

Borrego Water District
REPORT ON MONITOR WELL DRILLING PROGRAM 2007

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SUBJECT: Grant Agreement No. 4600004073 – Final Report on Phase II
Monitor Well Drilling Project

Cc: Russ Fogarty, General Manager

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MONITOR WELL STATISTICS

MW-4: Located on the San Diego County Airport complex, at east end of taxiway
State Well Number: 10S06E35Q001S
Latitude: 33°13'34.44" North
Longitude: 116°16'33.06" East
Elevation: 520 Feet Above Sea Level
Static Water Level after drilling: 87.38'
Total Depth: 927 Feet

MW-5A: Lower completion of dual well completion (east casing at surface)
Located 3 miles southeast of the intersection of Palm Canyon Drive and
Pegleg Road
State Well Number: 11S07E07R001S
Latitude: 33°13'33.84" North
Longitude: 116°16'32.40" East
Elevation: 480 Feet Above Sea Level
Static Water Level after drilling: 47.62'
Total depth: 480 Feet, completed to 345 Feet

MW-5B: Upper completion of dual completion (west casing at surface)
Located 3 miles southeast of the intersection of Palm Canyon Drive and
Pegleg Road
State Well Number: 11S07E07R002S
Latitude: 33°13'33.84" North
Longitude: 116°16'32.40" East
Elevation: 480 Feet Above Sea Level
Static Water Level after drilling: 47.72'
Total depth: 480 Feet, completed to 160 Feet

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BACKGROUND

In June of 2005, the California Department of Water Resources (DWR) awarded the Borrego Water District (BWD) a \$193,200 grant to drill two monitor wells in the Borrego Valley. This grant was supported by all of the major groups in the community of Borrego Springs, an unincorporated village of San Diego County. A memorandum of understanding (MOU) was signed by the local County Sponsor Group, Chamber of Commerce, the Save our Aquifer Coalition (SOAC), the Agricultural Alliance for Water and Resource Education (AAWARE), the Borrego Springs Fire Protection District, The Borrego Springs Unified School District, the Anza-Borrego Desert State Park, the Anza-Borrego Natural History Association, the Christmas Circle Park Foundation, the Civic Foundation of Borrego Springs, the Rotary Club of Borrego Springs, the Borrego Springs Country Club and Resort, the RoadRunner Club Golf Course, The De Anza Country Club and the Springs at Borrego Resort. This MOU showed that the people of Borrego Springs supported the BWD's efforts to learn more about the characteristics of the Borrego Valley aquifer, the community's sole source of water. The original plan was to drill one monitor well (MW-4) to attempt to prove/disprove the premise that a geologic structure was acting as an east-west barrier, dividing the aquifer from the north and the south. The second monitor well (MW-5) was to be drilled at the extreme outskirts of the Borrego Valley on the eastern end of the Borrego Sink, in close proximity to the original Borrego Spring, located on the Anza-Borrego Desert State Park. The primary reason for this site was to see if water could possibly be leaving the basin below the land surface.

THE REVISED PLAN

By the time the grant was awarded, a local farming entity began to drill a production well in the proposed location of MW-4 and the group offered to share the data gained from their drilling endeavor with BWD. Therefore, a new location was chosen with the assistance of Dr. Tim Ross of the DWR Southern District and Jim Bennett, the hydrogeologist for the County of San Diego. The new location for MW-4 was on an easement granted to BWD by the County of San Diego Airport Commission for a future production well. An arrangement was made with a local landowner for an easement on his 160 acre parcel located at the northeastern corner of the Borrego Sink for the drilling on MW-5. This process actually included two easements, one temporary easement for the drilling and one permanent easement with ingress and egress for the monitor well site.

THE PREPARATION

In February of 2006, the Borrego Water District Board of Directors approved a negative declaration for the monitor wells as per California Environmental Quality Act (CEQA) requirements. The notice inviting bids was published in the San Diego Union-Tribune with bids due on April 25, 2006. Bid specifications were drafted by the District Engineer and approved by the District's legal counsel. Bids went out to a total of twelve groups, eight drilling contractors and four others ranging from plan room organizations to material vendors. Three bids were presented on the scheduled opening date of April 25, 2006. The low bid of \$242,522 by SOCAL Pump and Well Drilling was accepted by the District Engineer and the following day by the Board of Directors. The low bid exceeded the proposed budget by nearly \$66,000 due in part by the recent rise in both fuel and steel prices but also because of the added coring segments and enhanced geophysical logging runs as per a letter from Darby Vickery. The Board of Directors was made aware of the difference and agreed to proceed, covering the overage with District groundwater management funds.

Drilling permits from the County of San Diego Department of Environmental Health (DEH) were issued with conditions. These conditions involved the screening of multiple water bearing zones. DEH does not allow monitor wells to screen these multiple zones which we anticipated encountering in both of the monitor wells. The screening would be handled in a case by case basis to comply with the DEH condition.

Monitor well #4 was moved from its original location due to the recent agricultural well being drilled in the vicinity. The replacement site was to be in the roadway easement adjacent to a production well site easement granted to BWD when the airport installed a 10" water main to the airport complex. The roadway easement site was not approved by the County Department of Public Works, so the site was moved onto the airport easement. This triggered the need for a right-of-entry and an airport use permit with the San Diego County Airport Commission. Several conditions had to be satisfied in order for this permit to be granted. A set of guidelines were agreed upon in so far as accessing the taxiway of the airport and the drilling could only occur in daylight hours; otherwise, an FAA permit would also be required.

