

**GROUNDWATER STATION DESCRIPTION
RINCON CREEK MONITORING WELLS RC-1 THROUGH RC-7 MADRONA RS, AZ
SAGUARO NATIONAL PARK**

Station Name	Station Identification No.	Well Location
RC-1	320745110370101	D(15-17) 16ACB
RC-2	320743110370001	D(15-17) 16 ACB
RC-3	320741110370001	D(15-17) 16 ACB
RC-4	None	D(15-17) 16 ADB
RC-5	None	D(15-17) 16 ADB
RC-6	None	D(15-17) 16 ADB
RC-7	None	D(15-17) 16 ACA

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Reviewed by: Gwen Gerber
Reviewed by: Kathryn Converse Date: 03/01/2011
Approved by: Bill Hansen Date: 03/22/2011

LOCATION

Rincon Creek monitoring wells RC-1 through RC-7 were installed for the National Park Service, Water Resources Division, Water Rights Branch (NPS-WRD/WRB) in April 2005. The wells are located along the middle reach of Rincon Creek (hydrologic unit code 15050302) on the southern boundary of the eastern district of Saguaro National Park east of Tucson in Pima County, Arizona (**Figure 1**; NE¼ of Section 16, T15S, R17E, Gila and Salt River Meridian and Baseline). The middle reach of Rincon Creek stretches from the confluence of Rincon and Chiminea creeks to a point about 0.7 miles downstream. The wells are located about 0.1 to 0.5 miles upstream from USGS gaging station 09485000 (Rincon Creek near Tucson, AZ) and approximately 480 feet to 0.5 miles downstream from the NPS gaging station at Pool A (320745110365701, Rincon Creek near Madrona Ranger Station, AZ) (**Figure 2**).

Monitoring wells, RC-1, RC-2, and RC-3, are located along a line perpendicular and south of Rincon Creek near Pool A. RC-1 is located about 50 feet south of the creek, RC-2 about 180 feet south of the creek, and RC-3 about 320 feet south of the creek. Monitoring wells, RC-4, RC-5, and RC-6, are located along a line perpendicular and south of Rincon Creek near Pool C. RC-4 is located about 20 feet south of the creek, RC-5 about 150 feet south of the creek, and RC-6 about 270 feet south of the creek. Monitoring well RC-7 is located about 220 feet south of Rincon Creek about 550 feet upstream of the USGS gaging station.

Contact Don Swann at Saguaro National Park (SAGU, 520-733-5177) prior to accessing the RC-Wells. Don will notify the X-9 Ranch gate house. One key accesses padlocks on all seven RC-Wells. To access the RC-Wells from SAGU park headquarters, drive southeast on Old Spanish Trail approximately 8.7 miles. Turn left (northeast) on the X-9 Ranch Road (**Figure 3**). Drive approximately 3.8 miles on the gravel road to the gate house. Identify yourself as NPS personnel and continue on the road. After approximately 1,000 feet, take the first left (northwest). Follow the road straight towards Rincon Creek. Travel approximately 1,100 feet and park in a large pull-out at an intersection in the road 220 feet south of Rincon Creek. Walk east along the dirt road; RC-3 is approximately 830 feet from the intersection and south of the road. RC-2 and RC-1 are approximately 120 and 250 feet north of the road. Walk west from your parked vehicle along the dirt road; RC-5 is approximately 580 feet from the intersection and south of the road. RC-4 is approximately 100 feet north of the road and RC-6 is approximately 150 feet south of the road. Walk west on the dirt road an additional 1,150 feet from RC-5; RC-7 is to the north of the road.

ESTABLISHMENT

RC-Wells 1-7 were installed by Haley & Aldrich Inc., of Tucson, Arizona (contractors to the Rincon Institute) in April 2005 for the NPS. The wells were constructed and water levels measured to support instream flow claims for Rincon Creek. Station data work-up by NPS-WRB was discontinued after water year (WY) 2006. Station operation, maintenance, and data work-up responsibilities were transferred to the Park.

