

# Application Note

## California Groundwater Management Program Serves 4 Million and Relies on Innovative Technologies

SMARTROLL™ Multiparameter Handheld Improves Groundwater Quality Monitoring Activities

### Introduction

When over four million people in 43 cities rely on you to deliver high-quality water, you need a robust water quality and water level monitoring program. The Water Replenishment District of Southern California (WRD or the District) has just that. Founded in 1959, the WRD manages groundwater replenishment and groundwater quality activities in cities that overlie the Central and West Coast Basins (CBWCB; Figure 1) in southern Los Angeles County. These basins supply about 40 percent of the water used by the population in that region. The 420-square-mile (1,088 km<sup>2</sup>) service area uses about 250,000 acre-feet (308,370,500 m<sup>3</sup>) of groundwater per year.

The WRD purchases water for artificial recharge from the CBWCB. Natural recharge occurs but is insufficient to maintain groundwater levels at current adjudicated pumping rates. Artificial recharge occurs by spreading, by allowing percolation in forebay recharge basins, and by injecting recycled water into seawater intrusion barriers along the coastal margins. Types of water used for artificial recharge include imported and recycled water. Use of recycled water for artificial recharge is regulated and conducted under several permits that require extensive monitoring and demonstration of protection of public health.

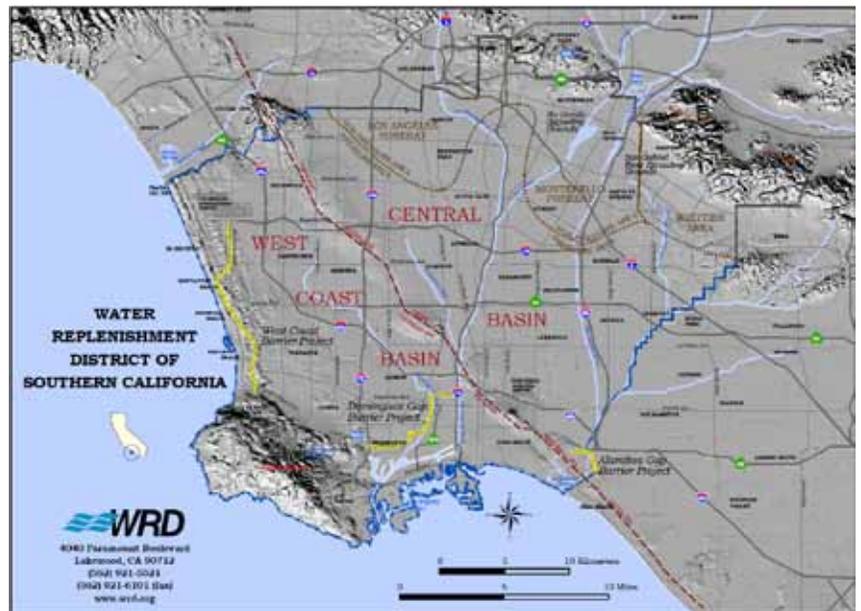


Figure 1. Map of the Water Replenishment District of Southern California (courtesy of WRD)

### 60,000 Data Points Every Year

The WRD's mission is to protect and preserve groundwater basins through innovative, cost-effective, and environmentally sensitive management practices for the benefit of residents and businesses in the CBWCB (WRD 2013). To deliver on that commitment, the WRD manages a growing network of nearly 300 monitoring wells at over 50 locations throughout the District. WRD staff routinely track groundwater levels and groundwater quality.

During biannual sampling events, the WRD samples 300 monitoring wells in a six- to eight-week period. Over 100 water quality constituents are analyzed to produce nearly 60,000 individual data points. All this data adds up to a comprehensive picture that informs the WRD about water quality in the basins and trends that may require policy changes.



Figure 2. The WRD staff simultaneously run two smarTROLL Low-Flow Systems to save time at sampling events.

