BORREGO WATER DISTRICT

CASGEM PROGRAM
GROUNDWATER MONITORING PLAN

NOVEMBER 2011

BORREGO WATER DISTRICT
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Table of Contents

Figures

Appendices

Borrego Water District

The Borrego Water District (BWD) was established in 1962 as a California water district under Water Code Section 35565. The District provides water and other services to the community of Borrego Springs. Borrego Springs is an unincorporated community located in the northeastern portion of the County of San Diego and is surrounded by the Anza-Borrego Desert State Park. The community of Borrego Springs is located approximately 58 miles northeast of the city of San Diego and about 32 miles south of the city of Palm Desert (Figure 1).

The BWD service area (shown in Figure 2) covers approximately 71.5 square miles, with approximately 67.3 square miles of the service area overlying the Borrego Valley Groundwater Basin (DWR Basin 7-24). The BWD service area also overlies a portion of the Ocotillo-Clark Valley Groundwater Basin (DWR Basin 7-25), however, no groundwater is currently extracted by the BWD in that basin. Water supplied to the BWD customers is from groundwater extracted from the Borrego Valley Aquifer, the area's sole source of water. Currently, the BWD operates 12 production wells (2 non-potable wells used for irrigation) and collects water level data from 10 monitoring wells.

History of Groundwater Monitoring

The Borrego Valley Groundwater Basin has a long history of groundwater level monitoring by the United States Geological Survey (USGS), the California Department of Water Resources (DWR), the County of San Diego, and the Borrego Water District. Groundwater elevations at selected wells have been monitored and reported by the USGS from 1945 to 1982 (Moyle 1982), by the DWR in the 1950s through 1960s and from 2003 to present, by the County of San Diego from about 1982 to present, and by BWD from 1980 to present. Moyle (1982) indicated that groundwater levels had been declining in the Borrego Valley since about 1945. More recent water level measurements by the USGS, DWR, the County of San Diego, and BWD indicate that groundwater levels continue to decline locally on the order of one to three feet per year.

Groundwater Basin Hydrogeology

Borrego Valley is filled with up to 2,400 feet of poorly consolidated to unconsolidated alluvial sediments (Mills, 2009). The alluvial sediments rest upon Pliocene to Pleistocene continental rocks and late Miocene to early Pliocene marine rocks. Cretaceous granitic and pre-Tertiary metamorphic rocks of the Southern California Batholith underlie the sedimentary units of the Borrego Valley. The alluvial sediments in Borrego Valley were generated by weathering of rocks in the mountains surrounding the valley; the sediments were then transported into the valley through stream flow processes with the coarser materials deposited near the source areas surrounding the valley and the finer sediments being transported greater distances from the source areas. The granitic and metamorphic rocks that form the base of the aquifer system are exposed in the mountains surrounding the BWD CASGEM monitoring area to the northeast, west, and south. The Coyote Creek Fault separates the Borrego Valley Groundwater Basin from the adjacent Ocotillo-Clark Valley Groundwater Basin.

Moyle (1982) identified an upper, middle and lower aquifer within the Borrego Valley Groundwater Basin based upon specific capacities and specific yields of wells. In general, the upper aquifer produces the greatest amount of water and the lower aquifer produces the least

amount of water. The upper aquifer was interpreted to be composed of various Quaternary alluvial and windblown deposits. The middle aquifer was interpreted to consist of the upper portions of the continental deposits. The lower aquifer is interpreted to consist of the lower portions of the continental deposits as well as the marine rocks. The granitic and metamorphic rocks are not considered to be a part of the Borrego Valley Aquifer.

The upper aquifer has been interpreted to be the thickest in the northern portion of the BWD service area and most wells in that area are believed to extract groundwater from the upper aquifer there. The middle aquifer is thought to be thickest in the northeast portion of the BWD service area, which is generally north and east of the Borrego Valley Airport; few wells exist in that area, but are thought to be completed within the upper and middle aquifers. The lower aquifer is not thought to be present in the northern portion of the BWD service area. The lower aquifer is thickest in the southern portion of the service area and is notably thickest in the area surrounding the Borrego Sink.

