11.5	3.5 - 4.5	0 - 3.5	3,155.02	3,153.19	04/21/2005
RC-6	13	8.25	4	+2.6 - 13	PVC	5.5 - 13	4.5 - 13	3 - 4.5	0 - 3	3,156.37	3,153.75	04/21/2005
RC-7	10	8.25	4	+2.5 - 9	PVC	4 - 9	4 - 10	3 - 4	0 - 3	3,147.41	3,144.93	04/22/2005

NOTES AND ABBREVIATIONS:
1. [(1)] Measuring point is a notch on the top north edge of casing.
2. ft = Feet.
3. bgs = Below ground surface.
4. MSL = Mean sea level.
5. Elevations resurveyed by the National Park Service in April 2007.