

APPENDIX E

Monitoring Protocols and Metering Plan

- E1:** Borrego Sampling and Analysis Plan and Quality Assurance Plan
- E2:** Borrego Metering Plan

APPENDIX E1

Borrego Sampling and Analysis Plan and Quality Assurance Plan

The Sampling and Analysis Plan and Quality Assurance Plan has been modified and superseded by Section 4.3 of the Settlement Agreement and Section VI.B. of the Judgment, whereby the interim Watermaster will continue the County-initiated program of water quality monitoring in the Basin that was conducted through March 2019 as part of GSP development on an interim basis until the Court approves the permanent Watermaster and the Watermaster adopts its own Plan.

**SAMPLING AND ANALYSIS PLAN AND QUALITY
ASSURANCE PROJECT PLAN
Borrego Springs Subbasin**

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ACRONYMS AND ABBREVIATIONS

COPC	constituent of potential concern
DMS	data management system
DQO	data quality objective
DWR	California Department of Water Resources
EPA	United States Environmental Protection Agency
GSP	Groundwater Sustainability Plan
HDPE	high-density polyethylene
LCS	laboratory control sample
LIMS	laboratory information management system
mL	milliliter
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
QAPP	Quality Assurance Project Plan
QA	quality assurance
QC	quality control
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
Subbasin	Borrego Springs Subbasin

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1 INTRODUCTION

The Borrego Springs Subbasin (Subbasin) of the Borrego Valley Groundwater Basin has been identified by the California Department of Water Resources (DWR) as subject to critical conditions of overdraft (DWR 2016a). As such, in accordance with California's Sustainable Groundwater Management Act, a Groundwater Sustainability Agency has been formed to develop and implement a basin-specific Groundwater Sustainability Plan (GSP). The general purpose of the GSP is to facilitate a long-term groundwater withdrawal rate less than or equal to the sustainable yield of the Subbasin within the 20-year implementation period mandated by the Sustainable Groundwater Management Act.

The objective of this Sampling and Analysis Plan (SAP) is to establish consistent field data collection and laboratory analytical procedures, including protocols for measuring groundwater levels and protocols for sampling groundwater quality. The SAP incorporates pertinent protocols presented in DWR's Best Management Practices for the Sustainable Groundwater Management of Groundwater Monitoring Protocols, Standards, and Sites (DWR 2016b).

1.1 Project Overview and Applicability of the SAP/QAPP

The GSP is currently being developed for the Subbasin. An interim Monitoring Plan was prepared in support of the GSP that outlines the types of monitoring necessary to address the six DWR-designated sustainability indicators in the Subbasin (Dudek 2017). This SAP serves to supplement the Monitoring Plan by establishing consistent monitoring procedures associated with the two primary sustainability indicators for the Subbasin: (1) chronic lowering of groundwater levels and (2) degraded water quality. The Monitoring Plan identifies these two sustainability indicators as the primary drivers of the anticipated undesirable effects from overdraft in the Subbasin. Although the data collected to address the above-referenced sustainability indicators will also be used to evaluate reduction in groundwater storage, other DWR-designated sustainability indicators (i.e., seawater intrusion, depletion of interconnected surface water, and land subsidence) are not considered significant in the Subbasin at this time (Dudek 2017). Therefore, this SAP does not provide protocols for monitoring seawater intrusion, measuring streamflow, or measuring subsidence.

Included within this SAP is a Quality Assurance Project Plan (QAPP). The QAPP provides a framework for implementing procedures for field sampling, chain-of-custody, sample transportation, laboratory analysis, and reporting that will yield defensible data of known quality. Together, the SAP and QAPP are designed to facilitate data collection such that data are of acceptable quality to meet project requirements.

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2 SAMPLING AND ANALYSIS PLAN

The following section describes the sampling methodology, analytical parameters, and sample handling procedures to be followed for routine groundwater monitoring activities in the Subbasin. Specific sampling locations and pertinent well specifications are identified in the Monitoring Plan (Dudek 2017).

2.1 Health and Safety

A project-specific Health and Safety Plan will be prepared and implemented to address potential hazards that may be encountered in the field. Safety meetings will be held at the commencement of the project and each day before work begins to discuss safe work practices during field activities.

2.2 Sampling Objectives

The objectives of monitoring activities are to collect accurate and defensible groundwater elevation data, and to collect representative groundwater samples to evaluate concentrations of constituents of potential concern (COPCs) in groundwater. The purpose of monitoring activities is to track groundwater conditions in the Subbasin throughout implementation of the GSP to evaluate progress toward achieving measurable objectives and sustainable management of the Subbasin, as defined in the Monitoring Plan (Dudek 2017).

2.3 Constituents of Potential Concern

Groundwater samples collected from the site will be analyzed for the site-specific COPCs defined in the Monitoring Plan, including the following:

Routine Constituents

- Arsenic
- Fluoride
- Nitrate
- Sulfate
- Radionuclides (gross alpha particle activity)
- Total dissolved solids

Baseline Constituents

- Anions (bicarbonate, carbonate, chloride, fluoride, hydroxide, nitrate, sulfate, total alkalinity)

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- Cations (calcium, magnesium, potassium, sodium, and total hardness)

Additional detail regarding COPCs is presented in Section 3.5, Analytical Methods, of this SAP.

2.4 Groundwater Monitoring Frequency

Groundwater elevation measurements and water quality sampling will be performed on a semi-annual schedule. The initial water quality sampling event will include sampling and analysis for cations and anions to establish baseline chemistry; analysis for cations and anions in subsequent sampling events is not currently planned.

2.5 Groundwater Monitoring Methods

Groundwater monitoring procedures described herein were compiled in consideration of the DWR's best management practices (DWR 2016b), the County of San Diego's Site Assessment and Mitigation Manual (County of San Diego 2012), and professional judgment. See Appendix A for an example groundwater elevation monitoring field form.

2.5.1 Groundwater Elevation Monitoring

Groundwater elevation monitoring will be conducted using the following procedures:

- Groundwater elevation data should approximate conditions at a discrete period in time; therefore, groundwater levels will be collected within as short a time interval as possible, preferably within a 1- to 2-week period.
- The sampler will have the previous depth to water measurements available in the field.
- The water level indicator will be decontaminated after each well.
- An electronic water level that employs a battery-powered probe assembly attached to a cable marked in 0.01-foot increments will be used. When the probe makes contact with the water surface, an electrical impulse is transmitted in the cable to activate an audible alarm. The equipment will be equipped with a sensitivity adjustment switch that enables the operator to distinguish between actual and false readings caused by the presence of conductive, immiscible components on top of groundwater. The manufacturer's operating manual should be consulted for instructions on use of the sensitivity adjustment.
- The well cap or cap covering the access port will be unlocked and removed.
- The sampler will listen for pressure release while removing the lid. If a release is observed, the measurement will wait to allow the water level to equilibrate. Additionally, multiple measurements will be collected to ensure that the well has reached equilibrium such that no significant changes in water level are observed.