WELL CONSTRUCTION AND CHARACTERISTICS

The monitoring wells were installed in approximately 7.5 to 15 feet of alluvium to the top of the underlying Pantano Conglomerate with an 8.5-inch air hammer. Air was used to remove cuttings from the borehole. Four-inch Schedule 40 PVC flush-threaded casing and screen was installed in each hole with the casing sticking about 2 feet above ground level. The screen was perforated with 0.25-inch wide slots and fitted with a PVC end cap. The annulus around the screen was filled with 0.5-inch filter pack and then topped with bentonite pellets and neat cement. An eight-inch diameter steel pipe and locking lid was securely attached to each well using neat cement (**Figure 4**). A water-tight well seal was attached to PVC pipe. See **Table 1** for installation dates and well depths. For further details on well construction, see Haley & Aldrich (2005).

Table 1: RC-Wells installation dates and depths

Well	Date Drilled	Total Depth of Well below Measuring Point (in feet)
RC-1	04/20/2005	10.26
RC-2	04/20/2005	13.89
RC-3	04/19/2005	16.94
RC-4	04/21/2005	10.82
RC-5	04/21/2005	13.41
RC-6	04/21/2005	15.5
RC-7	04/22/2005	11.5

The NPS notched the top of the PVC casing to mark the measuring point (MP). A benchmark (BM) was installed in the cement pad adjacent to the steel casing near ground level at each well.



Figure 4: RC-3 (Christensen photo: April 19, 2005)

HYDROLOGIC CONDITIONS

The RC-Wells are completed in the shallow alluvial aquifer along the middle reach of Rincon Creek which drains 40 square miles of the the Rincon Mountains of SAGU and Coronado National Forest. Rincon Creek is an intermittent stream with generally two periods of flow occurring during the water year (winter/spring runoff and late summer monsoon events). The climate in the Tucson area is classified as subtropical desert with an average of 12 inches of precipitation per year (<http://www.friendsofsaguaro.org/climate.html>).

Three weather stations have been used to relate precipitation to stream flow and RC-Well water levels. The Vail 7N weather station is located within the Rincon Creek drainage basin at an elevation of 2,980 feet and is approximately 6.0 miles west (downstream) of the RC-Wells. See **Figure 5** for a Weather Station Location map. The data from the Vail 7N weather station is available on-line from the *National Climate Data Center*

(<http://www.ncdc.noaa.gov/oa/ncdc.html>). The Rincon RAW's (remote automated weather) Station is located at an elevation of 8,240 feet and is located within the Rincon Creek drainage basin in the Rincon Mountains, approximately 6.5 miles north of the RC-Wells. The Rincon RAW's Station data is available from the following web-site: <http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?azARIN>. The Madrona Weather Station is located 1.6 miles northeast of the RC-Wells and was installed and operated by the NPS Sonoran Desert Network and the University of Arizona.

Vegetation, from the dry saguaro forest above 2,000 feet to cool moist coniferous forests of Mica Mountain at 8,666 feet, includes seven distinct biotic communities: desert scrub, desert grassland, chaparral, oak woodland, pine-oak woodland, pine forest, and mixed conifer forest (<http://www.friendsofsaguaro.org>). The geology of the lower Rincon Creek basin consists of a thin veneer of alluvium on top of the Pantano Formation (cemented conglomerate). Higher elevations consist of metamorphic rocks (<http://www.friendsofsaguaro.org/geology.html>). The majority of the Rincon Creek drainage basin consists of national park and national forest lands with a few residential and grazing properties.

GAGING

RC-Wells 1-7 were monitored by Haley & Aldrich Inc., from installation in April, 2005 through March, 2006. The NPS took over monitoring RC-Wells 1-3 starting in April, 2006. NPS started recording manual water levels from RC-Wells 4-7 starting in August, 2005. Manual water levels were recorded using an electronic water-level detector for each well. The depth to water from the measuring point (MP) was measured to the nearest hundredth of an inch.

