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DRAFT MEMORANDUM

To: Geoff Poole, General Manager Borrego Water District
From: Trey Driscoll, PG, CHG, Daniel Ritter, PG, PhD, Steven Stuart, PE, Trevor Jones, PhD
Subject: Information Necessary to Update the USGS Borrego Valley Hydrologic Model
Date: April 16, 2021
cc: James Bennett, County of San Diego, Samantha Adams and Andy Malone, West Yost

This memorandum has been prepared to address use of the Borrego Valley Hydrologic Model (BVHM) as a tool for updating the sustainable yield estimate for the Borrego Springs Groundwater Subbasin (Basin). This memorandum briefly describes the model background, discusses the steps necessary to extend the model to run through water year 2022-2023, and presents information on technical challenges that were encountered during the previous model update that occurred in 2019 which could impact future model updates.

1 Model Background

The BVHM was developed as part of a cooperative study between the U.S. Geological Survey (USGS) and the Borrego Water District (BWD). The study began in 2009, with the objectives of 1) improving the understanding groundwater conditions and land subsidence, 2) incorporating this improved understanding into a model that would assist in the management of groundwater resources in the Borrego Valley Groundwater Basin (BVGB), and 3) using this model to test several management scenarios (Faunt et al., 2015). The BVHM simulates the use, movement, and storage of water throughout the BVGB through time. The BVHM is a finite-difference groundwater model that was developed using the MODFLOW numerical code MODFLOW-OWHM. It was anticipated the model developed as part of the study would be used to help the BWD quantify the relative benefits of various groundwater management options that would need to be undertaken in the Basin in order to comply with the Sustainable Groundwater Management Act (SGMA). Currently, there is no major Graphic User Interface (GUI) that supports the creation of the Farm Process Package that is central to MODFLOW-OWHM.

1.1 Simulation Period

The BVHM was originally designed to simulate conditions in the BVGB during the period from October 1, 1929 through December 31, 2010. The BVHM uses 975 monthly stress periods to simulate groundwater inflows and outflows from the Basin. Faunt et al. (2015) noted that, “the first 192 stress periods (years 1930-45) are considered a model spin-up period, and the model calibration as well as the target simulation period used for analysis was October 1945 through December 2010.” The 16-year “spin-up” was used in the model to “eliminate significant effects caused by uncertainty in the initial conditions” defined in the model (Faunt et al. 2015). Because there was groundwater development and irrigation before the simulation period, the initial conditions defined in the model for the year 1945 may not have represented steady-state conditions.

The BVHM was updated in 2019 to support development of the Groundwater Sustainability Plan (GSP) for the Basin. The update included extending the model simulation to run through water year 2016. In addition, groundwater elevations collected between 2010 and 2016 were added to the model, and the relationship between simulated and observed heads during the model update period was used to validate the original model results (Dudek 2018).

1.2 Model Domain

The boundaries of the active model domain of the BVHM were defined by the Coyote Creek fault on the northeast and east of the alluvial valley, the Vallecito Mountains to the south, and the San Ysidro Mountains to the west and northwest. The southeastern boundary of the model was defined at a surface-water divide southwest of Ocotillo Wells. This boundary marks an area of the alluvial valley where subsurface flow leaves the Basin.

The model domain is defined by a finite-difference grid of uniform cells, or nodes, with each cell being 2,000-feet by 2,000-feet, or approximately 92 acres in area. The model domain includes 30 rows and 75 columns with 2,250 cells, 803 of which are active. The total area simulated in the model is 73,876 acres. The model was divided vertically into three layers. The top layer (Layer 1) represents the upper unconfined aquifer unit consisting of Quaternary alluvium. The thickness of the top layer ranges from 50 feet to 643 feet. The middle aquifer unit (Layer 2) is Pleistocene age continental deposits with a thickness ranging from 50 feet to 908 feet. The lower aquifer unit (Layer 3) includes the lower Palm Spring and Imperial Formations with a thickness ranging from 50 feet to 3,831 feet.

1.3 Boundary Conditions

The boundaries of the model domain were mostly defined as no-flow boundaries coinciding with the Coyote Creek fault and the foothills of the San Ysidro and Vallecitos mountains. Specified fluxes were defined at 44 cells representing underflow originating from the upstream watersheds draining to Borrego Valley, twenty-four (24) stream flow entry points were defined at nodes representing the locations where stream flow entered the valley via Coyote Creek, San Felipe Creek, Borrego Palm Creek, and other drainages, and three constant-head boundary nodes simulating the outflow of groundwater at the southern end of the BVHM. The natural recharge of underflow and surface water runoff from the adjoining watersheds was estimated from data obtained from the regional-scale USGS Basin Characterization Model (BCM).

