SAN GORGONIO PASS WATER AGENCY
1210 Beaumont Avenue, Beaumont, CA
Board of Directors Engineering Workshop
Agenda
October 13, 2014 at 1:30 p.m.

1. **Call to Order, Flag Salute and Roll Call**

2. **Public Comment**
   Members of the public may address the Board at this time concerning items relating to any matter within the Agency's jurisdiction. To comment on specific agenda items, please complete a speaker's request form and hand it to the board secretary.

3. **Discussion of USGS Proposed Work Plan* (Page 2)**

4. **Announcements**
   A. Regular Board Meeting, October 20, 2014 at 1:30 p.m.
   B. San Gorgonio Pass Regional Water Alliance – Technical Committee Meeting, October 22, 2014 at 4:30 p.m. - Banning City Hall Conference Room
   C. San Gorgonio Pass Regional Water Alliance – Committee Meeting, October 22, 2014 at 6:00 p.m. - Banning City Council Chambers
   D. Finance and Budget Workshop, **Tuesday,** October 28, at 1:30 p.m.

5. **Adjournment**

*Information included in Agenda Packet

(1) Materials related to an item on this Agenda submitted to the Board of Directors after distribution of the agenda packet are available for Public inspection in the Agency's office at 1210 Beaumont Avenue, Beaumont during normal business hours. (2) Pursuant to Government Code section 54957.5, non-exempt public records that relate to open session agenda items and are distributed to a majority of the Board less than seventy-two (72) hours prior to the meeting will be available for public inspection at the Agency's office, located at 1210 Beaumont Avenue, Beaumont, California 92223, during regular business hours. When practical, these public records will also be made available on the Agency's Internet Web site, accessible at http://www.sgpwa.com." (3) Any person with a disability who requires accommodation in order to participate in this meeting should telephone the Agency (951 845-2577) at least 48 hours prior to the meeting in order to make a request for a disability-related modification or accommodation.

United States Department of the Interior

U. S. GEOLOGICAL SURVEY
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IN REPLY REFER TO:

Sept 2014

DRAFT

Mr. Jeff Davis
General Manager and Chief Engineer
San Gorgonio Pass Water Agency
1210 Beaumont Avenue
Beaumont, California 92223

Dear Mr. Davis:

This letter confirms discussions between our respective staffs, concerning the cooperative program between the San Gorgonio Pass Water Agency (SGPWA) and the U.S. Geological Survey (USGS) during the period October 1, 2014 to October 31, 2015. The work proposed under the enclosed Joint Funding Agreement (JFA) is a continuation of the cooperative basin-wide monitoring network and study to identify, characterize and evaluate potential artificial-recharge sites for conjunctive use in the San Gorgonio Pass area. The program consists of four main tasks: (1) basin-wide monitoring, (2) Burnt Canyon flow analysis, and (3) Evaluation of Management Scenarios using the USGS model documented in "Geology, Ground-Water Hydrology, Geochemistry, and Ground-Water Simulation of the Beaumont and Banning Storage Units, San Gorgonio Pass Area, Riverside County, California," By Rewis and others, 2006. A detailed description of progress on tasks in FFY14 and plans and costs for tasks in FFY15 is included as an attachment to this letter.

The total cost of the proposed cooperative water-resources program in FFY14 is $183,750. Of this total, SGPWA will contribute $141,550 and, subject to the availability of Federal Matching Funds (FMF), the USGS will contribute $42,200. The proposed program for this period and associated costs are presented in Table 1.

Table 1. FFY15 Budget

Program element	USGS	SGPWA	Total
Task 1: Basin-Wide Monitoring			
A. Water-Level Monitoring	$12,375	$37,125	$49,500
B. Water-Quality Monitoring	$9,200	$37,050	$46,250
C. Recharge Monitoring	$6,250	$23,250	$29,500
subtotal	**$27,825**	**$97,425**	**$125,250**
Task 2: Burnt Canyon Flow Analysis	$6,375	$19,125	$25,500
Task 3: Evaluation of Management Scenarios using USGS model Documented in Geology, Ground-Water Hydrology, Geochemistry, and Ground-Water Simulation of the Beaumont and Banning Storage Units, San Gorgonio Pass Area, Riverside County, California, By Rewis and others, 2006	$8,000	$25,000	$33,000
Total	**$42,200**	**$141,550**	**$183,550**

Enclosed are four copies of Joint Funding Agreement (JFA)for your approval. Work performed with funds from this agreement will be conducted on a fixed-price basis. If the JFA is acceptable, please return three copies with original signatures to our office for further processing. The fourth copy of the JFA is for your files. After signature by the USGS, a fully executed original of the JFA will be forwarded to SGPWA for your records.

If you have any questions concerning the program described above, please contact Allen Christensen at (619) 225-6175 or Matthew Landon at (619) 225-6109, in or San Diego Office. If you have any administrative questions, please contact Irene Rios at (619) 225-6156.