In-Situ, Inc. SSP-100 miniTROLL's (dataloggers) rated for 5 PSI were installed in RC-Wells 1-3 on May 10, 2005 by Haley & Aldrich, Inc. and were programmed to log water-level every 15 minutes (**Table 2**). The cables connected to the dataloggers were vented In-Situ, Inc. minTROLL/MPT9000 downhole cables. Cables were secured at a fixed level by the NPS on April 7, 2006. The cables were attached to bolts inside the PVC casings (**Figure 6**).

Table 2: Serial numbers of dataloggers and cables and length of cable for RC-Wells 1-3

Well	Datalogger Serial Number	Cable Serial Number	Length of Cable, feet
RC-1	19957	90719	10
RC-2	20406	90718	15
RC-3	20326	90717	19



Figure 6: Datalogger cable secured to PVC casing in RC-3 (Gerber photo: April 7, 2006)

HISTORY

A chronological log of the RC-Wells history is shown below.

April 19 through 22, 2005	RC-Wells 1-7 installed
April 29, 2005	First of manual measurements by Haley & Aldrich, Inc.
May 10, 2005	Dataloggers installed in RC-Wells 1-3 by Haley & Aldrich, Inc.
August, 2005	NPS-WRD starts taking manual measurements from RC-Wells 4-7
April, 2006	NPS-WRD takes over monitoring from Haley & Aldrich, Inc., installs benchmark in the cement pads of each RC-Well, and installs the dataloggers in RC-Wells 1-3 at a fixed position
July 31, 2006	Rincon Creek high flow on record (14,000 cfs)
October 1, 2006	SAGU Park staff takes over well monitoring responsibilities

REFERENCE AND BENCHMARKS

A survey of RC Wells 1-7 was conducted in May, 2005 by Hawkeye Land Surveying Co., Tucson, AZ (Hawkeye). The top of the lid on the outer steel casing was the only point surveyed for each well. Haley & Aldrich, Inc, then performed measurements in the field using a standard tape measure to determine ground surface elevation, measuring point (MP) elevation, and total well depth elevations from Hawkeye's surveyed elevations. These surveyed, measured, and calculated elevations are shown in the spreadsheet in Section 4 of the water year folder. The potential error of these elevations are unknown since they were hand-measured. As a result, RC-Wells 1-7 were re-surveyed in April, 2007 by NPS-WRB and Tim Smith (GPS Program Coordinator), see **Table 3** and **Figure 7**. Elevations differed from the May, 2005 survey by up to 0.34 feet. See Section 4 of the water year folder and SAGU Survey Folder for survey data.

Table 3: April, 2007 Levels Survey of RC-Wells 1-7

Survey Location	Elevation (NAVD 1988, in feet)
RC-1 Benchmark (BM)	3159.26
RC-1 TOC/MP	3161.66
RC-1 TOC/Steel	3162.52
RC-2 Benchmark (BM)	3161.78
RC-2 TOC/MP	3163.65
RC-2 TOC/Steel	3164.20
RC-3 Benchmark (BM)	3166.00
RC-3 TOC/MP	3167.87
RC-3 TOC/Steel	3168.10
RC-4 Benchmark (BM)	3150.42
RC-4 TOC/MP	3152.99
RC-4 TOC/Steel	3153.17
RC-5 Benchmark (BM)	3153.19
RC-5 TOC/MP	3155.02
RC-5 TOC/Steel	3155.42
RC-6 Benchmark (BM)	3153.75
RC-6 TOC/MP	3156.37
RC-6 TOC/Steel	3156.63
RC-7 Benchmark (BM)	3144.93
RC-7 TOC/MP	3147.41
RC-7 TOC/Steel	3147.64

GROUNDWATER WITHDRAWALS

Groundwater withdrawals occur in the surrounding area from pumping a deep aquifer separated from the alluvial aquifer by the Pantano Conglomerate. Water levels in the bedrock aquifer are much deeper than in the shallow alluvial aquifer. Haley & Aldrich, Inc. (2007) estimated approximately 11 acre-feet of groundwater being pumped annually from wells in the middle reach of Rincon Creek.

ACCURACY

Accuracy of the record is considered good.