1.3.1 Basin Characterization Model

The BCM was developed by the USGS in 2004 and provides a "deterministic water-balance approach to estimate recharge and runoff in a basin" on a regional scale. The BCM "uses the distribution of precipitation, snow accumulation and melt, [potential evapotranspiration] PET, soil-water storage, and bedrock permeability to estimate a monthly water balance for the groundwater system" (Faunt et al. 2015). The result is an estimate of water recharging a basin (of which some may leave the basin as underflow to an adjacent basin) and potential runoff. Potential underflow and runoff to Borrego Valley was estimated from the BCM using the watersheds surrounding Borrego Valley. Water entering BVGB via underflow was represented by 44 cells along the mountain boundaries in the valley each defined with a constant specified flux based on estimates from the BCM. Water entering BVGB via surface water runoff was represented by 24 cells defined as entry points to the stream segments defined in the stream-flow routing (SFR) package.

Runoff and underflow entering the BVGB, as estimated by the BCM, were "simulated for the watersheds draining into the Borrego Valley on a monthly basis for years 1940-2007 as spatially distributed among the watersheds draining into Borrego Basin" (Faunt et al. 2015). The average annual underflow entering the BVGB was approximately 10% of the estimated recharge to the adjacent watersheds, or approximately 900 acre-feet per year. Typically, there was little to no stream flow to the BVGB from 1940 to 2007. Only after major wet seasons or large individual rainfall events did runoff to BVGB exceed 10,000 acre-feet per year or more. This only occurred during 7 years in the 1940 to 2007 period. Runoff to the BVGB ranged from less than 10 acre-feet per year to 44,000 acre-feet per year with an average annual rate of 3,600 acre-feet per year. The BVHM includes perennial flow entering Coyote Creek at 0.014 cubic feet per second (cfs) and an unnamed tributary at 0.002 cfs from a minor watershed to the southwest of the BVGB.

1.4 Farm Process

MODFLOW-OWHM is a fully coupled integrated hydrologic numerical modeling code capable of simulating all interactions of surface water and groundwater in the hydrosphere. Integrated within MODFLOW-OWHM is the Farm Process Package, or FMP, which simulates the movement of water over a landscape. Water may originate from natural (e.g., rainfall) and/or anthropogenic sources (e.g., applied irrigation) and move via surface water runoff, evapotranspiration, and infiltration into the unsaturated zone. A landscape is characterized by a land-use type (e.g., farm, golf course, etc.) with certain characteristics defined, like rooting depth, soil moisture characteristics, and application inefficiencies defined for irrigation and precipitation. The FMP simulates the water budget over a landscape defined at each cell, or node, in the model domain. Water inputs may include rainfall, applied irrigation, and stream flow. Water outputs may include evapotranspiration, surface water runoff, and, when coupled with MODFLOW, infiltration in the unsaturated zone and groundwater pumping from the saturated zone.

Faunt et al. (2015) defined fifty-two (52) water-balance subregions (WBS), or "farms," in the BVHM. These 52 farms were defined based on a parcel map showing land ownership from 2010. The area covered by each of these WBS remained constant throughout the entire model simulation period. Each farm was assigned one or more land-use types, of which there were 15 classifications that included golf course, urban, fallow, native, and certain crop types like grapes, citrus, and palm. Faunt et al. (2015) redefined land-use types on a near annual basis, with some land uses changing due to urbanization, zoning, and/or farming restrictions through the simulation period. For example, Faunt et al. (2015) noted that "before development, about 10 percent of land use consisted of phreatophytes, and 90 percent was other types of native vegetation and bare ground. In 2009, 78 percent was natural vegetation (6 percent phreatophytes and 72 percent other native types), 11 percent residential/municipal, 8 percent developed agricultural land, and about 3 percent recreational uses (golf courses)."

Land-use type was assigned on a cell-by-cell basis. The coarse grid of the BVHM, with cells of uniform dimensions of 2,000-feet by 2,000-feet (or 92 acres), however, meant that the land-use type that comprised the largest fraction of a cell was assigned to that cell. For example, the farm representing Rams Hill Golf Course included 10 cells comprising a total of 920 acres, but only two of those cells (total of 184 acres) were assigned a golf course land-use type after 2009. The other 8 cells were assigned a "native classes" land-use type designation.