Sincerely,

Eric Reichard
Director
USGS California Water Science Center

San Gorgonio Pass Water Agency Cooperative Program: Progress, Plans, and Costs

Task 1A – Groundwater-Level Monitoring

Progress

A basin-wide groundwater-level monitoring network was established in the San Gorgonio Pass area in Federal Fiscal Year 1997 (FFY97) to evaluate existing hydrologic conditions and to monitor the effects of pumping and artificial recharge on the groundwater system. A key component of the network is collecting data from the multiple-well monitoring sites, which provide information on water-level changes and vertical gradients in the different aquifers.

In FFY14, U.S. Geological Survey (USGS) personnel accompanied San Gorgonio Pass Water Agency (SGPWA) personnel in the spring and fall to measure water levels in 110 wells. Data collected as part of the water-level network are available through the USGS National Water Information System (NWIS) online database (table 2).

Water-Level Change

Water-level changes measured in the monitoring wells between fall 2012 and fall 2013 and spring 2013 and spring 2014 are shown on figures 1 and 2, respectively. Of the 76 wells with water-level change between fall 2012 and 2013, 8 wells recorded a water-level rise greater than 5 ft, 55 wells recorded little or no change (rise or decline less than 5 ft), and 13 wells recorded a water-level decline greater than 5 ft (fig. 1). Of the 79 wells with water-level change between spring 2013 and 2014, 6 wells recorded a water-level rise greater than 5 ft, 51 wells recorded little or no change (rise or decline less than 5 ft), and 22 wells recorded a water-level decline greater than 5 ft (fig. 2).

Multiple-Well Monitoring Sites

A total of 15 transducers recorded continuous water-level data at multiple-well monitoring sites 1, 3, 6, 8, 9, and 10 during FFY14 (fig. 1). These data were used to help determine vertical gradients in the aquifer system and document long-term water-level changes in the SGPWA service area. Sites 1 and 3 are discussed in the recharge monitoring task.

Site 6—Site 6 (002S001W35J001-4) is in the northeastern part of the Beaumont storage unit, and includes four 2-inch piezometers installed in the same borehole: 35J1 perforated between 860-900 ft bls; 35J2 perforated between 750-770 ft bls; 35J3 perforated between 610-630 ft bls; and 35J4 perforated between 240-260 ft bls (dry). Prior to late 2008 the water levels measured in the different piezometers at Site 6 (fig. 3) were similar; however, after late 2008 the depth to water in the piezometers increases with the depth of the perforated interval. This change is likely a response to pumping from the nearby BCVWD production well 25. BCVWD well 25 (shown on figure 1 in black) is about 0.7 mile southwest of Site 6 and started regular groundwater production for municipal supply in October 2008. Water levels at the site have declined between 40 and 45 ft during the period February 2002 and June 2013. The rate of decline was greater than 5 ft per year (ft/yr) prior to 2010. Since late 2010, all 3 wells have shown recovery of about 10 ft between the seasonal highs measured during spring of 2010-2014. All wells at the site have continued to show overall year-to-year recovery since 2010, with the greatest recovery occurring between late 2012 and early 2014. The water levels at the site continued to recover about 1 ft between seasonal highs in 2013 and 2114. The recent recovery at this site may have resulted from changes in pumping patterns in the area, natural recharge from recent wet years, artificial recharge at the SGPWA and BCVWD recharge facilities, or a combination of these factors.

Site 8—Site 8 (003S002E07P001-4) is in the central part of the Cabazon storage unit, and includes four 2-inch piezometers installed in the same borehole: 7P1 perforated between 980-1,000 ft bls; 7P2 perforated between 790-810 ft bls; 7P3 perforated between 640-660 ft bls; and 7P4 perforated between 550-570 ft bls. The hydrographs for site 8 show variations in water levels with depth at the site (fig. 3). In general, the water-level altitude increases with depth at the site with an upward groundwater gradient between the lower and upper aquifer system. The deepest well (7P1) has the highest water level altitude, more than 25 ft higher than water-level altitude in the shallower wells. This large difference in water-level altitudes indicates that well 7P1 is perforated in a different aquifer than the other wells. Wells 7P2 and 7P3 also show greater daily variation than wells 7P1 and 7P4. This variation likely is a response to pumping by the nearby supply well used by the Cabazon County Water District, shown as a black dot (fig. 1) 0.3 miles east of Site 8. The water-level decline measured at the site between May 2007 and June 2014 was 22, 21, 21, and 20 ft at wells 7P1, 7P2, 7P3, 7P4, respectively. The rates of decline were calculated on physical measures at each well, the transducer in well 7P2 failed in early 2014 and was replaced in June 2014. Since mid-2012, all wells show a general 1.5 ft/yr decline during the period mid-2012 to mid-2014.