The main sources for groundwater recharge in the northern portion of the Borrego Valley Groundwater Basin are considered to be Coyote Creek north of the BWD service area and the San Felipe Creek located to the southeast of the BWD service area (Figure 2). Moyle (1982) and DWR[1] have produced groundwater level contour maps showing groundwater flow patterns in the Borrego Valley since 1945. Before widespread development of the Borrego Valley, groundwater was interpreted to generally flow from all areas in the northern Borrego Valley toward the Borrego Sink and discharge from the basin through the Borrego Sink Wash (Figure 2). Recent groundwater level contour maps show that groundwater is being discharged in the northern and southwestern portions of the BWD service area as evidenced by groundwater pumping depressions in addition to discharge through the Borrego Sink Wash. The primary sources of discharge within the vicinity of the BWD service area include agricultural wells, municipal supply wells, private residential wells and to a lesser degree, the Borrego Sink and Borrego Sink Wash.

Monitoring Wells and Measurement Frequency

Static groundwater levels are measured in BWD production wells on a bi-annual frequency and water levels are also measured in monitoring wells on a bi-annual frequency. Based upon historical and recent static groundwater level data collected in BWD's CASGEM monitoring area, the seasonal groundwater level high and low occur, respectively, during the months of March and November. All wells in the BWD CASGEM monitoring well network will be monitored on a bi-annual frequency and the data will be uploaded to the CASGEM system.

The following table identifies the wells to be monitored and the frequency with which they will be monitored and reported to the CASGEM Program.

[1]DWR Southern Region website showing interpretations of water level contours for Borrego Valley. http://wwwdpla.water.ca.gov/sd/groundwater/basin_assessment/basin_assessment.html

Monitoring Well Name	Monitoring Frequency
MW-1	bi-annual in March and November
MW-3	bi-annual in March and November
MW-4	bi-annual in March and November
ID4-1	bi-annual in March and November
ID4-2	bi-annual in March and November
ID4-5	bi-annual in March and November
ID1-1	bi-annual in March and November
Paddock	bi-annual in March and November

Discussion of Data Gaps

A data gap refers to an area that lacks a density of monitoring wells that would allow seasonal and long-term trends in groundwater elevations to be adequately evaluated over the monitoring area. The BWD has production wells in the northern portion of the service area, however, there is currently only one monitoring well in the northern portion of the BWD groundwater level monitoring area (MW-1, Figure 2). There are data gaps in the northwestern and northeastern portions of the monitoring area that exists due to a lack of suitable monitoring wells in those areas.

There are currently no plans or funding to install dedicated monitoring wells in Borrego Valley Groundwater Basin within the District boundary where the data gap exists. The Water District would be interested in discussing the installation of dedicated monitoring wells in the data gap area should outside funding become available.

Water Level Data Measurement Methods

The Borrego Water District uses standard procedures for the collection and documentation of groundwater elevation data. The following description of field methods indicates how BWD will maintain quality, consistency and reliability of monitoring data for internal use and for the users of the CASGEM database.

The reference point (RP) for all monitoring wells are marked at each site. A description of each RP is documented in field files along with pictures and other information on the well data sheet (see Appendix A). Water level measurements will be completed using a Powers Electric Well Sounder. This well sounder is marked with graduations with accuracy to hundredths of a foot.

Before making a measurement

1. The person collecting ground water level measurements will identify the RP on site and compare it to the description contained on the well data sheet.
2. Well sounder will be inspected before each use checking for wear, kinks, frayed electrical connections and possible stretch.
3. Check the distance from the electrode's probe sensor to the nearest foot marker on the tape to confirm that it puts the sensor at the zero foot point for the tape.

4. Confirm electrical circuitry of sounder by placing electrode into tap water and confirming that the electrical circuit is complete by observing the indicator needle and beeper.
5. Wipe off electrode probe and the lower 5 to 10 feet with a disinfectant and rinse with de-ionized or tap water.
6. Dry the tape before lowering into the well.
7. Prepare field forms.

Making a measurement

1. Use previous measurement data on Groundwater Level Data Form (Appendix B) to estimate the length of tape that will need to be lowered into the well to reach the water surface.
2. Lower the tape slowly into the well until the indicator shows that the circuit is closed and contact with the water surface has been made. Note the time, date and the measurement of the water surface to the RP to the nearest 0.01 foot and record this value as "Tape at RP" on the Groundwater Level Data Form.
3. Lift the electrode up slowly a few feet and make a second measurement by repeating step 2 and record the information below the first measurement. If the second measurement does not coincide with the first measurement within 0.02 of a foot, make a third measurement and record the information below the second measurement. If more than two readings are taken, record the average depth to water measurement of all reasonable readings.