Pumping data for agricultural uses was not available to the USGS when designing the BVHM. The FMP estimates agricultural pumping by calculating estimated water demands for the various crop types receiving applied irrigation. The FMP calculates the water demand for a specific crop using potential evapotranspiration (PET) provided by the BCM and crop coefficients assigned to each crop type simulated in the BVHM. The FMP then calculates a crop irrigation requirement (CIR), or residual water demand, after accounting for water supplied via precipitation and root uptake via groundwater. The CIR was increased to compensate for evaporative losses and estimated inefficiencies of delivering water for irrigation supply. The result is a total farm delivery requirement (TFDR) that is satisfied in the BVHM via estimated pumping in the FMP.

2 Data Needed to Extend Model Simulation

In order to extend the BVHM to simulate the period through water year 2022-2023, at a minimum additional data and inputs would need to be added to the packages described in the following sections. Other packages would need to have their simulation periods extended but would not necessarily require additional data to extend the model. Depending on results of model simulations once the model has been extended, and how technical issues with model code (described in Section 3 below) are addressed, additional model calibration may be necessary to use the model to accurately estimate the sustainable yield of the Basin.

2.1 Farm Process Package

2.1.1 Land Use Types

As noted above, the FMP in the BVHM relies on land use assignments to calculate conjunctive water use for each of the WBS in the model. Land use was previously updated for nearly every year simulated in the model. Land use would need to be updated for any changes observed within the BVGB during the period of the model update.

2.1.2 Precipitation and Evapotranspiration

The FMP uses monthly precipitation and evapotranspiration data to calculate a water balance on a cell-by-cell basis. Monthly precipitation and evapotranspiration data for the BVHM were extracted as arrays from the BCM. Each cell in the model has a specified precipitation and evapotranspiration value. Currently, the BCM only has precipitation and evapotranspiration values through water year 2016. If the BCM has not been updated by the time the model is updated and extended, monthly precipitation and evapotranspiration amounts for each model cell will have to be updated using a different source.

2.2 Stream Flow

Runoff to the 24 stream flow entry points were taken from historical stream gage and precipitation data. As described in section 3 below, an attempt was made to repeat the methodology the USGS used in defining runoff to the 24 stream flow entry points using BCM data, but the process utilized by the USGS was not well defined in the model documentation and could not be replicated during the previous model update. Streamflow at these 24 entry points would need to be estimated to extend the model simulation further. As with precipitation and evapotranspiration, if the BCM is not extended by the time of the model update, streamflow will need to be estimated using a different method than the one applied in the original construction of the model.

2.3 Pumping

While agricultural pumping, including pumping for recreation and golf courses, is estimated by the FMP in the BVHM, municipal pumping is specified in the model for each monthly stress period. Municipal pumping data for the period the model is extended would need to be added to the model.

2.4 Septic System Return Flows

The number of septic tank systems were periodically defined in the model and used for subsequent monthly stress periods until the next count. Based on land use changes, the number of septic systems may need to be updated if significant development occurs in the BVGB during the period of the model update.

3 Technical Issues Encountered During Previous Model Update

3.1 Model Version Issues

During the model update in 2019, Dudek identified an inconsistency in the simulated hydraulic heads and water balance between different versions of the OWHM code. Dudek obtained 3 versions of MODFLOW-OWHM in the process of updating the Borrego Valley numerical model and extending it to run future scenarios: Version 1.0, Version 1.0.12, and Version 1.1. Dudek used the USGS code ZONEBUDGET to extract the water budget components from the model output to compile basin water budgets by water year in Excel. The model was originally designed and calibrated using MODFLOW-OWHM version 1.0. However, there was an unresolved bug in the version 1.0 code which caused ZONEBUDGET to incorrectly extract pumping values from the model output files. As a result, Dudek contacted USGS to which they suggested Dudek run the model using code version 1.0.12. The same model input files were run using version 1.0.12 and the correct pumping values were extracted from the model output files using ZONEBUDGET.