Site 9—Site 9 (003S002E15P001-3) is in the eastern part of the Cabazon storage unit, and includes three 2-inch piezometers: 15P1 perforated between 373-383 ft bls; 15P2 perforated between 330-350 ft bls; and 15P3 perforated between 240-260 ft bls. Prior to early 2011, water-level altitude in well 15P1 is slightly higher than the water-level altitude in well 15P2, indicating an upward groundwater gradient conditions at the site. (fig. 4). The water-level decline measured at the site between May 2007 and April 2011 was 9.3 ft (about 2.4 ft/yr) at well 15P1and 8.5 ft (about 2.2 ft/yr) at 15P2. In April-May, 2011 both wells show rapid increases in water-level altitude at the site. The transducer in well 15P1 recorded a 4.6 ft rise in water table between late-April and late-August, 2011. The transducer in well 15P2 recorded a 10.3 ft rise in water table between mid-May and mid-August, 2011. It is important to note that this water-level rise event occurred in the deeper well (15P1) first then approximately 1 month later started in the shallower well (15P2). This event also reverses the vertical gradients at the site. This recharge event was likely the result of recent natural recharge in the area. Since this event in 2011, both wells show nearly parallel water-level decline and continue to show a downward gradient between the two wells. Prior to May, 2011 manual water-level measurements collected from the shallow well (15P3) were dry. However, manual measures in well 15P3 also captured this water-level rise event with a measured water level at 220.8 ft below land surface or about 115 ft above the water levels measured in wells 15P1 and 15P2. Well 15P3 has been dry since November 2011.The USGS installed a transducer in well 15P3 in June, 2014 to be prepared to measure rises in response to future recharge events so that the response at the shallow, possibly perched, depth can be contrasted with responses of the deeper parts of the aquifer system. The overall decline at well 15P1 is approximately 3.9 ft and the overall rate of decline is 1.4 ft per year since 2007. The overall decline at well 15P2 is 9.6 ft and the overall rate of decline is 3.5 ft per year since 2007.

Site 10—Site 10 (003S001E11F001-4) is in the western part of the Cabazon storage unit, and includes four 2-inch piezometers installed in the same borehole: 11F1 perforated between 1060 and 1040 ft bls; 11F2 perforated between 860 and 840 ft bls; 11F3 perforated between 660 and 680 ft bls; and 11F4 perforated between 600 and 580 ft bls. The water-level decline measured at the site between August 2009 and November 2011 was 8.8, 8.7, 8.9, and 9.25 ft at wells 11F1, 11F2, 11F3, and 11F4, respectively (fig. 4). Since November 2011 water-level altitudes at the site have increased. The water-level rise measured at the site between November 2011 and June 2013 was 5.5, 5.3, 5.1, and 5.2 ft at wells 11F1, 11F2, 11F3, and 11F4, respectively (fig. 4). Wells 11F3 and 11F4 have nearly identical depth to water and water-level change indicating these wells are in the same aquifer. Since mid-2013, when water levels at the site reached recent highs, water levels have declined between 5 and 6 ft at the site. Continuous data were not collected at this site during the period November 2013 to April 2014, due to maintenance and repair of the all transducers at the site.

Plans

During FFY15, SGPWA personnel will collect water-level data from groundwater-level monitoring-network wells (fig. 2) on a semi-annual basis. The USGS will continue to canvass new wells, and verify well information for wells in the network. Water-level data will be collected at one-hour intervals at all sites equipped with pressure transducers (table 2); these sites will be downloaded on a quarterly basis by the USGS. The USGS will continue to enter water-level and well-site data collected by SGPWA and USGS personnel into the USGS database with appropriate quality-control checks, including accompanying SGPWA personnel during both spring and fall measurement periods. Water-level data are available through the USGS NWIS online database. As part of the calibration process completed in FFY14, it was noted that many of the transducers are near or have exceeded expected serviceable lifetime of the transducers. The factory expected serviceable lifetime of the transducers used at the continuous monitoring sites is between 7-10 years. The USGS will continue to monitor each transducer and recommend replacement as needed. Currently the SGPWA has 15 transducers deployed and the replacement cost is approximately $1,100. The SGPWA should expect one or two transducer failures per year for the next 5-10 years until all transducers are replaced. The proposed number of wells in the FFY15 water-level network was reduced from 110 wells to 103 wells in FFY15 for reasons noted in table 2.

Total FFY 2015 cost for water-level monitoring $ 49,500

Task 1B – Water-Quality Monitoring

Progress

In FFY14, 8 water-quality network wells were sampled. The samples were analyzed for major ions, nutrients, selected trace elements, stable isotopes of oxygen and hydrogen. Complete results for all samples collected as part of the water-quality monitoring network are available through the USGS NWIS online database. NWIS links to individual wells are provided in table 3. Note, wells denoted with "X*" on table 3, column 2014 are scheduled to be sampled in early October 2014 as part of FFY14 funding carried over from the previous cooperative agreement. These wells were not available for sampling during the summer of 2014.

Plans

The current water-quality monitoring network includes 38 wells (fig. 5 and table 3). About one third of the wells are sampled on a triennial basis. Water-quality samples will be collected and analyzed from 13 wells in FFY15. The samples will be analyzed for major ions, nutrients, selected trace elements, stable isotopes of oxygen and hydrogen. All data collected will be entered into the USGS database with appropriate quality control, and are available upon request.

Total FFY 2015 cost for water-quality monitoring $ 46,250

Task 1C – Recharge Monitoring

Progress

The SGPWA has been artificially recharging the groundwater basin using imported water from the California State Water Project (SWP) via recharge ponds along the Little San Gorgonio Creek in Cherry Valley since November 2002; however, full-scale recharge operations started in June 2003. To evaluate the effect of the artificial recharge on water levels and water quality in the underlying aquifer, data were collected from nine wells and suction-cup lysimeters at five locations including the SWP pipeline at the southern pond of the San Gorgonio Pass Recharge Facility (fig. 6 and table 4). The total deliveries of SWP water to the San Gorgonio Creek recharge ponds between November 2002 and June 2014 was 10,633 acre-ft (fig. 7).