To collect representative groundwater samples, the WRD typically uses traditional water quality sondes or handheld instruments and manually records field notes. In 2013, the WRD started using In-Situ® Inc.'s smarTROLL™ Multiparameter (MP) Handheld, iSitu® App for iOS devices, and low-flow sampling cell (Figure 2).

### **Up to \$5,000 per Sample**

Laboratory analysis of groundwater samples is costly. Typical lab fees for regional monitoring range from \$80 to \$400 per sample. To meet drinking water regulations under the California Code of Regulations, lab fees are typically \$2,000 per sample. Groundwater samples involving recycled water have stringent regulations, and lab fees range from \$3,000 to \$5,000 per sample.

“We need to be sure that when it’s time to fill the sample bottle during groundwater sampling events that we are collecting representative groundwater samples,” said Tony Kirk, WRD hydrogeologist. “If samples aren’t representative of groundwater formation water, then laboratory analyses can be meaningless and a lot of time and money are wasted.”

The District has multiple confined aquifers separated by substantial aquitards. To improve water quantity and quality monitoring, a network of nested monitoring wells (Figure 3) have been developed that typically include between five and six zones with depths up to 610 m (2,000 ft). Each nested well is screened in a portion of a

specific aquifer to provide water quality and water level information for each specific zone.

To improve efficiency, WRD staff typically sample two wells (zones) simultaneously and use two smarTROLL MP Handhelds during a day-long sampling event at a nested monitoring well. WRD staff set up each smarTROLL MP Handheld with a low-flow sampling cell and appropriate sampling pump.

“WRD sampling trucks are set up for one person operation,” said Mr. Kirk. “With so many samples to collect, I set up two smarTROLL Systems to collect samples from two zones staggering the start times and ensuring that each iPod touch® device connects to the appropriate smarTROLL Handheld.”

Flow rates are between 1 and 6 gallons/minutes. One-half gallon/minute is routed through the flow cell. The WRD monitors dissolved oxygen (DO), conductivity, ORP, pH, and temperatures readings every 10 seconds. Depending on the depth of the well and volume to water in the well, purges can last from 15 minutes to 4 hours. WRD staff carefully monitor key water quality parameters to determine stabilization prior to sample collection.

### **300 Samples Collected in Less than 8 Weeks**

Prior to a day of groundwater quality sampling, WRD staff calibrate the smarTROLL MP Handheld.

“Compared to other water quality instruments used by the WRD, the smarTROLL Handheld is easier to calibrate,” said Mr. Kirk. “By using the iSitu App and Quick Cal Solution, calibrations are faster and a digital calibration report is generated that can be saved to the iOS device or emailed to coworkers. Other systems that we’ve used do not generate a digital calibration report.”