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- All parts of the water level indicator that may come into contact with liquids in the well will be thoroughly rinsed or sprayed with deionized water immediately prior to lowering the probe into the well.
- The probe will be lowered through the access port or well casing to the anticipated depth of water.
- When the water level probe signals contact with water, the depth will be read on the tape from a datum point permanently marked on the well casing. Continue until two consecutive readings are within 0.01 foot of each other. The depth will be recorded on the Water Level Measurement Log.
- Measurements will be taken at an established reference point, generally at the top of the casing at the surveyor's mark. The mark should be permanent (e.g., a notch or mark at the top of casing). If the surveyor's point is not marked at the time of the water level, the north side of the casing will be used and marked.
- If water is not encountered in the well, the depth to water will be recorded as "dry" on the Water Level Measurement Log.
- If the water level in the well has dropped below the top of the dedicated pump, the probe will not be lowered past the pump. If feasible, remove the dedicated pump. Once the pump has been removed, allow the water level to equilibrate and measure the water level according to the method described above.
- Rewind the probe, replace the well cap, and relock the well.
- The sampler will calculate the groundwater elevation by subtracting the depth to water from the reference point elevation. The sampler must ensure that all measurements are consistent units of feet, tenths of feet, and hundredths of feet. Measurements at reference point elevations should not be recorded in feet and inches.
- The sampler will record the well identifier, date, time (24-hour format), reference point elevation, height of reference point above the ground surface (stick-up), depth to water, groundwater elevation, and comments regarding any factors that may affect the depth to water readings such as weather, recent well pumping or nearby irrigation cascading water, or well condition. If there is a questionable measurement or the measurement cannot be obtained, it will be noted.
- All relevant data will be entered into the Groundwater Sustainability Agency's data management system (DMS) as soon as possible. Care will be taken to avoid data entry mistakes, and the entries will be checked by a second person for compliance with data quality objectives (DQOs).

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Pressure Transducers

Groundwater levels and/or calculated groundwater elevations may be recorded using pressure transducers equipped with data loggers installed in monitoring wells. When installing pressure transducers, care must be exercised to ensure that the data recorded by the transducers is confirmed with hand measurements.

The following general protocols will be followed when installing a pressure transducer in a monitoring well:

- The sampler will use an electronic sounder and follow the protocols listed above to measure the groundwater level and calculate the groundwater elevation in each well to properly program and reference the installation. It is recommended that samplers use transducers to record measured groundwater levels to conserve data capacity; groundwater elevations can be calculated at a later time after downloading.
- The sampler will note the well identifier, the associated transducer serial number, transducer range, transducer accuracy, and cable serial number.
- Transducers must be able to record groundwater levels with an accuracy of at least 0.1 foot. The installer of the transducer will consider battery life, data storage capacity, range of groundwater level fluctuations, and natural pressure drift of the transducers at the time of installation.
- The sampler will note whether the pressure transducer uses a vented or non-vented cable for barometric pressure compensation; appropriate corrections for natural barometric pressure changes will be implemented.
- Manufacturer specifications will be followed for installation, calibration, data logging intervals, battery life, correction procedure (if non-vented cables used), and anticipated life expectancy to assure that DQOs are being met for the GSP.
- The cable will be secured to the well head with a well dock or another reliable method. The cable will be marked at the elevation of the reference point with tape or an indelible marker to allow for estimate of potential future cable slippage.
- The transducer data will be regularly checked against hand-measured groundwater levels to monitor electronic drift or cable movement. This will happen during routine site visits, at least semi-annually, or as necessary to maintain data integrity.
- Data will be downloaded as necessary to ensure no data is lost and will be entered into the Groundwater Sustainability Agency's DMS following the established quality assurance/quality control (QA/QC) program. Data collected with non-vented data logger cables will be corrected for atmospheric barometric pressure changes, as appropriate. After

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the sampler is confident that the data have been safely downloaded and stored, the data will be deleted from the data logger to ensure that adequate data logger memory remains.

2.5.2 Groundwater Quality Monitoring

Groundwater quality monitoring and sampling will be conducted using the following procedures. See Appendix B for an example groundwater quality monitoring field form.

- Prior to sampling, the sampler must contact the selected California-certified environmental laboratory to schedule laboratory time, obtain appropriate sample containers, and clarify any sample holding times or sample preservation requirements.
- Each well used for groundwater quality monitoring must have a unique identifier. This identifier must appear on the well housing or the well casing to avoid confusion.
- Groundwater elevation will be measured in the well following appropriate protocols, as described above.
- General well specifications for the wells to be sampled should be available in the field, most notably the screened interval and total well depth.
- Sample containers will be labeled prior to sample collection. The sample label must include sample ID, sample date and time, sample personnel, sample location, preservative used, and analyses and analytical method.
- Samples will be collected under laminar flow conditions. Laminar flow occurs when fluid flows in parallel layers, with limited lateral disruption or mixing of the layers. This may require reducing pumping rates prior to sample collection to minimize turbulent flow of groundwater entering the well screen.
- All field instruments will be calibrated daily and evaluated for drift throughout the day. Calibration will be documented in field logs.
- All samples requiring preservation must be preserved as soon as practically possible, ideally at the time of sample collection. Samples will be appropriately filtered, as recommended for the specific analyte. Samples to be analyzed for metals (i.e., arsenic) will be field-filtered prior to preservation; unfiltered samples will not be collected in a preserved container.
- If pumping during sampling or purging causes a well to go dry, the condition will be documented and the well will be allowed to recovery to within 90% of the original level measured prior to pumping. Professional judgement should be used about to whether the sample will meet the DQOs, and will be adjusted as necessary.

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- The following will occur for groundwater wells equipped with a functioning dedicated pump:
 1. Samples will be collected at or near the wellhead. Samples will not be collected from storage tanks, at the end of long pipe runs, or after any water treatment.
 2. After cleaning the sampling port, a new, clean length of flexible clear plastic tubing will be connected to the sample access port. The tubing will be inserted into the sample bottle. The sample access port will be opened slowly. It will be verified that the liquid stream is not flowing greater than 100 milliliters (mL) per minute.
 3. The sample bottle will be filled so that no air space remains. The bottle will be capped and then wiped clean after capping. The completed label will then be adhered to the sample bottle.
 4. Field measurements for depth to water, pH, specific conductance, temperature, turbidity, dissolved oxygen, oxygen-reduction potential, and color will be collected and documented after the samples are collected.
- The following will occur for groundwater wells requiring sample collection using a temporary pump:
 1. The pump will be lowered slowly down the well, positioning the well intake at the middle of the well screen or at the predetermined selected sampling depth.
 2. Disturbance of the water column in the well will be minimized by initiating pumping at a low rate (see below). Dedicated tubing (left in place between sampling events) is recommended to minimize disturbance to the water column before and during sampling.
 3. Pumping will begin at a steady rate of 100 mL per minute and the depth to water will be measured frequently (e.g., every 1 minute for the first few minutes) to ensure that less than 0.1 feet of drawdown occurs. The pumping rate may be increased if drawdown is less than 0.1 feet, but the pumping rate will not exceed 500 mL per minute.
 4. Field parameters and depth to water will be recorded on field data sheets a minimum of every 5 minutes while purging. Purging will continue until pH, temperature, specific conductance, oxidation reduction potential, dissolved oxygen, and turbidity stabilize (three consecutive readings), which is defined as follows:
 - a. ± 0.2 units for pH
 - b. $\pm 3\%$ – 5% for specific conductance
 - c. ± 20 millivolts (mV) for oxidation reduction potential
 - d. $\pm 10\%$ for temperature
 - e. $\pm 10\%$ for turbidity