San Gorgonio Pass Water Agency Cooperative Program: Progress, Plans, and Costs

Water-Level Data

Water-level data have been collected on a continuous basis using pressure transducers at wells 002S001W22P006 (Site 3), 002S001W27L001 (Site 1), and 002S001W35J001 (Site 6) (fig. 6). Water-level data collected from well 22P006, located above the perching layer beneath (240 ft blsd) the San Gorgonio Recharge facility show water-level rises and declines corresponding to changes in deliveries of SWP to the recharge facility (fig 8). Since 1999, the highest water-level altitude of 2727 ft above sea level (asl) or about 185 ft below land surface datum (lsd) was measured in December 2008. Since full-scale recharge operations began in 2003, the average daily water delivery to the facility is 2.7 acre-ft per day. Figure 9 shows water-level changes above the perching layer and the cumulative departure from average deliveries to the recharge facility. During the period 2003 to 2008 the delivery rate of 2.6 acre-ft per day was not maintained and the cumulative departure from average delivery declined. Since 2008, the delivery rate increased with the greatest daily delivery rate increase occurring in mid-2008 and mid-2010. Since 2013, the rate of recharge has decreased due to limited availability of SWP because of ongoing drought conditions in California. This change in delivery rate also cause a corresponding decline in the water table of approximately 30 ft from December 2012 to June 2014, 15 ft of the noted decline occurred during the period January 2014 to June 2014. This rate of water-level decline is consistent with other periods of steep decline in early 2009 and mid-2011 indicating that the perched aquifer system continues to drain rapidly in response to reduced application of recharge water. As previously mention in past program letters, the generally flat long-term change in the water table beneath the recharge facility indicates that the maximum recharge rate has not yet been reached. Water-level altitude measured above the perched layer are near low levels measured in 2008 and just after recharge began in early 2004.

Water-Level Changes in the Regional Aquifer

Well 22P3 is adjacent to the recharge pond in Area 3 and perforated in the regional aquifer. From 1999, when the well was first installed, until late 2006 the water level at well 22P3 was declining at a rate of about 4.3 ft/yr (fig. 10). From late 2006 until May 2009, the water level rose about 35 ft (about 13.1 ft/yr) (fig. 10). Water-level data has not been collected at 22P3 (Site 3) since 2009 due to access problems. This water-level rise is likely the result of artificial recharge.

Water-level data collected at well 27L1 (Site 1) indicate about 77 ft of water-level decline between December 1989 and September 2008 (about 8.5 ft/yr). However, from September 2008 through early 2014, the water level at 27L1 has increased about 48 ft (about 8 ft/yr). In early 2014 the water-level measured at well 27L reached 15 year high of 2261 ft above sea-level. Water-level data collected at well 35J1, east of the recharge facilities, also shows a water-level rise of about 13 ft since late 2009. The increase in water level at these sites probably is the result of artificial recharge of SWP water at the SGPWA and BCVWD recharge facilities or reduced groundwater withdrawal in the area

(Fig. 10). As of June 2014, the SGPWA recharge facility has received 10,633 acre-ft and BCVWD recharge facility has received 54,692 acre-ft of SWP water since 2002, for a total of about 65,325 acre-ft

Water-Quality Data

During FFY14, a total of 12 water-quality samples were collected from Site 3 and SWP water delivered to the recharge ponds (four samples were collected at the 235-ft lysimeter, four samples from the 31-ft lysimeter, and four samples from the SWP discharge to the ponds). Since FFY99, the USGS has collected a total of 189 water-quality samples at the recharge ponds. A total of 38 samples were collected from the SWP discharge into the recharge ponds and 151 samples were collected from the saturated and unsaturated zones beneath the recharge ponds. Sample volume permitting, samples were analyzed for major ions, nutrients, selected trace elements, and the stable isotopes of oxygen ($\delta^{18}O$) and hydrogen (δD). Data collected as part of the recharge monitoring network are available through the USGS NWIS online database, links to individual wells are provided in table 4.

Nitrate (nitrate plus nitrite) concentrations for all samples collected from suction-cup lysimeters and wells beneath the recharge ponds ranged from less than the laboratory reporting level of 0.04 to 9.0 milligram per liter (mg/L) as N (fig. 11). The U.S. Environmental MCL for nitrate reported as N is 10 mg/L. Nitrate concentrations in samples from the 32-ft lysimeter (002S001W22P011) were 9.0 mg/L as N in 2004 and 0.8 mg/L as N in 2014, reflecting the recharge of SWP water that contains low nitrate concentrations (0.2 to 1.0 mg/L as N). Similarly, nitrate concentrations in samples collected from the perched aquifer at the 235-ft lysimeter (002S001W22P007) were 4.6 mg/L as N in 2004 and 0.6 mg/L as N in 2014. Since late 2007, the nitrate concentration has not exceeded 1.5 mg/L as N for samples collected from the perched aquifer. Concentrations below 1 mg/L are similar to concentrations found in the SWP recharge water. Nitrate concentrations in samples from the regional aquifer beneath the recharge ponds (well 002S001W22P003) varied between 4-6 mg/L in samples collected in 2000-2006, prior to the arrival of the applied artificial-recharge water at the water table. Samples have not been collected at the well 002S001W22P003 since 2005, due to a damaged pump at the site.