Monitor well #5 was located in a remote area of large parcels, mostly owned by absentee owners. The area was very popular with weekend campers and their sand toys consisting of motorcycles, dune buggies, quads and sand rails. Due to the time of year, early summer, the activity would be minimal because of the hot temperatures. The actual site was located adjacent to the Anza-Borrego Desert State Park which only allows licensed vehicles so we did have that to our advantage. The road accessing the property was very rough and needed to be upgraded for the drilling rig and the daily trips needed by the drilling and monitoring crews. A local dozer was contracted due to his knowledge of the area and two additional water trucks were rented to transform the powdery sand into a passable roadway.

DRILLING MW-5

With the advent of summer approaching and the associated extreme temperatures, the more remote site of MW-5 was chosen to be drilled first. The drill rig and equipment was mobilized on June 12th and drilling commenced on the 13th. DWR geologists Darby Vickery and Tim Ross were on-site for the preparation but Darby had to return to Sacramento and was replaced with Doug Ellis of the DWR Southern District. Drilling continued around the clock for the next three days until a total depth of 480 feet was reached. Thirty feet of core was attempted yielding approximately 20 feet of core samples. The core was comprised of sandstone with one distinct calcite vein. Due to the persistence of “hard rock”, the drill hole was cut short to 480 feet from the planned total depth of 700 feet.

The geophysical logger arrived on June 20th to perform a series of logs including sonic, e-log, caliper and acoustic borehole televiewer. The logs revealed the presence of two distinct water bearing formations. In order to comply with the County DEH conditions, it was decided to make the well a dual completion well with an upper completion from the surface seal to 165 feet and the lower from 185 to 350 feet.

The water levels of the two completions were very close with the upper completion of 47.72 feet below land surface and the lower completion of 47.64 feet. The water quality on the other hand varies substantially with the upper completion at 1500 mg/l total dissolved solids and the lower at 2100 mg/l.

A detailed report of the drilling by Dr. Tim Ross of the DWR Southern District and the log of the borehole cuttings are located in the appendices.

DRILLING MW-4

Drilling began on MW-4 on July 6, 2006 with DWR geologist Doug Ellis logging the cuttings. As per the conditions of the permit with the County Airport, the drill rig mast had to be lowered each day and no night time drilling was allowed. This not only hindered the completion schedule but also limited the total depth that could be reached due to retrieving the drilling tools from down the hole every day.

Drilling progress was slow and encountered the primary water bearing formation from 350 to 400 feet below land surface. Drilling continued to a total depth of 927' on July 26th. Three 10' core runs were attempted from 850' to 890' resulting in a total of 7-1/2' of solid core from the bottom of the drill hole. The final core run resulted in riverbed boulders and a sea shell, indicating the drill hole may have reached the marine formation.

Geophysical logs were run on July 27th. Due to budget overruns, the proposed completion of this hole was cut short to 400 Ft.

The static water level was 87.38 feet below land surface and the total dissolved solids were 620 mg/l.

A log of the borehole cuttings is located in the appendices; however, the report of the MW-4 drilling by Dr. Doug Ellis of the DWR Southern District was not completed at the time of this publication.

MONITORING EQUIPMENT:

Two different monitoring devices were chosen to record monitor well information for the two monitor wells. The “Troll 9500” developed by In Situ of Ft. Collins, Colorado was utilized in MW-4 to track water level, conductivity, temperature, barometric pressure and battery life of the device. The “Level Troll”, also by In Situ was chosen for MW-5 due to its remote location and susceptibility to vandalism. The level troll only monitors for water level; however, the device has a long-term lithium battery and a relatively low cost that will provide use with the basic data needed at this location.

Basically, the devices have reflected little change in the water level over the short period of monitoring. An aquifer test was performed on MW-4 utilizing a test pump and water level recording device. Two tests were performed, a step test and a constant rate test. The second test was scheduled after the step test had ample time to recover. A water quality sample was collected at the end of the aquifer test. After recovery from the constant rate test, the water level has had little change.

Both completions of MW-5 (dual completion of upper zone and lower zone) have relatively the same water level. As each completion was pumped for a water quality sample the well responded with dropping water levels. The other completion was also monitored and showed no drop in the water level. This proves that the seal between the two completions is intact and that the upper zone water does not mingle with that of the lower zone. Although the static water levels of the two completions are within one inch of each other, the water quality suggests that there are two different water bearing formations in the well.

WATER QUALITY SAMPLING/AQUIFER TESTING

Water quality samples were collected from MW-4 and the two completions of MW-5. As per water quality sampling procedures, at least 10 times the casing volume of each well was pumped immediately prior to the sample collection. The water quality reports are located in the appendices and a tabulation of the results is included on the follow page. The best quality was found in MW-4, at 720 total dissolved solids. The upper completion of MW-5 was slightly better quality than the lower zone, 1300 and 2300 total dissolved solids, respectively; however, neither are considered acceptable for drinking water standards without further treatment.

Two aquifer tests were performed by BWD staff to see if the MW-4 site could possibly be an area to drill a future production well. First a step test was performed with three steps; 100 gallons per minute (gpm), 200 gpm and 300 gpm. The well was allowed a day to recover and a constant rate test of 250 gpm was performed. The graphs of these tests are located in the appendices.

PUBLIC OUTREACH

Water issues are of extreme importance the citizens of Borrego Springs. Every issue of the bi-weekly “Borrego Sun” features articles on recent events at the water district board meetings. Prior to and during the monitor well drilling program, presentations were made at the monthly the Groundwater Management Standing Committee of the Board of Directors. In addition, Dr. Doug Ellis of the DWR Southern District made a powerpoint presentation to the general public at the BWD annual “Town Hall Meeting” held February 28, 2007. This annual event is held in conjunction with the District’s Groundwater Management Plan, adopted by the Board of Directors in September 2002.