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- f. ± 0.2 milligrams per liter for dissolved oxygen
 5. Dissolved oxygen and turbidity tend to stabilize last and are better measures of sufficient purging. Drawdown will be minimized during purging and/or sampling, not exceeding 0.1 feet, if possible.
 6. In the case that the above criteria for stabilization are not met before three well volumes have been pumped, then a maximum of five well volumes will be pumped before samples are taken. Also, if stabilization has not occurred after 2 hours of purging regardless of well volume status, samples will be collected at this point. In the spirit of water conservation, this method will be avoided if possible.
 7. For protocol regarding variances, consult the Site Assessment and Mitigation Manual (County of San Diego 2012).
- If pumping during sampling or purging causes a well to go dry, the condition will be documented and the well will be allowed to recovery to within 90% of the original level measured prior to pumping. Professional judgement will be used as to whether the sample will meet the DQOs and adjusted as necessary.
 - After sample collection, the sealed sample bottle will be placed in a “zip-lock” style bag and placed inside an ice chest filled with ice to maintain a sample temperature of 4°C to prevent degradation of the sample. At the completion of sampling, the completed chain-of-custody will be placed in the ice chest, which will be sealed and labeled. The samples will be transported from the site to the laboratory by courier service or other means. The samples will be delivered to the laboratory within 24 hours after the sample has been collected.

2.6 Sample Handling

The following section details methods that are to be used for sample labeling, identification, containerizing, preservation, transportation, and maintaining proper chain-of-custody. Samples will be handled in accordance with San Diego County’s Site Assessment and Mitigation Manual (County of San Diego 2012) and the United States Geological Survey’s National Field Manual for the Collection Water Quality Data sampling protocols (USGS 2014).

2.6.1 Sample Handling and Identification

Each groundwater sample collected for analysis will be designated with a unique identification (ID) number. The sample identification number will include information to identify the sample location, date, and field QC classification, if applicable.

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The following identifying factors will be used:

- Local well ID (e.g., ID4-18)
- Date (i.e., year, month, day)
- Field QC classification, if applicable (e.g., “D” for field duplicate)

For example:

- Sample identification number “ID4-18-20170704” would represent a groundwater sample collected from well ID4-18 on July 4, 2017.

2.6.2 Sample Containers and Transportation

Groundwater samples will be collected in the following containers:

- Arsenic by United States Environmental Protection Agency (EPA) Method 6010B: 250 mL high-density polyethylene (HDPE) bottle preserved with hydrochloric acid
- Cations and anions: 1 liter unpreserved HDPE
- Fluoride by SM 4500-F C: 250 mL unpreserved HDPE
- Nitrate by EPA 300.0: 250 mL unpreserved HDPE
- Radionuclides (gross alpha particle activity) by EPA 900.0: 1 liter unpreserved HDPE
- Sulfate by EPA 300.0: 250 mL unpreserved HDPE
- Total dissolved solids by SM 2540 C: 1 liter unpreserved HDPE

Analyte-specific laboratory holding times as described in Section 3.5.3 will be reviewed to plan for samples to be received by the laboratory within the appropriate timeframe.

2.6.3 Chain-of-Custody Procedures

A chain-of-custody form will be used to record possession of the samples from the time of collection to the time of arrival at the laboratory. The individual who collects the samples will prepare them for shipment, complete the chain-of-custody form, and sign the form when transferring the samples to the laboratory courier. The samples will be released to the laboratory by the courier signature on the chain-of-custody form and signed as received by laboratory receiving personnel. The laboratory receiving personnel will verify that all samples listed on the chain-of-custody form are present, sample integrity, and that proper sample preservation procedures were used.

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2.6.4 Equipment Decontamination

Prior to sampling, re-usable sampling equipment (e.g., submersible pumps) will be decontaminated using an Alconox wash, a potable water rinse, then a distilled water final rinse (i.e., the three-bucket wash method).

2.6.5 Investigative-Derived Waste

Evidence of hazardous concentrations of COPCs has not been identified in Subbasin wells. If purge water is generated from a groundwater well it will be discharged to the ground away from the wellhead. Additionally, investigative-derived wastes (e.g., sampling gloves, disposable sampling devices, tubing) will be disposed of off site as municipal solid waste.

2.6.6 Field Documentation

Field logbooks will be maintained during confirmation sampling field activities. The field logbooks will serve to document observations, personnel on site, equipment activity, field procedures, and other vital information. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. The following information for each sampling area will be documented on field forms:

- Field crew names
- Date of sampling
- Wells names
- Names and times of samples collected
- Chain-of-custody number
- General observations

2.6.7 Photographs

Photographs will be taken at sample locations and other relevant areas on site. The photographs will serve to verify information entered in the field logbooks.

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3 QUALITY ASSURANCE PROJECT PLAN

3.1 Roles and Responsibilities

Brief descriptions of key personnel responsibilities are provided below.

The sampling project manager is a member of the project team who will provide oversight and serve as the point of contact for the responsible parties. The sampling project manager will have responsibility for the overall project performance.

The QA manager will be responsible for ensuring the integrity of the SAP/QAPP and will coordinate all QA-specific activities. The QA manager will do the following:

- Ensure that the appropriate analytical methods and sampling equipment are selected.
- Be responsible for data validation and advise the sampling project manager with respect to data management and statistical evaluation of the data.
- Be responsible for performance and/or systems audits of the laboratory, should they be required.

The field manager or designated representative will be located at the site during field activities and will coordinate the technical field activities in accordance with approved plans, including the Monitoring Plan (Dudek 2017), QAPP, and Health and Safety Plan. The field manager will be responsible for verifying that the field work (to include sampling operations and sampling QC) is performed within the approved guidelines. The field manager will be responsible for implementing and maintaining overall operating standards and field QA responsibilities. Such responsibilities will include the following:

- Appropriate calibration and maintenance of field instruments
- Appropriate equipment decontamination
- Compliance with QA/QC sampling requirements (e.g., field duplicate collection)

In addition, the field manager will coordinate safety and technical activities occurring at the site, and conduct daily briefing sessions prior to work on the site. Although various field functions will be performed by individuals, the field manager will bear field responsibilities.