After making a measurement

1. Wipe down the electrode probe and the section of tape that was submerged in well water using disinfectant and rinse thoroughly with de-ionized or tap water.
2. Dry the tape and probe and rewind the cable onto the reel. Do not store a dirty or wet cable.

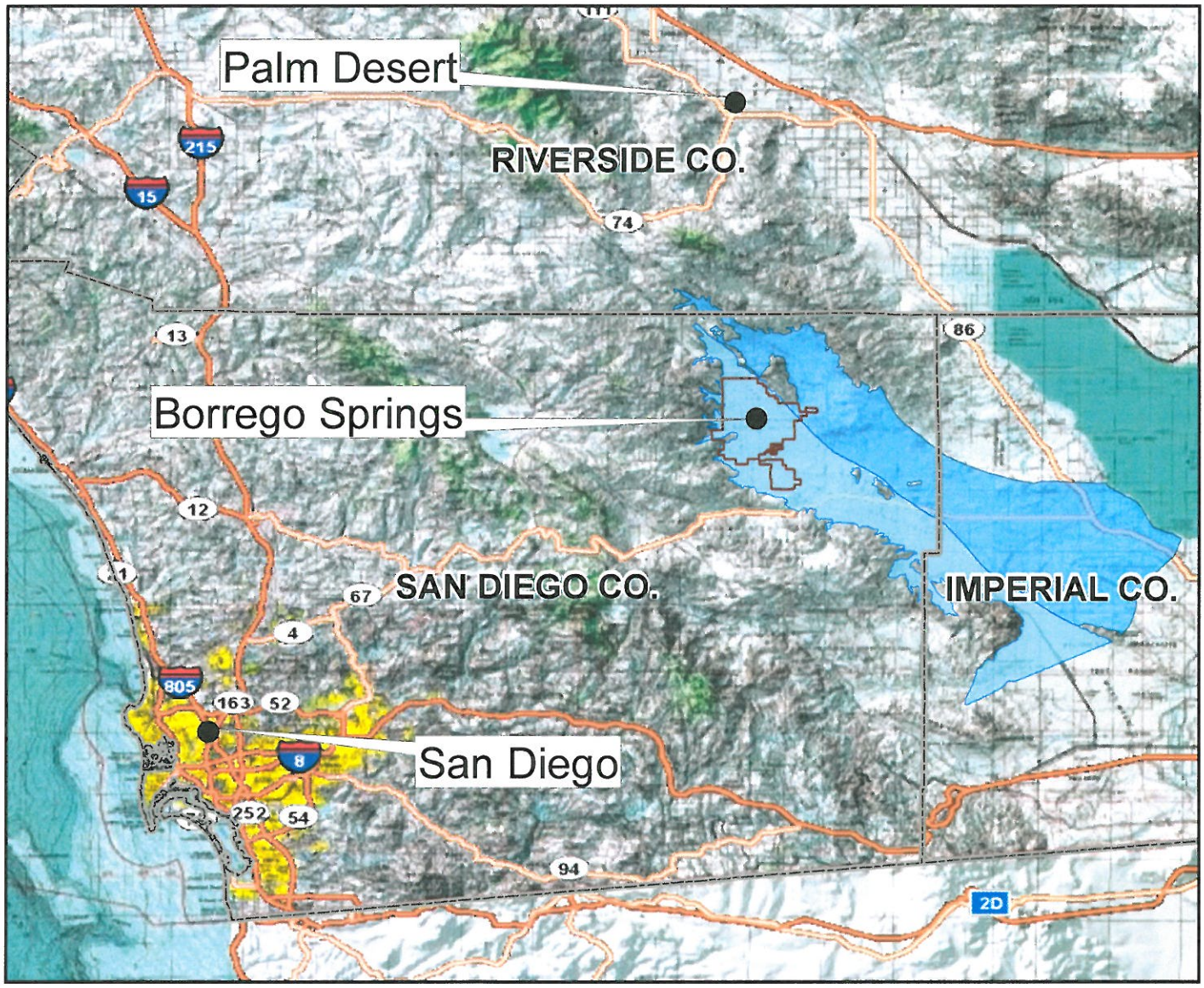
References

California Department of Water Resources, 1968, Water wells and springs in the Borrego, Carrizo, and San Felipe Valley areas, San Diego and Imperial Counties, California: Bulletin 91-15, 16 p.

Mills, R.M., 2009, Borrego Water District, Final Report: Integrated Water Resources Management Plan, 74 p.