When compared to the water balance results from model version 1.0, the water balance results were different in version 1.0.12. Small differences in the change in storage for each stress period were observed between versions 1.0.12 and version 1.0, which led to a cumulative change in storage in version 1.0.12 that was approximately 50,000 acre-feet less than the cumulative change in storage calculated by version 1.0. Hydraulic heads simulated during the calibration period from 1945 through 2010 were also different between versions 1.0.12 and 1.0 and, as a result, the model would essentially require recalibration to accurately simulate observed conditions when run in version 1.0.12. Dudek contacted USGS to share this observation and to determine the possible causes of this discrepancy between the two model versions, but Dudek never received an answer as to why there are differences in the two versions. Consequently, Dudek elected to use version 1.0 for the model update and simulating future scenarios to maintain consistency of model results so that different scenarios can be compared. It should be noted that MODFLOW-OWHM now has a model version 2.0, which has changed the format of most of the input files required to run the model. As a result, using the most up-to-date version of the MODFLOW-OHWM code would require re-formatting many of the input files in addition to adding updated inputs and updating model calibration.

An additional bug in version 1.0 was discovered when reduced future pumping scenarios were run in the model. The intended way to reduce groundwater pumping in future scenarios in MODFLOW-OWHM is to create an input file that assigns groundwater allotments to farm wells to limit the amount of water they are allowed to pump in a stress period. However, a bug was causing certain wells to ignore the allotments, so the pumping output for the model was higher than designed in the future scenarios. The USGS was contacted, and the bug was fixed in model version 1.1, but remains in model version 1.0. However, version 1.1 contains the same issue with the water balance as version 1.0.12 described above. Dudek eventually moved forward with workarounds to reduce pumping in future scenarios in version 1.0 to maintain consistency with the original model and the model update. The final workaround required setting the maximum pumping capacity of wells included in the farm package to the total amount of pumping desired in each of the future water years. This bug should not be an issue if a model version higher than version 1.1 is used in the model update.

3.2 Streamflow and Underflow Calculations

In the process of updating the Borrego Valley Hydrologic Model, Dudek attempted to replicate the calculation of streamflow into the Basin from 1945 to 2010 that was implemented by the USGS during the original model design. In the model documentation, the USGS stated that they used runoff and recharge outputs from the BCM to calculate streamflow for each of the 24 sub-watersheds that drain into the model domain. Dudek contacted the USGS and was provided with a GIS shapefile containing the boundaries of the sub-watersheds. However, the USGS stated that they could not provide a detailed description of how streamflow was calculated and referred to the model documentation as containing all necessary information. Dudek obtained the BCM output files that were used to calculate streamflow and attempted to recreate the streamflow simulated in the USGS model from 1945 to 2010 using the sub-watershed boundaries to extract recharge and runoff output from the BCM.

Dudek experienced two major issues when attempting to replicate the calculations of stream flow to the Basin. The first issue was that the raw runoff and recharge data from the BCM had to be multiplied by a factor to get the streamflow from each sub-basin defined in the input file, and it was unclear from the model documentation exactly what factors were used to calculate this data. The second issue was that there were instances where the BCM had runoff while the model input did not, and vice versa. This suggested that there may be some time delay component, or some other factor included in the USGS calculation of streamflow for the input file, and there was no clear documentation of what this might be. There was also a constant inflow from two watersheds in the model (Coyote Creek and a smaller unnamed watershed) which could not be recreated with BCM outputs. The USGS later stated that they would be willing to share their process files for generating streamflow, but multiple contacts to the USGS to obtain the necessary files never resulted in the files being sent over. Eventually, historical streamflow and precipitation relationships were used to estimate streamflow inputs needed to extend the model through water year 2016. Precipitation data recorded at climatic stations from 2011 to 2016 in the BVGB were compared to historical (i.e., pre-2011) monthly precipitation data recorded at the same climatic stations to find months with similar precipitation. These months were then used to pull stream gage data from stream gages on Coyote Creek, Palm Canyon Creek, and San Filipe Creek during historical periods when these stream gages were active. These monthly values were added to the appropriate stress periods for the extended model simulation.

Underflow inputs to the model are calculated in a similar manner to streamflow using BCM outputs. Since underflow from adjacent watersheds is constant in the BVHM, Dudek did not attempt to validate or recreate these calculations.

4 References

Dudek 2019. DRAFT FINAL Update to United States Geological Survey Borrego Valley Hydrologic Model for the Borrego Valley Sustainability Agency. Prepared for County of San Diego Planning and Development Services. July 2019.