The laboratory project manager will be responsible for the day-to-day management of the laboratory work, to include data processing and data processing QA, verification that laboratory QA/QC procedures are being maintained, and verification that technical review of reports has been performed. Although various laboratory functions will be performed by different

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individuals, the laboratory project manager will provide signature approvals to laboratory-generated information and bear laboratory responsibilities.

3.2 Quality Objectives and Criteria

The DQO process is used to derive qualitative and quantitative statements in relation to a particular data collection event (or group of events). Performing the DQO process is generally one of the prerequisite steps to data collection. The DQO process is described in EPA Guidance (EPA 2006). The steps of the DQO process are as follows:

- State the problem
- Identify the goals of the study
- Identify information inputs
- Define the boundaries of the study
- Develop the analytic approach
- Specify performance or acceptance criteria
- Develop the plan for obtaining data

The steps of the DQO process for the project are summarized below:

- The problem: Groundwater quality in the Subbasin, as observed through groundwater samples collected from monitoring and production wells, is potentially degrading. Overdraft conditions are potentially exacerbating impacts from naturally occurring COPCs, which may result in undesirable effects such as degraded water quality that is unsuitable for irrigation and/or drinking.
- The goals: Evaluate baseline and long-term trends in COPC concentrations for comparison to measurable objectives to be established in the GSP.
- Information inputs: Obtain analytical data for groundwater samples using the tests outlined in Section 3.5.1 of this SAP.
- The boundaries of the study: Samples will be collected from groundwater wells within the Subbasin, as designated in the Monitoring Plan (Dudek 2017).
- The analytic approach: Concentrations of COPCs will be tracked and studied throughout implementation of the GSP, as described in the Monitoring Plan.
- Performance or acceptance criteria: The usability of the data collected for this phase of work will be based on measurement activities, consistent with accepted guidance

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documents such as SW846 Test Methods. Testing results will be evaluated against performance-based acceptance criteria.

- The plan for obtaining data: The overall plan is outlined within the Monitoring Plan (Dudek 2017), and sampling details are presented in Section 2 of this SAP.

3.3 Special Training/Certification

No specialized training is required. Standard training specifications will be outlined in the project-specific Health and Safety Plan.

3.4 Documentation and Records

Documentation will involve generating, maintaining, and controlling field data, laboratory analytical data, field logs, reports, and any other data relevant to the project. Bound field log books, loose-leaf drilling logs, or automated field data entry records generated with personal data assistants are examples of documents. This project will have dedicated field log books, forms, and a DMS that will not be used for other projects. Entries will be dated and the time of entry will be recorded. Sample collection data and visual observations will be documented on forms or personal data assistants, or, when forms are not available or applicable, in the field log book. Any sample collection equipment, field analytical equipment, and equipment used to make physical measurements will be identified in the field documentation. Calculations, results, equipment usage, maintenance, and repair and calibration data for field sampling, and analytical and physical measurement equipment will also be recorded in field documentation. Once completed, the field forms, field databases, and field log book will become part of the project file.

Office data management will involve establishing and maintaining a project file. The project file will include the following:

- Planning documents, such as the QAPP
- Plans and schedules
- Standard operating procedures (SOPs) (for both the field and laboratory)
- Field sampling logs
- Field screening data
- QA auditing and inspection reports
- Laboratory analytical data
- Calculations
- Drawings and figures

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- Reports
- External and internal correspondence
- Notes/minutes of meetings and phone conversations
- Contract/purchase orders
- Change orders
- Bid evaluations

All project-related information will be routed to the sampling project manager who will be responsible for distributing the information to appropriate personnel. Project documentation will be archived for a minimum of 15 years. Pertinent documentation will be uploaded to the project's online DMS.

3.5 Analytical Methods

3.5.1 Laboratory Methods

The following laboratory methods will be used during groundwater sample analysis activities:

- Arsenic by EPA Method 6010B
- Cations and anions by Methods 300.0, SM 2340C, and SM 2320B
- Fluoride by SM 4500 F C
- Nitrate by EPA 300.0
- Radionuclides by EPA 900.0
- Sulfate by EPA 300.0
- Total dissolved solids by SM 2540 C

3.5.2 Required Reporting Limits and Method Detection Limits

Reporting limits represent the lowest normally obtainable measurement level achieved and reported by the laboratory under practical and routine laboratory conditions for a variety of sample matrices. The method detection limit (MDL) is the minimum concentration that can be measured with 99% confidence that the analyte concentration is greater than zero by an analytical procedure in a given matrix containing the analyte. Sample-specific reporting limits may vary as a result of sample matrix and compound concentration. Samples with no positive results (down to the MDL) are typically reported as "ND" (indicating "not detected") by the laboratory. Positive results below the reporting limit but above the MDL are reported as

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estimated values by the laboratory. Reporting limits and MDLs are adjusted for dilutions, as necessary, by the laboratory. A summary of the MDLs and reporting limits for the COPCs is presented in Table 1.

Table 1
Summary of Method Detection Limits and Reporting Limits

COPC	Method	Reporting Limit (mg/kg)
Fluoride	SM 4500-F C	0.10
Arsenic	6010B	0.0100
Calcium	6010B	0.100
Magnesium	6010B	0.100
Potassium	6010B	0.500
Sodium	6010B	0.500
Total Dissolved Solids	SM 2540 C	1.0
Chloride	300.0	1.0
Nitrate (as N)	300.0	0.10
Sulfate	300.0	1.0
Hardness (as CaCO ₃)	SM 2340 C	2.0
Alkalinity	SM 2320B	1.0
Bicarbonate	SM 2320B	1.0
Carbonate	SM 2320B	1.0
Hydroxide	SM 2320B	1.0
Radionuclides (Gross Alpha Particle Activity)	900.0	Variable

COPC = constituent of potential concern; mg/kg = milligrams per kilogram

Laboratory analytical methods specified in Section 3.5.1 are generally consistent with those used during previous sampling performed in the Subbasin.

3.5.3 Holding Times

Knowledge of required holding times will have a direct impact on scheduling of sample collecting, packing, and shipping activities. To ensure proper sample handling, the sample container, volume, preservation, and holding times applicable to each analytical method are shown in Table 2.