The stable isotopes of oxygen ($\delta^{18}O$) and hydrogen (δD) for samples collected from the SWP discharge at the recharge ponds and the suction-cup lysimeters or wells beneath the ponds are shown on figure 12 in relation to the meteoric water line. Samples were separated into four groups based on isotopic differences: (1) SWP water, (2) perched-aquifer samples from 1999 to 2005, (3) perched-aquifer samples from 2005 to 2014, and (4) samples from the regional aquifer. In general, the isotopic composition of the SWP water is lighter (more negative) and lies beneath the meteoric water line compared to local groundwater. Samples collected from the perched aquifer from 1999 to 2005 and the regional aquifer represent local groundwater and plot above the meteoric water line (fig. 12). Since 2005, some samples collected from the perched aquifer plot below the meteoric water line and above the SWP water indicating that these samples contain a mix of SWP and local groundwater; other perched aquifer samples have isotopic values consistent with recharge of SWP water. Isotopic results from samples from the perched aquifer collected since 2008 show a distinct departure from samples collected from 2005 to 2007. Samples collected from 2008 to 2012 are isotopically lighter than the 2005 to 2007 samples indicating a higher percentage of SWP water in the samples. These results are confirmed by the low nitrate concentrations measured in samples collected from the lysimeters installed above the perching layer (fig. 11).

Plans

During FFY15, zones 1 and 2 of the recharge monitoring network (fig. 6) will be active for data collection. Data will be collected on a continuous basis from the pressure transducers installed in the tensiometer at 238 ft bls (22P006) at Site 3 to monitor the perched aquifer and in well 27L001 and at Site 1 to measure the regional water table (table 4). These data will be downloaded quarterly. Water-quality samples will be collected on a semi-annual basis from the SWP water discharging to the recharge ponds and from the suction-cup lysimeters; annually from wells in zone 1 and zone 2 (table 3). BCVWD well (27P001) located south of the Noble Creek recharge facility will be sampled annually to monitor arrival of the applied artificial-recharge water. Sample volume permitting, all of the samples will be analyzed for major ions, nutrients, selected trace elements, and the stable isotopes of oxygen and hydrogen.

Total FFY 2015 cost for recharge monitoring - $ 29,500

Total FFY 2015 cost for task 1 - $ 121,250

Task 2: Burnt Canyon Flow Analysis

Progress

In FFY07, the USGS completed a series of investigations to determine flow characteristics within the Burnt Canyon steam section between Raywood Flat and the lower Burnt Canyon weir (Figure 13). Based on data collected between August 2007 and November 2007 cumulative losses along the Burnt Canyon reach to the lower weir were approximately 11.3 million cubic feet or 80 acre feet. In FFY13, the USGS reconstructed and re-installed the temporary weir at the lower collection pond to compare flow between the turnout at upper Burnt Canyon and the collection pond at lower Burnt Canyon. The USGS also installed a new transducer at the lower weir site and factory-recalibrated the transducer used at the upper weir to collect stage at 15 minute intervals. In FY14, the USGS completed 5 detailed flow measurements; (1) in the flume south of the east fork diversion; (2) in the flume before the weir at the turnout into upper Burnt Canyon; (3) in the stream above the collection pond at lower Burnt Canyon. These flow measurements were used to calibrate and rate weirs installed at the turn out of upper Burnt Canyon and lower Burnt Canyon and to determine losses or gains between upper and lower Burnt Canyon. Data collected at the upper Burnt Canyon weir and the lower Burnt Canyon weir have been reviewed and uploaded to the USGS on-line data base. Discharge data derived from stage measurements are shown on figure 14a and 14b. The complete flow record is shown on both figures (fig14a and 14b), the scale of the discharge was reduced in figure 14b to show flow detail at lower rates. Two storm flow were measured by the transducers in November of 2013 and in March of 2014 with estimated peak flows of 8 and 14 cubic feet per second (cfs). The maximum rated (calibrated) flow at Upper and Lower Burnt Canyon weirs is 6.09 cfs. Flows in excess of 6.09 cfs will over top the weir, flows greater than 6.09 cfs were estimated from pressure head measured from the transducer and stream geometry at the site and should be considered poor. Comparing flows between the Upper Burnt and Lower Burnt Canyon shows continual losses between the upper and lower weirs, except for a few periods of storms as noted above. Generally, the loss is approximately 0.25-0.5 cfs. During the summer of 2014, flows from the upper weir were less than 0.5 cfs. At that rate and during summer conditions, no flow was measured at the lower weir. Total flow measured at the upper weir during the period April 2013 and July 2014 was 662 acre feet (acre-ft). Total measured flow at the lower weir was 450 acre-ft over the same period. Since the lower weir has a data gap between March 2014 and April 2014 (for repair and recalibration of the transducer after the storms of March 2014), flows during that period from upper weir were not included in the estimate of total loss. To estimate total loss, the total flow from the upper weir (662 acre-ft) minus flow during the data gap (0.96 acre-ft)) was subtracted from the total flow from the lower weir. Estimated total loss is approximately 211 acre-ft during the period April 2013 to July 2014. Based on analysis of flows, losses are generally constant between October to January, then tend to increase during spring and summer months (April to September). This is expected as evapotranspiration rate increase in spring and summer in the canyon reach between the upper and lower weirs.