Faunt, C.C., Stamos, C.L., Flint, L.E., Wright, M.T., Burgess, M.K., Sneed, Michelle, Brandt, Justin, Martin, Peter, and Coes, A.L., 2015. Hydrogeology, hydrologic effects of development, and simulation of groundwater flow in the Borrego Valley, San Diego County, California: U.S. Geological Survey Scientific Investigations Report 2015-5150, 135 p.

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DRAFT MEMORANDUM

To: Geoff Poole, Borrego Water District
From: Trey Driscoll, PG No. 8511, CHG No. 936, Devin Pritchard-Peterson
Subject: Borrego Springs Subbasin Groundwater Level Monitoring Data
Date: April 16, 2021
cc: Jim Bennett, County of San Diego, Samantha Adams and Andy Malone, West Yost

The existing groundwater monitoring network in the Borrego Springs Groundwater Subbasin (Basin) includes 23 dedicated monitoring wells and 27 extraction wells. Of the 50 wells in the network, 46 are monitored for groundwater levels, 30 are monitoring for water quality, and 19 are monitored for production. Dudek understands that the California Department of Water Resources (DWR) has reportedly been monitoring groundwater levels in an additional approximately 20 private wells in the Subbasin since about 2010. At this time, however, the groundwater level data collected by DWR have not been made available for use in evaluating Basin conditions, such as the groundwater contouring and change in storage analyses completed for the 2019 and 2020 Borrego Springs Groundwater Basin Annual Reports (Annual Reports). The purpose of this memorandum is to recommend that private well owners provide release of the data collected by DWR for use in evaluating historical and current Basin conditions, and the private well owners permit continued access and monitoring of their wells for use in evaluating Basin conditions moving forward.

1 Recommendations

The DWR has measured groundwater levels in approximately 20 privately owned wells in the Basin since about 2010. Many of the wells are reportedly located in areas of the Basin where data gaps in the existing groundwater level monitoring network exist. Inclusion of the additional groundwater level data would fill several data gaps that currently exist and provide for an improved understanding of historical and current conditions in the Basin. It is recommended that upon acquisition of the groundwater level data from DWR, calculations of change in groundwater in storage for the period from 2016 to 2020 (for which change in storage calculations have been computed in the Annual Reports) be recalculated using the additional data to refine the estimates. In addition, it is recommended that the private landowners whose wells have previously been monitored by DWR be contacted to obtain approval for continued groundwater level monitoring moving forward. The access agreement would authorize an identified entity (e.g., Watermaster) to measure groundwater levels at each private well on a semi-annual basis, or other defined interval. Incorporation of the additional approximately 20 private wells into the existing groundwater level monitoring network would likely significantly improve understanding of both historical and current Subbasin conditions, and allow for more accurate tracking of groundwater conditions over time.

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DRAFT MEMORANDUM

To:	Geoff Poole, Borrego Water District
From:	Trey Driscoll, PG No. 8511, CHG No. 936, Devin Pritchard-Peterson
Subject:	Borrego Springs Subbasin Annual Report Spring 2019 Groundwater Elevation Erratum
Date:	April 16, 2021
cc:	Jim Bennett, County of San Diego, Samantha Adams and Andy Malone, West Yost

During review of the Borrego Springs Subbasin (Basin) 2020 Annual Report (Annual Report) Mr. Jim Bennett, Water Resources Manager at County of San Diego, identified several inconsistencies in reported groundwater elevations for wells measured in spring 2019 between the 2019 and 2020 Annual Reports. Dudek subsequently performed a thorough review of the spring 2019 groundwater elevation data contained in both Annual Reports and confirmed that there were indeed inconsistencies in reported groundwater elevations for several wells. The purpose of this memorandum is to describe the errors and to provide the correct spring 2019 groundwater elevations, based on the best available data.

1 Errata

The errors identified pertain to inconsistencies in reported groundwater elevations for wells in the monitoring network for spring 2019. Dudek completed a review of the spring 2019 groundwater elevation data and determined that the inconsistencies in the reported spring 2019 groundwater elevations are due to the use of different well reference point elevations to calculate groundwater elevations. Different entities have reported different well land surface elevations and measurement point heights over time, which has resulted in slightly different groundwater elevations. Dudek has determined that the errors do not affect the change in groundwater in storage calculations but may slightly alter the spring 2019 groundwater elevation contours presented in the Annual Reports.