Table 2
Borrego Springs Subbasin – Groundwater Sample Analytical Suite

Constituent	Method	Sample Container	Preservative	Holding Time (days)
Fluoride	SM 4500-F C	250 mL HDPE	Ice 4°C	28
Arsenic	6010B	250 mL HDPE	Ice 4°C	28
Calcium	6010B	250 mL HDPE	Ice 4°C	28

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Table 2
Borrego Springs Subbasin – Groundwater Sample Analytical Suite

Constituent	Method	Sample Container	Preservative	Holding Time (days)
Magnesium	6010B	250 mL HDPE	Ice 4°C	28
Potassium	6010B	250 mL HDPE	Ice 4°C	28
Sodium	6010B	250 mL HDPE	Ice 4°C	28
Total Dissolved Solids	SM 2540 C	1 L HDPE	Ice 4°C	7
Chloride	300.0	125 mL HDPE	Ice 4°C	28
Nitrate (as N)	300.0	125 mL HDPE	Ice 4°C	2
Sulfate	300.0	125 mL HDPE	Ice 4°C	28
Hardness (as CaCO ₃)	SM 2340 C	250 mL HDPE	Ice 4°C	180
Alkalinity	SM 2320B	250 mL HDPE	Ice 4°C	14
Bicarbonate	SM 2320B	250 mL HDPE	Ice 4°C	14
Carbonate	SM 2320B	250 mL HDPE	Ice 4°C	14
Hydroxide	SM 2320B	250 mL HDPE	Ice 4°C	14
Radionuclides	900.0	1 L HDPE	Ice 4°C	5

mL = milliliters; L = liters; HDPE = high-density polyethylene bottle

3.5.4 Field Methods

Procedures for using field measurement devices are presented in Section 3.6.4.

3.6 Quality Control

3.6.1 Introduction

This section addresses QC procedures associated with field sampling and analytical efforts. Included are general QC considerations, as well as specific QC checks that provide ongoing control and assessment of data quality in terms of precision and accuracy.

3.6.2 Field Quality Assurance/Quality Control

QA/QC for fieldwork refers to methods of measuring the quality of the field sampling techniques. Drilling, sampling, and field record keeping will be conducted in accordance with current sampling protocols for groundwater sampling, as applicable. Field instrumentation will be calibrated in accordance with the manufacturer's instructions at the beginning of each field day.

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In addition to the primary samples, the following QA/QC samples will be collected:

- **Field Duplicate.** One field duplicate sample will be collected for every 20 samples collected. The field duplicates will be analyzed for the same COPCs as the primary samples, and will be used to evaluate field sample collection reproducibility. The location where the field duplicate is collected will be noted on the sampling logs. The duplicate sample name will be different than the original sample name.
- **Matrix Spike/Matrix Spike Duplicate (MS/MSD).** One MS/MSD sample will be selected as applicable, and noted on the chain-of-custody. The MS/MSD samples will be analyzed for the same COPCs as the primary samples, and will be used by the laboratory to check for the ability to accurately and precisely recover compounds of interest from the site-specific matrix.

Field blanks will not be collected for this scope of work because easily transferable constituents such as volatile organic compounds are not anticipated to be encountered. The results of the analyses of these QC sample types are used as independent, external checks on field sample collection techniques.

3.6.3 Laboratory Quality Control

To obtain data on precision and accuracy, the analytical laboratory will analyze the QC samples described below. The control limits and corrective actions for each parameter are specified in the pertinent laboratory analytical method SOPs. The analytical methods require analyses of the following QC samples:

- Calibration verification following instrument calibration and continuing calibration verification.
- Laboratory blank verification at instrument calibration and at the method required frequency thereafter for continuing blank verification.
- Method blank analysis at a rate of once per batch of samples or one per 20 samples of a single matrix, whichever is more frequent, to determine contamination levels during sample preparation.
- Laboratory control sample (LCS) analyses at a rate of one per batch. The LCS is used to verify that the analytical system is in control based on the percent recovery of the analyte(s).
- MS/MSD or MS/Laboratory Duplicate analyses will be conducted as applicable. The MS/MSDs and/or MS/Laboratory Duplicate are used to check for the ability to accurately and precisely recover compounds of interest from the matrix.

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3.6.4 Field Procedures

Field monitoring and analytical equipment will be maintained in accordance with the manufacturers' recommended schedules and procedures. Maintenance activities will be documented by either field or laboratory personnel. Calibration will be performed on a routine basis and as otherwise required. Calibrating equipment or calibration standards will also be routinely recalibrated or replaced and documented. Routine inspection of equipment is intended to identify problems requiring maintenance before they cause a major disruption in field monitoring or analytical activities, or adversely affect the validity and precision of the data being measured.

3.6.5 Laboratory Procedures

The laboratory is responsible for maintaining laboratory equipment in accordance with manufacturers' recommended maintenance and procedures in order to minimize downtime of the analytical systems. Each analyst is responsible for conducting a daily inspection of critical systems on instruments under their charge. Inspections will include vacuum lines and pumps for the gas chromatograph/mass spectrometer, automatic injection systems, controlled reagent-feed motors, temperature-controlled ovens in gas chromatographs, capillary columns, detectors and support systems, gas control system for atomic adsorptions, and many others. Wear-dependent items, such as septa on gas chromatograph injection systems, will be replaced as needed. The performance of instruments will be checked against known standards at the beginning of each working day or shift. Failure to achieve proper performance indicates a system problem, which will be addressed by laboratory personnel or by the manufacturer's service representative.

In addition, laboratory personnel or the manufacturer's service representative will service working systems according to a fixed schedule. A record of service and repairs, whether accomplished by laboratory personnel or by the manufacturer's service representative, will be maintained in a log book kept with each instrument.

3.7 Inspection/Acceptance of Supplies and Consumables

Critical field supplies and consumables include the following:

Sample bottleware

- Decontamination fluids
- Personal protective equipment
- General sampling consumables (e.g., ice, plastic bags, paper towels, aluminum foil)

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For bottleware, the acceptance criteria will entail an inspection upon receipt of analytical testing to confirm the absence of cross-contamination and the presence of appropriate preservatives. For decontamination fluids, field staff will ensure that the fluids meet the necessary requirements for concentration and quality grade (e.g., reagent-grade methanol). Personal protective equipment will be inspected to confirm integrity and ensure that the appropriate sizes are available as required by sampling team members.

3.7.1 Laboratory Supplies

The inspection and acceptance criteria for analytical reagents will be performed in accordance with the selected California-certified laboratory's SOPs.

3.8 Assessments and Response Actions

The project team may conduct performance and systems audits of field and laboratory activities, as necessary. Following is a discussion of audits, corrective action, and reporting procedures.

3.8.1 Systems Audit

A systems audit consists of the evaluation of key components of the measurement systems to determine their proper selection and use. When required by the EPA or alternative regulatory authority, systems audits are performed prior to or shortly after systems are operational. This audit includes a careful evaluation of field and laboratory QC procedures, which are explained below.

Field Systems Audits

Field systems audits are on-site audits that focus on data collection systems, using the appropriate SAP/QAPP as a reference. Specific activities vary with the scope of the audit, but can include a review of sample collection activities, decontamination practices, equipment calibration techniques and records, decontamination and equipment cleaning, background and training of personnel, sample containers and preservation techniques, and chain-of-custody procedures.

Laboratory Systems Audit

The laboratory systems audit is a review of laboratory operations to verify that the laboratory has the necessary facilities, equipment, staff, and procedures to generate acceptable data.

Specific activities vary with the scope of the audit, but can include a review of equipment suitability and maintenance/repair; SOPs; background and training of personnel; laboratory control charts and support systems; and QA samples, including performance evaluation samples, chain-of-custody procedures, data logs, data transfer, data reduction, and validation.