Plans

During FFY15, the USGS is proposing to continue to maintain the sites. In addition, the USGS will complete quarterly (access permitting) detailed flow measurements to insure accurate flow ratings. Site maintenance includes; quarterly data downloads (access permitting), site inspection, and complete leveling surveys between reference marks annually. Since the lower weir is subject to periodic removal during high flow events, the USGS will complete detailed flow measurements and leveling surveys after the lower weir is periodically replaced to insure accurate flow measurements are maintained. Data collected will be added to the USGS database with appropriate quality-control checks. Data collected as a result of this study will be used to determine daily and seasonal losses or gains along the Burnt Canyon reach.

Total FFY 2015 cost for task 2 - $ 25,500

Task 3: Evaluation of Management Scenarios using USGS model Documented in *Geology, Ground-Water Hydrology, Geochemistry, and Ground-Water Simulation of the Beaumont and Banning Storage Units, San Gorgonio Pass Area, Riverside County, California,* By Rewis and others, 2006

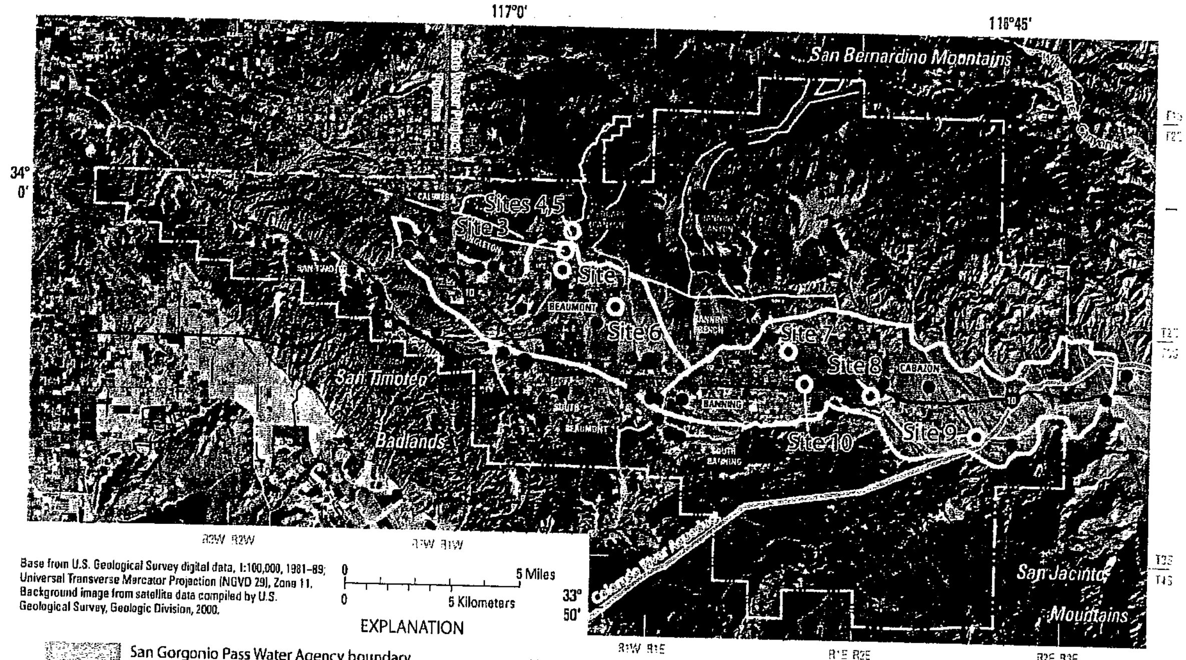
The calibrated groundwater-flow model developed and documented by Rewis and others 2006 will be modified to simulate future management alternatives to water-supply issues in the Banning and Cabazon areas using predictive simulations. The management alternatives will be established in close consultations between the staffs of SGPWA and USGS. These management alternatives may include, but not limited to, (1) assuming no SWP water was available for artificial recharge and pumping remained constant equal to 2008 groundwater pumpage (20,000 acre-ft/year) (2) assuming no SWP water was available for artificial recharge and increased pumping with predicted growth in population or municipal demand, (3) changing the quantity and distribution of artificial recharge and pumpage based on land availability and changes in pumping locations. The results of the modified model simulations will be presented as change in water-level maps. These maps can be generated as a time-series animation or for specific time intervals as needed to help the SGPWA staff with management decisions with regard to varying location and volume of proposed recharge scenarios.

Total FFY 2015 cost for task 3 - $ 33,000

References

U.S. Environmental Protection Agency, 2009, Drinking water contaminants, accessed November, 2009, at *http://www.epa.gov/safewater/contaminants/index.html*.