LOCAL PARK PARTNER

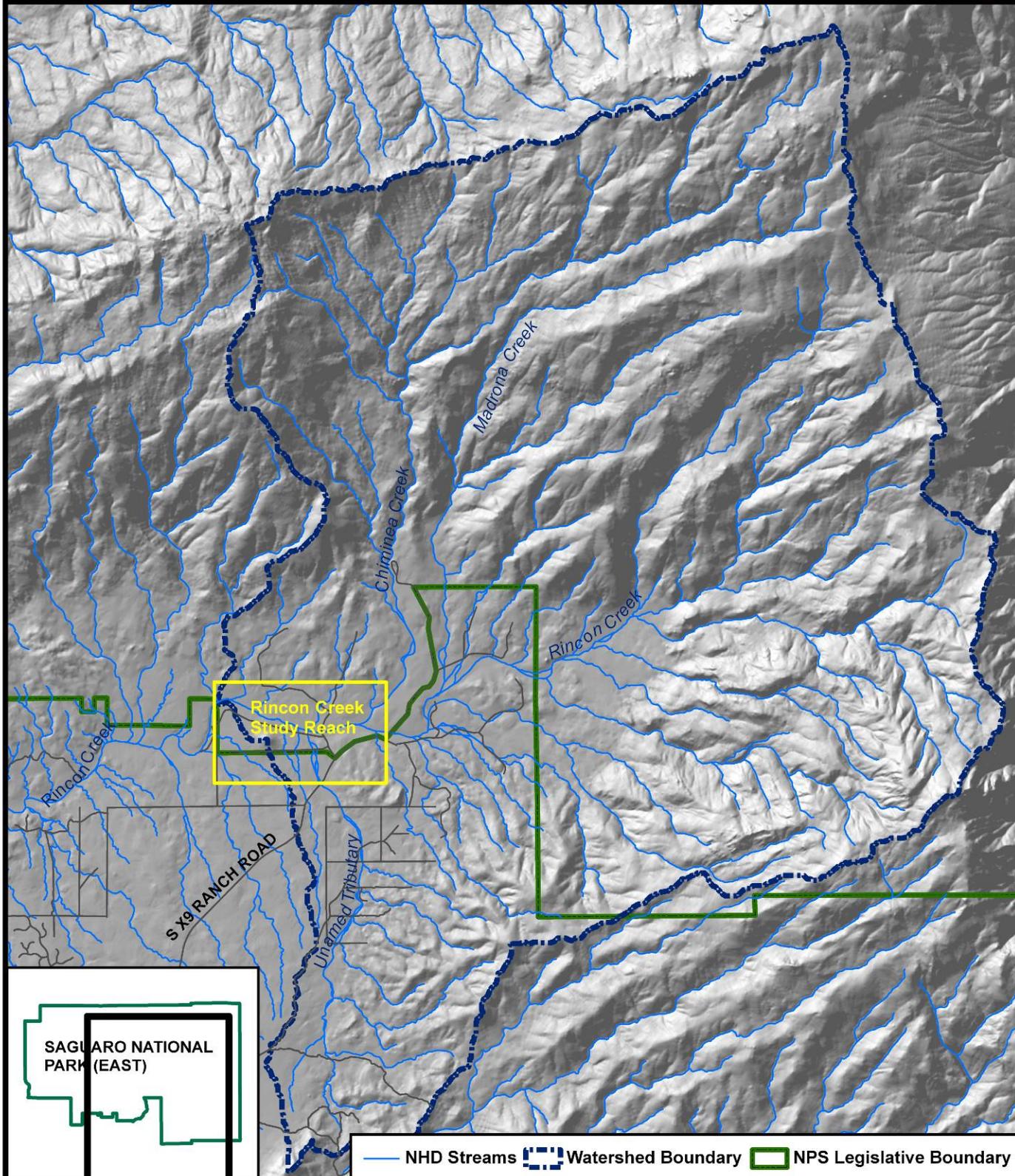
Chuck Perger (Park Volunteer) (520)-885-7401 (home)
Don Swann (520)-733-5177
Saguaro National Park 3693 South Old Spanish Trail, Tucson, AZ 85730-5601

REFERENCES

Haley & Aldrich, Inc, 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: Report prepared for the Rincon Institute, Tucson, Arizona, 4 pp. with 2 figures and 4 appendices.