To rectify the errors, Dudek used the best available data to recalculate the spring 2019 groundwater elevations as provided in Table 1. Well reference point elevations used to calculate the revised groundwater elevations relied on high-precision Global Positioning System (GPS) survey data collected by the United States Geological Survey (USGS), where available, and the most recent measurements of well measurement point (i.e., stick up) height.

Table 1. Spring 2019 Well Data

State Well Number	Well Name	Land Surface Elevation (feet msl)[a]	Reference Point Elevation (feet msl)[b]	Depth to Water (feet btoc)	Groundwater Elevation (feet msl)
011S006E10N001S	Abandoned Motel-1	528.52	529.41	134.37	395.04
010S006E35N001S	Airport 2	516.91	517.49	111.21	406.28
011S006E22E001S	Anzio/Yaqui Pass	662[c]	663.63	265.93	397.7
011S006E34A001S	Army Well	923.85	924.5	426.52	497.98

Table 1. Spring 2019 Well Data

State Well Number	Well Name	Land Surface Elevation (feet msl)[a]	Reference Point Elevation (feet msl)[b]	Depth to Water (feet btoc)	Groundwater Elevation (feet msl)
011S006E22A001S	Bakko	531.15	531.25	74.92	456.33
011S007E20P001S	Bing Crosby Well	570.47	570.68	76.09	494.59
011S006E04F001S	Cameron 2	536.9	537.26	133.59	403.67
011S006E15G001S	County Yard (SD DOT)	509.03	509.93	106.88	403.05
010S006E14G001S	Hanna (Flowers)	618.71	622.38	177.04	445.34
011S007E32Q001S	Hayden (32Q1)	694.9	696.73	196.66	500.07
009S006E31E003S	Horse Camp	929	931.1	290.26	640.84
011S006E25A001S	ID1-1 (RH-1)	526.32	526.9	58.29	468.61
010S006E32R001S	ID4-1	572.8	572.8	179.96	392.84
011S006E18L001S	ID4-10	829.64	830.74	433.5	397.24
011S006E07Q003S	ID4-2	710.06	712.19	313.62	398.57
010S006E18R001S	ID4-3	665.66	667.16	287.12	380.04
011S006E24Q001S	JC Well	503[c]	504.33	67.25	437.08
011S006E23E001S	La Casa	539.82	542.22	88.81	453.41
010S006E21A002S	MW-1	636.73	636.33	258.19	378.14
011S006E23J002S	MW-3	522.65	523.36	79.31	444.05
010S006E35Q001S	MW-4	517.75	517.33	105.46	411.87
011S007E07R002S	MW-5B (West-Upper)	466.45	466.12	55.72	410.4
011S006E22B001S	Paddock	536.47	537.1	82.96	454.14
010S006E33J001S	Palleson	545.36	546.55	133.96	412.59
011S006E24Q002S	RH-4	523[c]	525.42	101.59	423.83
010S006E29A001S	White Well	603[c]	603.9	217.28	386.62
011S006E23H001S	WWTP-1	496[c]	497.62	25.54	472.08

Source: msl =mean sea level; btoc = below top of casing point.
[a] Land surface elevation from USGS well survey data collected in NAVD88, unless otherwise noted.
[b] Reference point elevation is sum of land surface elevation and most recent measurement of well measurement point height.
[c] Land surface elevation from Google Earth.

2 Recommendations

To ensure that groundwater elevations are calculated consistently moving forward, Dudek recommends that the land surface elevation and reference point elevation of each well in the monitoring network is verified and/or remeasured during the next groundwater monitoring event. In particular, Dudek recommends completing a geodetic survey using high-precision global positioning (GPS) equipment for wells that have not been previously surveyed (i.e., wells using land surface elevation from Google Earth as listed in Table 1).

The geodetic survey should be completed using the World Geodetic System 1984 for the datum, latitude/longitude for the coordinate system, Earth Gravitational Model 96 for the geoid model, and mean sea level for the altitude reference or similar appropriate datum. The differential correction should be completed using the Borrego Springs California Continuously Operating Reference Station located near the Borrego Airport as the reference position base provider. Collection of this updated land surface elevation data will assist with preparing more accurate groundwater level contour maps. In addition, the USGS previously installed survey markers at many of the wells in the Subbasin. The distance between the surveyed land surface elevation marker and the reference point elevation—or "stick up"— should be verified during the next semi-annual monitoring event as there is potential for this distance to change when modifications are completed to the well-head.