**NESTED WELLS vs. PRODUCTION WELLS  
FOR AQUIFER-SPECIFIC DATA**

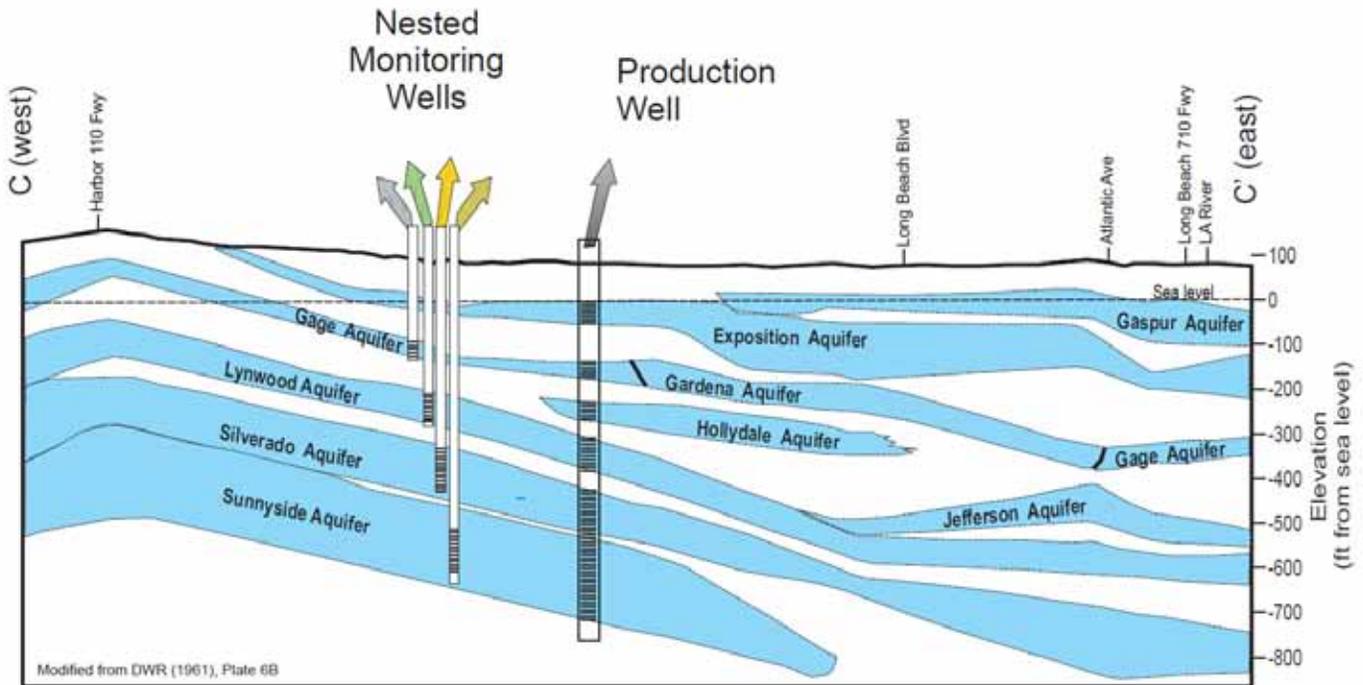


Figure 3. Production wells are typically perforated across multiple aquifers producing an average water quality. Nested monitoring wells are screened in a portion of a specific aquifer, providing water quality and water level information for the specific zone.

The WRD must save records, like calibration reports, for seven years. The iSitu App automates generation of digital calibration reports, which reduces transcription errors and speeds up the transfer of information from the field to the office.

“The kind of instrumentation we use is important for identifying representativeness of the sample,” Mr. Kirk continued. “The data we are collecting with the SMARTROLL Handheld is as consistent and accurate as any data collected with other water quality instruments.”

Compared to currently available water quality sondes and software, Mr. Kirk identified features of the SMARTROLL Handheld and iSitu App that have improved sampling events:

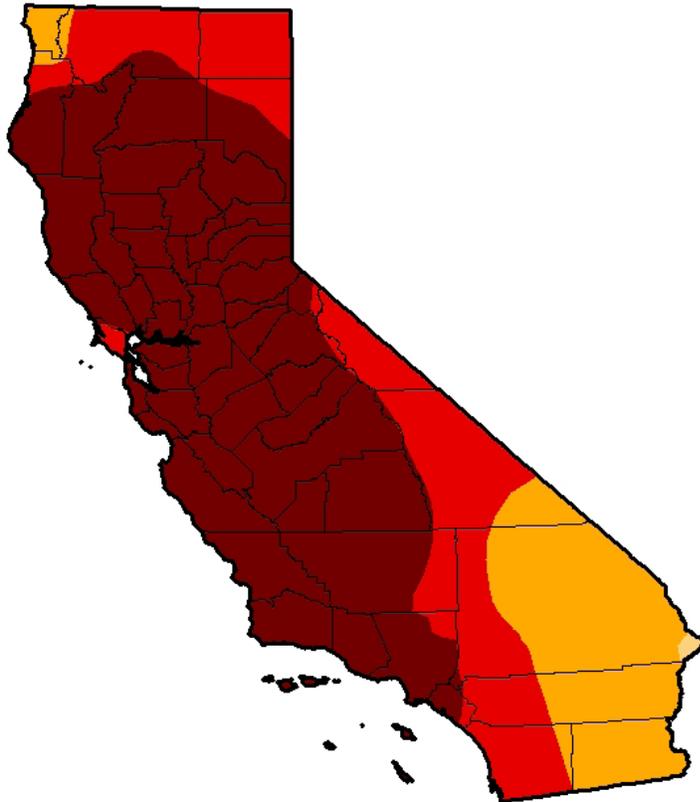
- The compact SMARTROLL System includes a narrow-diameter, lightweight sonde, and the iSitu App for an iOS device eliminates the need for a laptop computer. This frees up space in WRD’s truck and is easier to carry into the field.
- The iSitu® App interface offers intuitive functionality, which basically eliminated the need for training time.
- In-Situ Inc.’s optical Rugged Dissolved Oxygen (RDO®) Sensor eliminates maintenance required for Clark cells—membrane and filling solution replacement. WRD staff report that the RDO Sensor Cap is economical and easy to replace.
- The SMARTROLL Handheld includes a removable and serviceable pH probe with refillable reference junction, which is not found on many water quality sondes. At the end of a busy sampling day, where as many as 10 to 12 wells are sampled, WRD staff remove the pH sensor and store it in KCl solution overnight. The SMARTROLL pH sensor does not require conditioning, but WRD staff have found that storing the pH sensor in KCl solution overnight extends the life of the reference junction solution.
- With other sondes, sensors must be removed for conditioning. Often, sensors must be unscrewed from the sonde after every sampling event—SMARTROLL sensors are push-in and easier to install and remove.