Haley & Aldrich, Inc, 2007, Hydrology of the middle reach of Rincon Creek, Pima County, Arizona: Report prepared for the Rincon Institute, Tucson, Arizona, 23 pp. with 12 tables, 19 figures, and 4 appendices.

Project Location Map: Rincon Creek Study Reach



Produced by Water Resources Division

June, 2008

Figure 1: Project Location Map

Project Location Map: Middle Reach of Rincon Creek

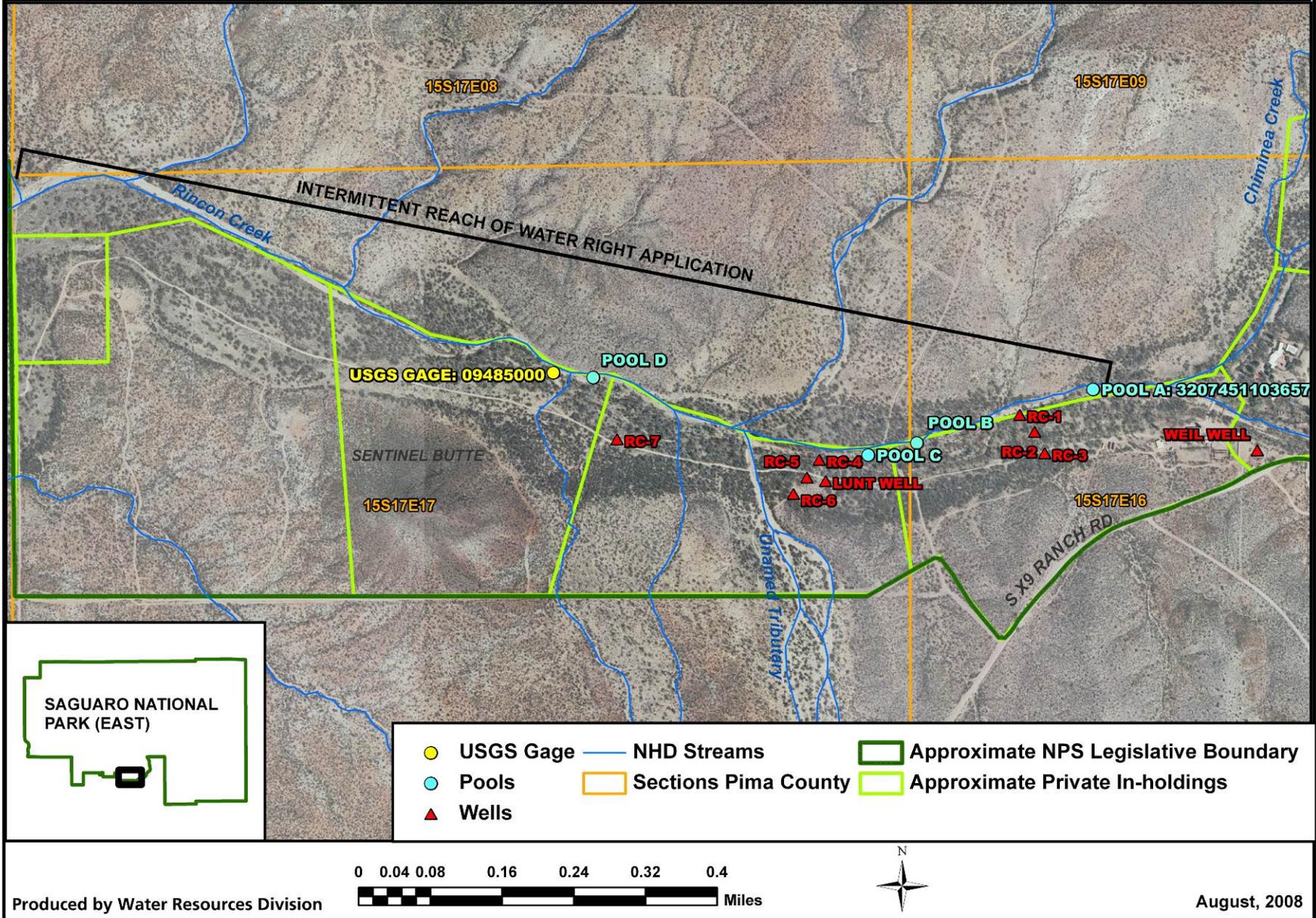


Figure 2: Study Area Map

Rincon Creek Gage Location Map

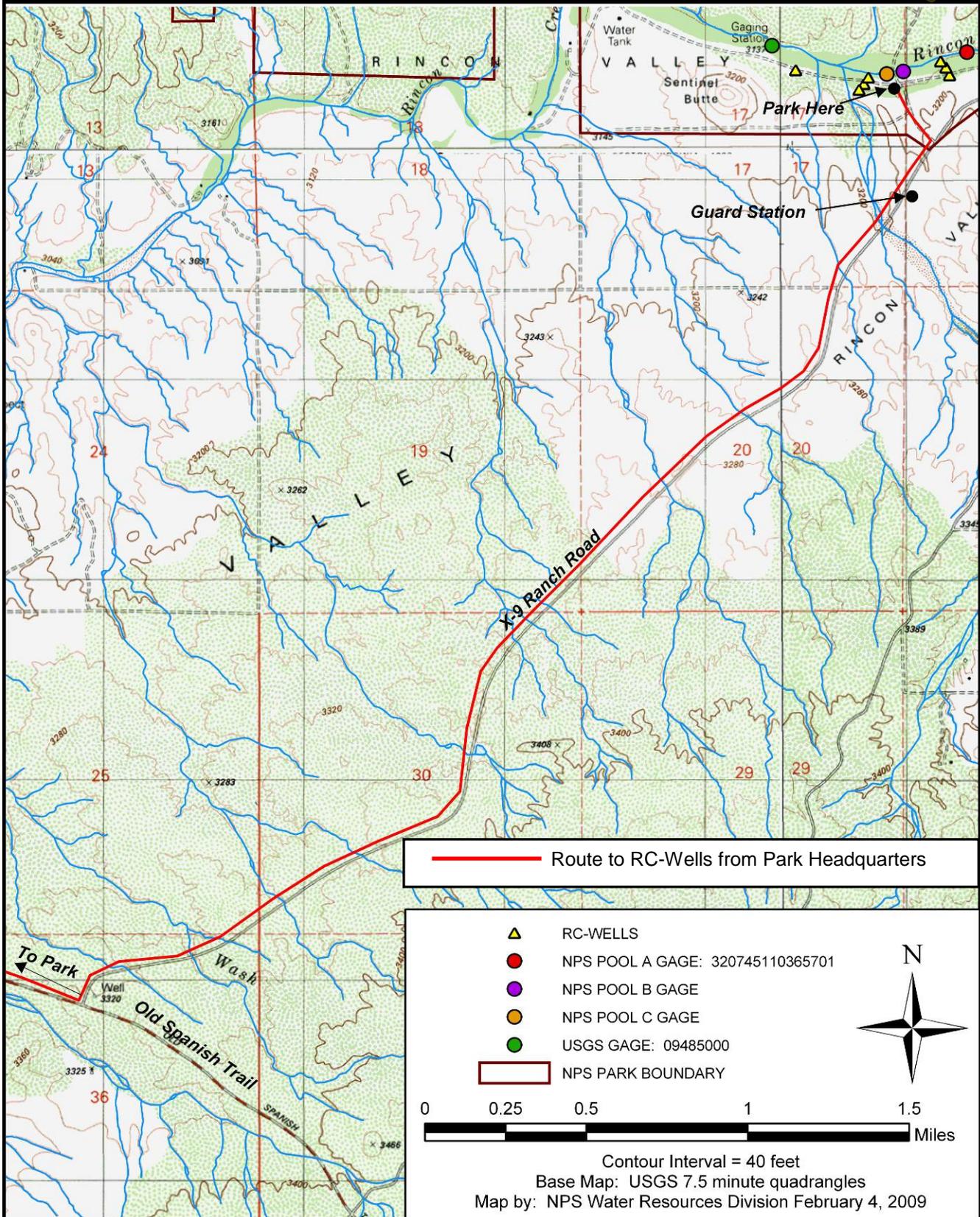


Figure 3: RC-Well Location Map

Weather Station Location Map