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3.8.2 Performance Audits

After systems are operational and generating data, a performance audit may be requested to determine the accuracy of the total measurement system(s) or component parts thereof. Similar to the systems audit, there are two types of performance audits, as explained below.

Field Performance Audit

Performance audits of sampling activities will be conducted using review of laboratory sample receipt forms.

An inspection for suitability of the samples for proper laboratory analysis will serve as the performance audit of the sample collection procedures. Insufficient sample volume for analysis, or improper preservation of samples, will be noted by the analytical laboratory. A preponderance of such reports of unsuitable samples will indicate that the sampling procedures are poor or unacceptable. Analytical results will be reviewed by the sampling project manager and the QA manager to assess the performance and adequacy of sample collection procedures.

Proper execution of sampling procedures will be audited by the sampling project manager and the QA manager. The sampling project manager and QA manager will audit these project operations on a regular basis over the life of the project through review of the field log book and audit forms, and through discussion with the field manager.

Laboratory Performance Audits

The project laboratories participate in a variety of federal and state programs that subject laboratories to stringent performance audits on a regular basis. QA policies and procedures currently in place at the laboratories, and actions that will be included in sampling activities to ensure QA, include the following:

- Inter-laboratory check samples
- Periodic audits
- Laboratory control samples analyzed at applicable analytical method frequencies
- Performance evaluation samples to be submitted to laboratories by the project team to each laboratory during major sampling events that use the particular laboratory

Laboratory performance in these areas will be monitored by the project team QA manager. If necessary, the project team QA manager will conduct an on-site audit of field operations or the analytical laboratory.

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3.8.3 Corrective Action for Measurement Systems

When a problem situation arises regarding any significant impediment to the progress of the SAP during site characterization, corrective action will be implemented to identify the problem and its source. Appropriate documentation of this action will be recorded in the project file.

Personnel responsible for the initiation and approval of corrective action will be the laboratory QA manager (for corrective action at the laboratory) and the project team project manager (for corrective actions identified during field activities and/or during the data validation effort).

3.8.4 Quality Assurance Reporting Procedures

Below are the QA reporting procedures that will be implemented for this project.

Reporting Responsibility and Recordkeeping

Comprehensive records will be maintained by the project team to provide evidence of QA activities. These records will include the following:

- Results of performance and systems audits
- Data validation summary
- QA problems and proposed corrective action
- Changes to the project documents

The proper maintenance of QA records is essential to provide support in any evidentiary proceedings. The original QA records will be kept in the QC manager's records.

Access to working files will be restricted to project personnel.

Audit Reports

Should audits be requested, the corresponding audit reports will be distributed to the following project personnel, as appropriate:

- Project Manager/Project Director
- Field Manager
- Laboratory QA/QC Manager

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3.9 Data Reduction, Review, Verification, and Validation

This section addresses the stages of data quality assessment after data have been received. It addresses data review, verification, and validation. It also sets procedures for evaluating the usability of data with respect to the DQOs set forth in Section 3.2.

3.9.1 Data Reduction

Raw analytical data generated in the laboratory are collected on printouts from the instruments and associated data system, generated electronically and stored in a laboratory information management system (LIMS), or manually recorded into bound notebooks. Analysts review data as they are generated to determine that the instruments are performing within specifications. This review includes calibration checks, surrogate recoveries, blank checks, retention time reproducibility, and other QC checks as specified in the laboratory's SOPs. If problems are noted during the analytical run, corrective action will be taken and documented.

Each analytical run is reviewed for completeness prior to interpretation and data reduction.

3.9.2 Data Review

Data review is an initial and relatively non-technical step of data assessment that primarily addresses issues of completeness and data handling integrity. In data review, the reviewer will ensure that all necessary reporting components have been included in laboratory reports, such as necessary fields (e.g., collection/analysis dates, units) and the presence of (but not implications of) QA/QC data components (e.g., LCS records, surrogate results).

3.9.3 Data Verification and Validation

Data verification is a more technical process than data review in that the core technical aspects of data quality (e.g., precision, accuracy) are evaluated through a review of the results of QA/QC measures, such as LCSs and surrogates.

Following interpretation and data reduction by an analyst, data are transferred to the LIMS either by direct data upload from the analytical data system or manually. The data are reviewed by the group leader or another analyst and recorded in the LIMS as being verified. The person performing the verification reviews all data, including QC information, prior to verifying the data. The laboratory will complete the appropriate forms summarizing the QC information and transfer copies of all raw data (e.g., instrument printouts, spectra, chromatograms) to the project management group for the final laboratory deliverable. This laboratory project manager will combine the information from the various analytical groups and the analytical reports from the LIMS into one package. This package will be reviewed by the laboratory project manager for

Sampling and Analysis Plan and Quality Assurance Project Plan

conformance with SOPs and to ensure that all project QC goals have been met. Any analytical problems are discussed in the case narrative, which is also included with the data package deliverables. A Level 2 data deliverable will be required for this project.

Following data verification by the laboratory, data validation will be conducted on 100% of the laboratory data by an entity independent of the laboratory. The following level of validation will be performed:

- Stage 1: 100% of samples collected

If systematic errors with the laboratory data are identified, further validation may be necessary. Data validation may be performed on hard-copy data or electronically, as applicable. General compliance to the August 2014 National Functional Guidelines for Inorganic Data Review and the National Functional Guidelines for Superfund Method Organic Data Review (EPA 2014), and EPA Region 9 validation guidance will be used as the basis for the validation. The guidance documents provide structured approaches for the assignment of data qualifiers based on observations made in the data verification process, and will be used in conjunction with the specific EPA method criteria and the QA criteria set forth in the project-specific SAP.

3.9.4 Data Validation and Usability Determination

Data verification is a technical process to evaluate data, but it does not answer the final question of the usability of the data and the implications of any departures from data expectations. The data validation process is designed to assign data qualifiers based on the data verification results, and provide a case-by-case review of data quality issues with respect to QAPP objectives to render a final assessment of data usability.

3.10 Data Evaluation Roles and Responsibilities

The following components of data evaluation will be performed:

- Data reduction will be performed by the analytical laboratory
- Data review will be performed by both the laboratory and by the project team
- Data verification will be performed by the laboratory
- Data validation and usability determination will be performed by the project team

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3.11 Data Reporting

Laboratory reports will contain the following:

- **Case Narrative:** Description of sample types, tests performed, any problems encountered, corrective actions taken, and general comments.
- **Analytical Data:** Data are reported by sample or by test. Pertinent information, such as dates sampled, received, prepared, and extracted, will be included on each results page. The reporting limit and method detection limit for each analyte will also be recorded. In addition to a report saved as a pdf, the laboratory will provide an electronic data deliverable in a text format corresponding to each analytical report.
- **Laboratory Performance QC Information:** The results for all of the associated laboratory QC samples and practices will be reported (e.g., LCS, method blanks, surrogate recoveries).
- **Matrix-Specific QC Information:** Results of any sample duplicates, MSs, MSDs, or other project-specific QC measures that are requested will be reported.
- **Methodology:** The reference for the applied analytical methodology will be cited.