Rewis, D.L., Christensen, A.H., Matti, J., Hevesi, J.A., Nishikawa, T., and Martin, P., 2006, Geology, groundwater hydrology, geochemistry, and groundwater simulation of the Beaumont and Banning storage units, San Gorgonio Pass Area, Riverside County, California: U. S. Geological Survey Scientific Investigations Report 2006–5026,191 p.



EXPLANATION

- San Gorgonio Pass Water Agency boundary
- San Gorgonio Pass ground-water basin
- BEAUMONT — Name of storage unit in ground-water flow model
- Storage unit boundary—Outside ground-water flow model
- Name of storage unit outside ground-water flow model
- Canyon storage unit boundary
- Name of canyon storage unit

Water level change between fall 2012 and fall 2013

- ● Network well with water level rise greater than 5 feet
- ● Network well with water level change less than 5 feet
- ● Network well with water level drop greater than 5 feet
- ● FFY13 Network well, data not available for comparison

Figure 1. Map showing the water-level network and water-level change between fall 2012 and fall 2013 at selected wells.

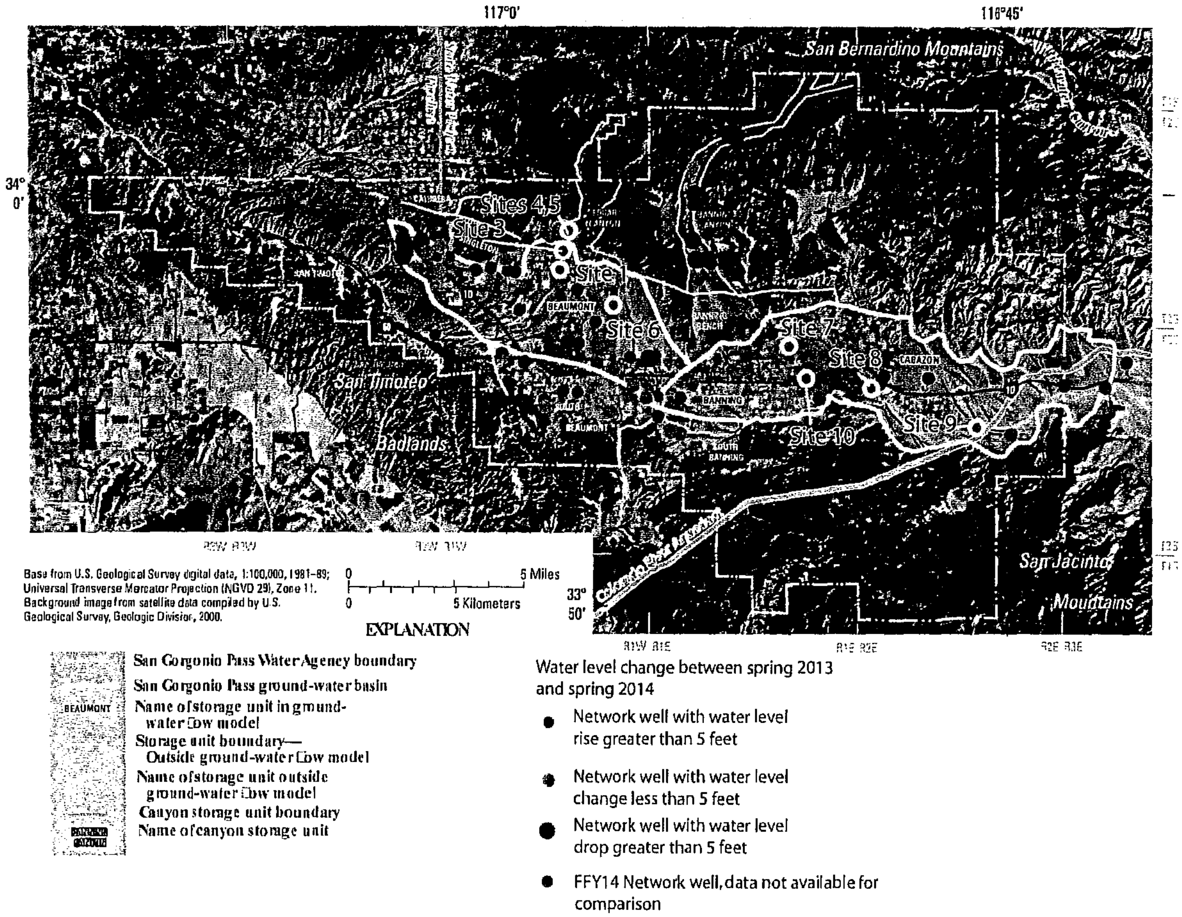
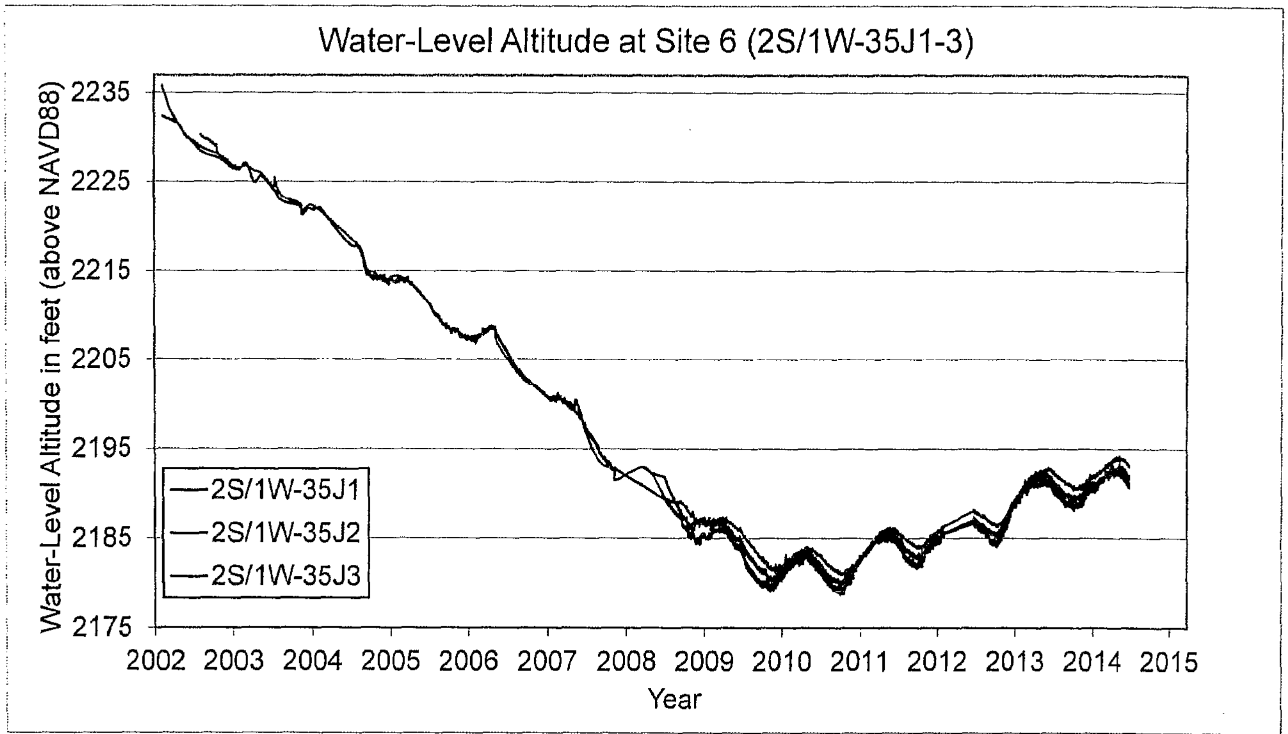