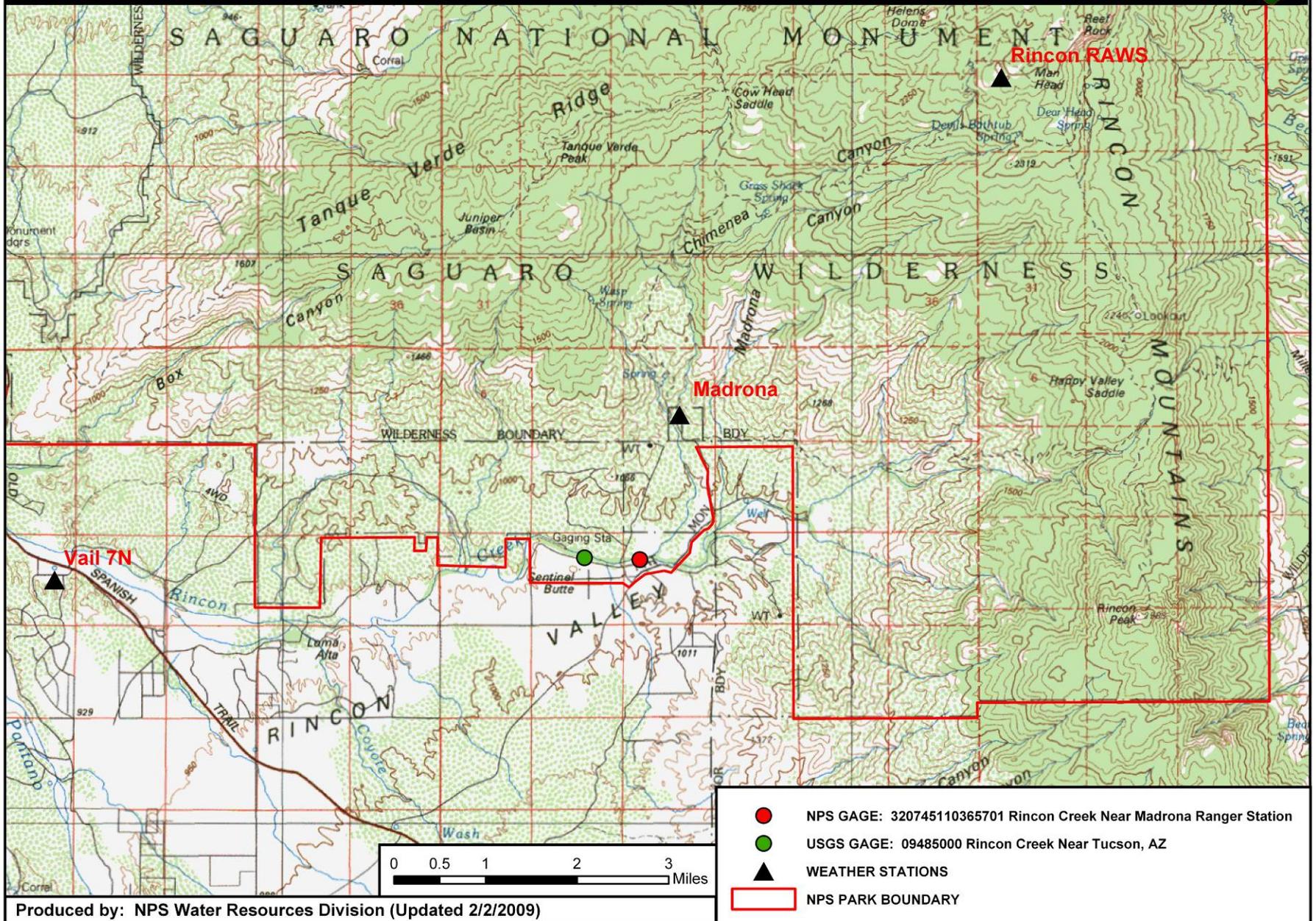


Figure 5: Weather Station Location Map

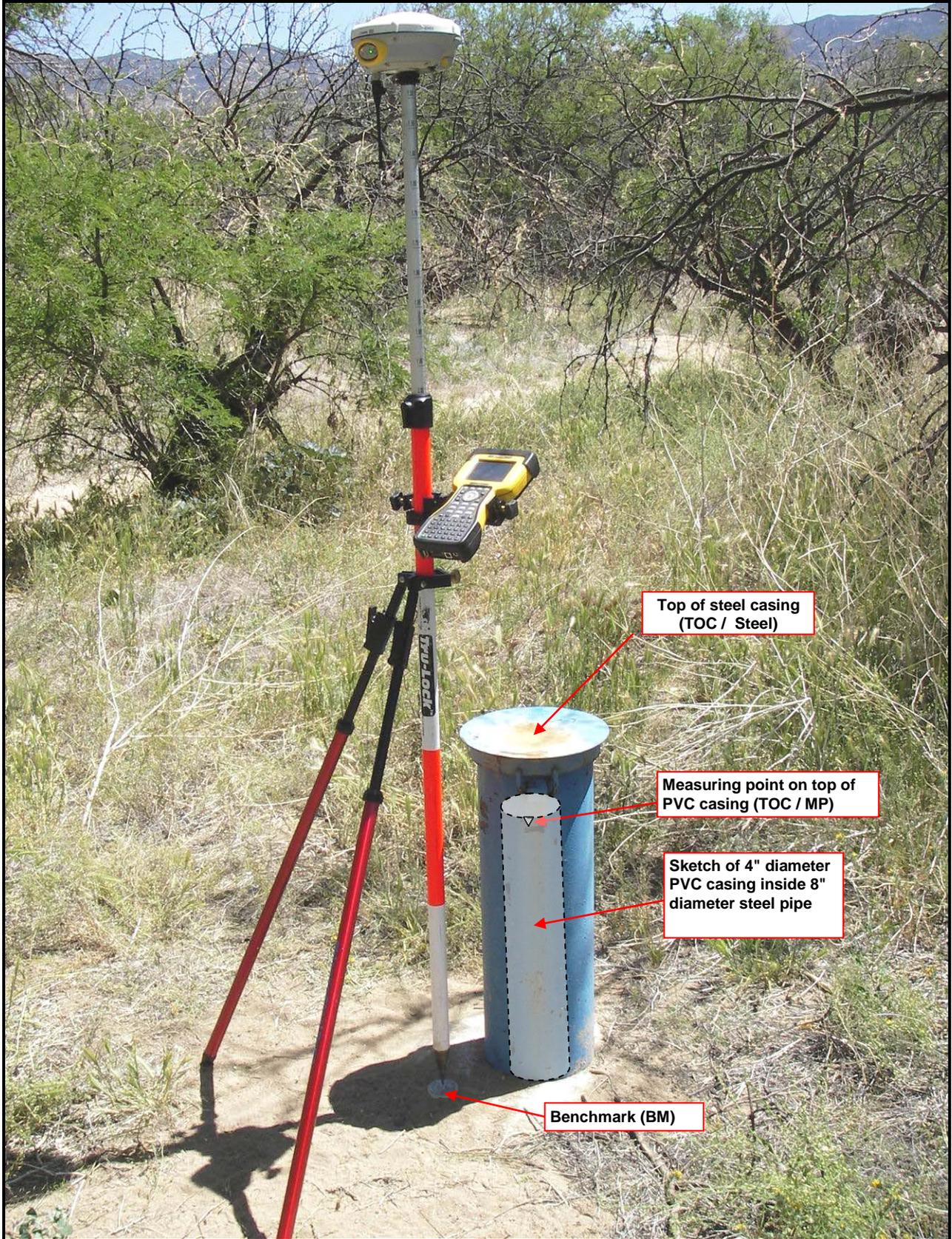


Figure 7: Survey setup and sketch of RC-5 (Tim Smith, April 26, 2007).