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Sampling and Analysis Plan and Quality Assurance Project Plan

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APPENDIX A
*Example Groundwater Elevation
Monitoring Field Form*

APPENDIX B
*Example Groundwater Quality
Monitoring Field Form*

SAN DIEGO COUNTY LOW FLOW WELL MONITORING DATA SHEET

DATE: _____

Project Name: Borrego Springs Subbasin					Project Address:				
Sampled by:					Project Number:				
Sampling Company:					Well GPS Latitude: _____				
Well ID:					Longitude: _____				
Borehole Diameter: _____ inches					Well Diameter: _____ inches				
Static Water Level (ft. btc): _____ Time _____					Referenced to: Top of PVC Casing				
Reference Point Elevation (ft. MSL):									
Total Well Depth (ft. btc) (WD):									
Meter type/ID: Ultrameter YSI 556 YSI 550					ID: _____				
Water Level Indicator Type: GeoSlope Indicator ID: _____									
Decontamination Method: Steam/High Pressure Wash 3 Stage Rinse Other									
Sampling Equipment: _____ Other: _____									
Purge Method: Low Flow					Date Pump Installed: _____				
Pump Depth (ft btc): _____					Start Purge: _____				
Purge Rate: _____									
Time	Temp (°C)	pH	Cond. (mS or µS)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Depth to Water (ft btc)	Water Removed (ml)	Observations
Stabilization Parameters*	+/-3%	+0.2 units	+/-3-5%	+/-10%	+0.2 units	+/-20 mV			
Sampling Date:				Sampling Time:			Depth to Water:		
Sample I.D.:					Laboratory:				
Analyzed for:	Volume	Container	Filtered	Pres.	Parameters				
EB I.D. (if applicable): _____ Time _____					Duplicate I.D. (if applicable):				
Field Sheet Checked By:					License #:				
COMMENTS:									

* 3 Consecutive Readings

APPENDIX E2
Borrego Metering Plan

DRAFT

**GROUNDWATER EXTRACTION METERING PLAN
BORREGO SPRINGS GROUNDWATER SUBBASIN**

Prepared for

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MARCH 2019

Groundwater Extraction Metering Plan

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Groundwater Extraction Metering Plan

1 INTRODUCTION

The Borrego Springs Groundwater Subbasin (Subbasin) of the Borrego Valley Groundwater Basin (BVGB) has been identified by the California Department of Water Resources (DWR) as subject to critical conditions of overdraft (DWR 2016). As such, in accordance with California's Sustainable Groundwater Management Act (SGMA), a Groundwater Sustainability Agency (GSA) has been formed to develop and implement a basin-specific Groundwater Sustainability Plan (GSP). The general purpose of the GSP is to facilitate a long-term groundwater withdrawal rate less than or equal to the sustainable yield of the Subbasin within the maximum 20-year implementation period mandated by SGMA.

This Groundwater Extraction Metering Plan (Metering Plan) is a foundational component of the GSP that will facilitate the reporting of groundwater extraction data. Collection and reporting of these data are integral to enable proactive and adaptive management of groundwater resources and documentation of seasonal fluctuation in water demand. Agricultural pumping was identified as one of the greatest sources of uncertainty in the Borrego Valley Hydrological Model (BVHM), because the groundwater use was indirectly estimated using potential evapotranspiration, crop coefficients, and irrigation efficiencies. Collecting metered data is one of the three primary recommendations proposed to improve the accuracy of the BVHM, which in turn improves the GSA's tools for adaptive management. Furthermore, the collection of metered pumping data is a key metric for evaluating the effectiveness of four out of the six projects and management actions being undertaken by the GSA (i.e., the water trading program, water conservation, pumping reduction program, and the voluntary fallowing of agricultural land). The GSA derives its authority to require groundwater extraction metering pursuant to the SGMA § 10731.

This plan has also been prepared consistent with Borrego Valley GSP Advisory Committee (AC) Policy Recommendation #1 – Questions #1 and #2 (AC Agenda and Minutes November 2017). AC Policy Recommendation #1 – Question #1 recommended meters to be installed on all wells with the exception of wells that use two acre-feet per year (AFY) (651,702 gallons/year) or less within the Subbasin.

AC Policy Recommendation #1 – Question #2 provided two options to the AC for consideration as follows:

Option 1: The GSA inspects and monitors/reads the meter on a monthly basis and ensures the accuracy of the data including meter calibration. The GSA would provide an annual statement setting forth the total extraction in gallons from each

Groundwater Extraction Metering Plan

well. The GSA will keep data confidential to the maximum extent allowed by law (California Govt. Code 6254(e)).

Option 2: The property owner (or third-party contractor acceptable to the GSA) monitors/reads the meter on a monthly basis. A third-party contractor acceptable to the GSA would inspect and read the meter on a semi-annual basis to verify the accuracy of data including meter calibration. On behalf of the property owner, the third-party contractor would provide an annual statement to the GSA with verification of the total extraction in gallons from each well and verification that each flow meter is calibrated to within factory acceptable limits. The GSA will keep data confidential to the maximum extent allowed by law (California Govt. Code 6254(e)).

Although the AC did reach consensus on requiring meters to be installed on all wells except those wells that use two AFY or less, consensus was not achieved for AC Policy Recommendation #1 – Questions #2 as indicated by Level 5 and 6 AC member votes. As such, that issue was returned to the Core Team without a recommendation as per the Borrego Valley GSP AC By-laws adopted and approved January 29, 2017. This Plan has been prepared under the presumption that the Core Team accepts both Option 1 and Option 2 presented in AC Policy Recommendation #1 – Question #2 as acceptable.

1.1 Applicability of the Metering Plan

An interim Monitoring Plan was prepared in support of the GSP, outlining the types of monitoring necessary to address the applicable DWR-designated SGMA sustainability indicators in the Subbasin (Dudek 2017). This Metering Plan serves to supplement the Monitoring Plan by outlining consistent groundwater extraction metering procedures required for all groundwater production wells in the Subbasin which pump in excess of two AFY. However, *de minimis* groundwater production wells that pump less than two AFY are exempt from the metering requirement defined herein pursuant to SGMA § 10721e.

Implementation and compliance with this Metering Plan will be mandatory for all non-*de minimis* wells in the Subbasin beginning 90 days from adoption of the GSP. The GSA may require metered data from any well located in the Subbasin if it is uncertain whether it qualifies as *de minimis* groundwater production.

This Metering Plan will be implemented to address the following:

- The GSA is currently relying on estimates of pumping, which is considered a source of uncertainty in the Subbasin's numeric groundwater model at this time. Initially these data

Groundwater Extraction Metering Plan

will be used to refine existing groundwater extraction estimates for non-de minimis groundwater production wells in the subbasin. Additionally, the data will be used to verify and refine the sustainable yield of the Subbasin.