Moyle, W. R., Jr., 1982, Water resources of Borrego Valley and vicinity, California; Phase 1 – definition of geologic and hydrologic characteristics of basin: U.S. Geological Survey Open File Report 82-855, 39 p.

Borrego Water District
CASGEM Program Monitoring Area Location Map



Legend

- Borrego Water District Jurisdictional Boundary
- Borrego Valley Groundwater Basin (7-24)
- Ocotillo-Clark Valley Groundwater Basin (7-25)

Figure 1

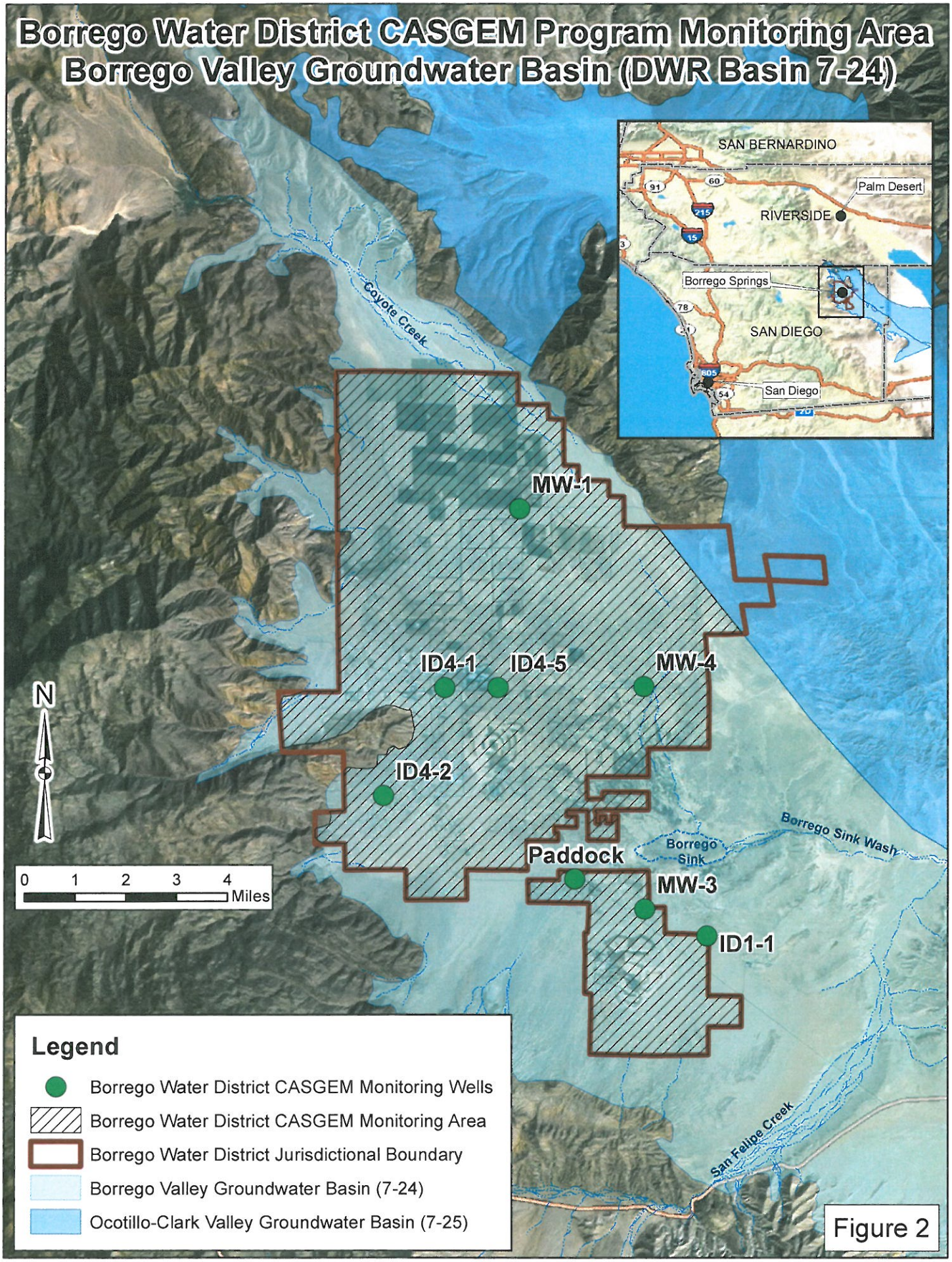

Borrego Water District CASGEM Program Monitoring Area
Borrego Valley Groundwater Basin (DWR Basin 7-24)
SAN BERNARDINO
Palm Desert
RIVERSIDE
Borrego Springs
SAN DIEGO
San Diego
Coyote Creek
MW-1
ID4-1
ID4-5
MW-4
ID4-2
Paddock
Borrego Sink
Borrego Sink Wash
MW-3
ID1-1
San Felipe Creek
N
0 1 2 3 4 Miles
Legend
Borrego Water District CASGEM Monitoring Wells
Borrego Water District CASGEM Monitoring Area
Borrego Water District Jurisdictional Boundary
Borrego Valley Groundwater Basin (7-24)
Ocotillo-Clark Valley Groundwater Basin (7-25)

Figure 2

Appendix A

Well Data Sheet, DWR Form 429

State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

WELL DATA

State Well No. _____

Region _____

OWNER			SITE ID	
ADDRESS			WELL NAME	
TENANT			OTHER NO.	
ADDRESS				
TYPE OF WELL ☐ SPECIAL STUDIES	☐ MONTHLY	☐ SEMI ANNUAL	☐ WATER QUALITY	
LOCATION COUNTY	BASIN		NO.	
U.S.G.S. QUAD.			QUAD NO.	
1/4 1/4 SECTION	TWP.	RGE.	☐MD ☐SB ☐H BASE & MERIDIAN	
COORDINATES (NAD83) LONGITUDE	LATITUDE		SOURCE	
DESCRIPTION				
REFERENCE POINT DESCRIPTION				
WHICH IS FT. ABOVE ☐ BELOW ☐	LAND SURFACE DATUM		GROUND ELEVATION	FT.
REFERENCE POINT ELEVATION FT.	DETERMINED FROM			