Figure 2. Map showing the water-level network and water-level change between spring 2013 and spring 2014 at selected wells.



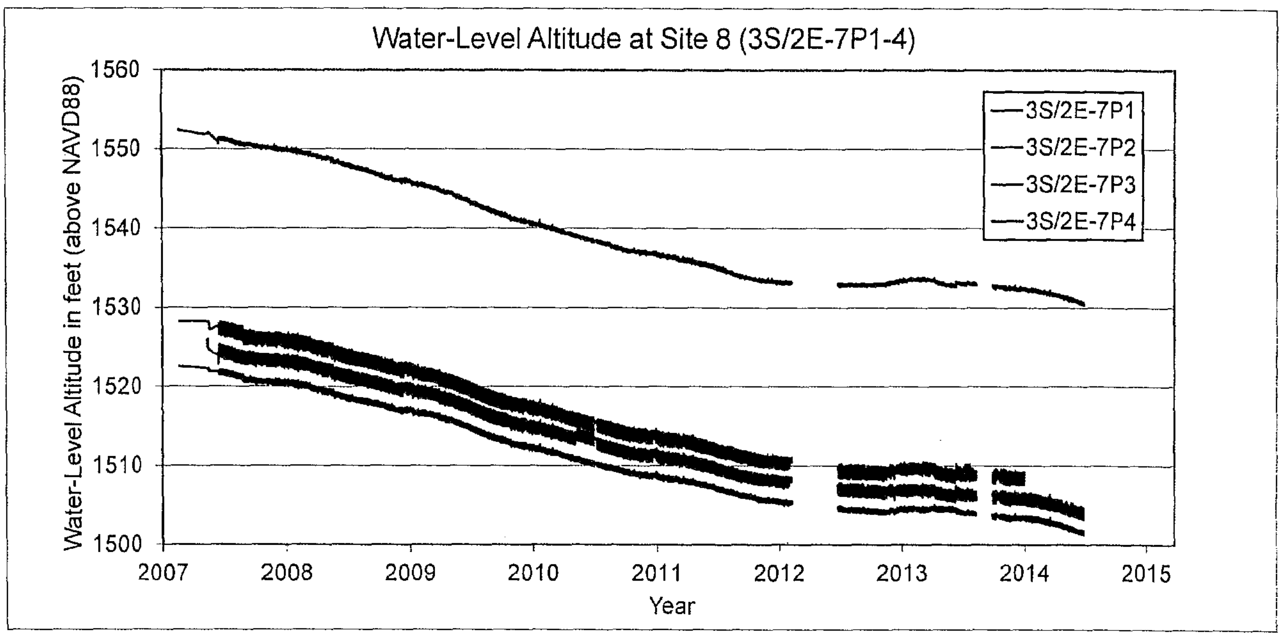


Figure 3. Graph showing water-level hydrographs for wells at sites 6 and 8.