- The SMARTROLL doesn't include a turbidity sensor. WRD staff have found that turbidity sensors on other sondes don't last long and are expensive to replace. WRD staff prefer to use a benchtop turbidimeter because the results are more accurate. Operators can input turbidity results from a standalone meter into the iSitu App.
- Use of the flow-through cell eliminates the need to constantly collect samples throughout the sampling event.

### More Sampling Ahead

Currently, extreme drought conditions in California (Figure 4) are making policy makers aware of the importance of groundwater monitoring to ensure the sustainability of this vital resource. Prudent groundwater basin management requires up-to-date records and continued monitoring of both water quantity and water quality. With the WRD's focus on using innovative and cost-effective management practices, the SMARTROLL MP Handheld adds an effective monitoring instrument to the WRD's toolbox.

## U.S. Drought Monitor California



**August 5, 2014**

(Released Thursday, Aug. 7, 2014)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	0.00	100.00	100.00	99.80	81.92	58.41
<b>Last Week</b> 7/29/2014	0.00	100.00	100.00	100.00	81.89	58.41
<b>3 Months Ago</b> 5/6/2014	0.00	100.00	100.00	95.93	76.68	24.77
<b>Start of Calendar Year</b> 12/1/2013	2.61	97.39	94.25	87.53	27.59	0.00
<b>Start of Water Year</b> 10/1/2013	2.63	97.37	95.95	84.12	11.36	0.00
<b>One Year Ago</b> 8/6/2013	0.00	100.00	98.23	93.86	0.00	0.00

#### Intensity:

D0 Abnormally Dry	D3 Extreme Drought
D1 Moderate Drought	D4 Exceptional Drought
D2 Severe Drought	

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

#### Author:

Brad Rippey  
U.S. Department of Agriculture



<http://droughtmonitor.unl.edu/>

Figure 4. California faces another year of drought, which requires careful management of groundwater supplies. Image provided by <http://droughtmonitor.unl.edu>.



For more information, contact In-Situ Inc.  
221 East Lincoln Avenue, Fort Collins, CO 80524  
1-800-446-7488 (toll-free in U.S. & Canada)  
1-970-498-1500 (international & domestic)  
[www.in-situ.com](http://www.in-situ.com)

Rev 0.0, August 2014

In-Situ, the In-Situ logo, Baro Merge, BaroTROLL, HERMIT, iSitu, Pocket-Situ, RDO, RuggedCable, RuggedReader, smarTROLL, TROLL, and Win-Situ are trademarks or registered trademarks of In-Situ Inc. © 2014. All rights reserved.