WELL USE	CONDITION		DEPTH	FT.
CASING, SIZE IN.,	PERFORATIONS			
MEASUREMENTS BY ☐ DWR ☐ USGS ☐ USBR ☐ COUNTY ☐ IRR. DIST. ☐ WATER DIST. ☐ CONS. DIST. ☐ OTHER				
GRAVEL PACK? ☐ YES ☐ NO	DEPTH TO TOP GR.		DEPTH TO BOT GR.	
TYPE OF MATERIAL	PERM. RATING		THICKNESS	
CHIEF AQUIFER	DEPTH TO TOP AQ.		DEPTH TO BOT. AQ.	
SUPP. AQUIFER	DEPTH TO TOP AQ.		DEPTH TO BOT. AQ.	
DRILLER	DATE DRILLED		LOG NUMBER (DWR 188)	
WELL PUMP TYPE	MAKE	MODEL	SERIAL NO.	
WATER ANALYSIS MIN.	SAN.		H.M.	
POWER SOURCE		WATER LEVELS AVAILABLE? ☐ YES	☐ NO	
H.P.	MOTOR SERIAL NO	PERIOD OF RECORD BEGIN	END	
ELEC. METER NO.	TRANSFORMER NO.	COLLECTING AGENCY		
SIZE OF DISCHARGE PIPE		IN.		
YIELD G.P.M.	PUMPING LEVEL FT.	PROD. REC.	PUMP TEST	YIELD

SKETCH

N

REMARKS

RECORDED BY

DATE

DWR 429 (Rev. 7/10)

Appendix B

Groundwater Level Data Form

DWR Groundwater Level Data Form
Manual Measurements

SWN:	County:	Location:	GPS:
Owner:	Well Address:	TD Well: feet	Casing Ø: in.	Casing material:
RP:	RP Elev.: feet amsl	MP:	MP height ↑ or ↓ RP: feet	MP Elev.:

No measurement (NM)		Questionable measurement (QM)		Measurment method (MM)
0 Measurement discontinued	5 Unable to locate well	0 Caved or deepened	5 Air or pressure measurement	0 Steel tape
1 Pumping	6 Well has been destroyed	1 Pumping	6 Other	1 Electric sounding tape
2 Locked	7 Special	2 Nearby well pump operating	7 Recharge operation at/nearby	2 Other
3 Tape hung up	8 Casing leaky or wet	3 Casing leaky or wet	8 Oil in casing	
4 Can't get tape in or down casing	9 Temporarily inaccessible	4 Pumped recently; recovering		

Date	Time	Observer	NM	QM	MM	Make	Model	Serial No.	Length (feet)	Tape at MP	Tape at WS	MP to WS	WS Elev.	Comments