- Groundwater extraction metering data will be integrated with other data being collected (i.e., groundwater level data) to track changing conditions in the Subbasin in order to evaluate the SGMA sustainability indicators: chronic lowering of groundwater levels, reductions in groundwater storage, and the potential for water quality impacts to municipal supply as groundwater levels decline.
- Groundwater extraction metering data will be used throughout the GSP implementation period to quantitatively track compliance with prescribed pumping allocations and reductions.

The Metering Plan outlines a procedure that will facilitate confidential collection and reporting of groundwater extraction data to the GSA, which will not be subject to public review pursuant to Government Code 6254(e).

The Metering Plan has been modified and superseded by Section VI.A of the Judgment, whereby the parties will install, at their own expense, meters approved by the Watermaster that can electronically transmit a recording of the amount of groundwater pumped from the Basin and other data to Watermaster in real-time on a schedule determined by the Watermaster.

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2 METERING PLAN

This section describes the metering objectives and acceptable approaches, meter types and installation configurations, and meter maintenance and calibration requirements for routine groundwater extraction metering activities in the Subbasin.

2.1 Metering Objectives

The purpose of this Metering Plan is to outline the procedures for the metering of all non-*de minimis* groundwater extraction wells (>2 AFY) within the Subbasin to enable proactive management of water resources. The GSA may request metered data from any well located in the Subbasin if it is uncertain whether it qualifies as *de minimis* groundwater production.

2.2 Approach

All non-*de minimis* wells will be required to register with the GSA upon GSP adoption, which will include identification of flow meter type, San Diego County Assessor’s Parcel Number (APN) for each parcel served by each well and farm identification, golf course identification or other type of water use identification. Figure 1 illustrates an example of one well serving multiple parcels within a farm:

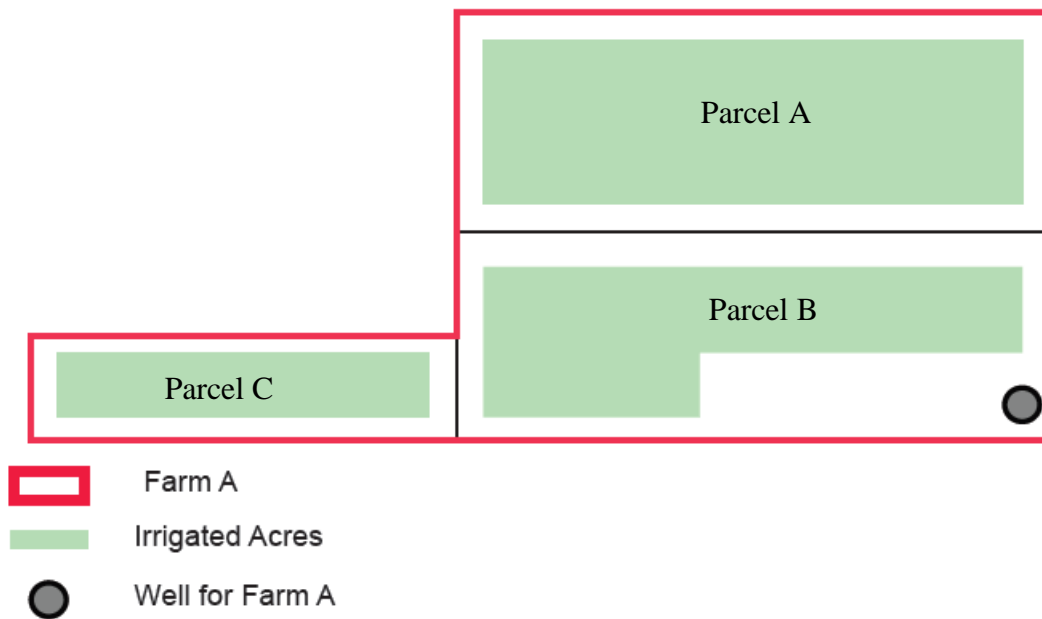


Figure 1. Example Documentation of Parcels Served by a Well for a Farm

Groundwater Extraction Metering Plan

Registration of non-*de minimis* production wells is achieved by submittal of the registration form to the GSA and is due within 90 day of GSP adoption. A copy of the registration form is provided as **Attachment A**, which specifies details for electronic submittal of the form. At the time of form submittal, the GSA will verify parcels served by each well and current area of irrigation based on aerial photography and GIS analysis.

Subsequent to registration, each applicable well owner that does not already have an appropriate flowmeter installed (as reported on registration form and verified by GSA) will be required to have one installed near the wellhead. The registrants will be required to install the flowmeter within 60 days of registration, or as determined appropriate by the GSA at time of GSP adoption. The meter is required to be read and recorded monthly and reported to the GSA annually. Registrants will be required to begin recording groundwater production immediately following installation. A third-party contractor acceptable to the GSA would inspect and read the meter on a semi-annual basis to verify the accuracy of data including meter calibration. An annual report will be required to be submitted to the GSA to demonstrate compliance with the Metering Plan.

2.3 Meters

Historically, basin-wide monitoring has included municipal reading of Borrego Water District Wells and San Diego County Major Use Permit readings for golf courses in the basin. Additional meters are required in the Subbasin to more accurately measure and document water usage.

Flow meters must be installed on existing production wells and should be installed at easily accessible above-ground portions of the well. Flow meters should be installed according to the meter's installation specification (e.g., correct upstream and downstream pipe length). Flow meters must include both an instantaneous flow rate and a totalizer recording the total volume of water extracted from the well. Appropriate meter types are described in the following subsections.

2.3.1 Meter Types

Wells owners can select the brand of flow meter to be installed on their well(s); however, meters must be calibrated as described in Section 3 of this Metering Plan. The propeller-type flow meter is recommended for installation as part of the GSP. Propeller-type meters have been used throughout the Subbasin, and have proven to be a reliable mechanism for long term monitoring. Also, additional implementation of propeller type meters would ensure data comparability to previous historical data.

Groundwater Extraction Metering Plan

Propeller Flow Meter:

- Propeller type flow meters use mechanical parts to record production and/or measure flow rate.
- Commonly used in agriculture and municipal settings (majority of meters in Borrego Valley are propeller meters).
- Propeller meters must be sized based on expected flow rate and pipe diameter.
- Historically reliable for long-term use.
- May require maintenance, as bearing wear can occur from the internal propeller, and calibration is also periodically required.
- Future data collected would be of comparable accuracy to historically collected flow meter data.
- Flow meter accuracy is commonly plus or minus 2%.



Figure 2. Example Propeller Type Flowmeter

Source: McCrometer 2017

Additionally, Automated Meter Infrastructure (AMI) can be implemented to remotely report measurements. AMI can be implemented to minimize visits to the wellhead, and remote

Groundwater Extraction Metering Plan

communication options include satellite and cellular connections. Power options for AMI can include grid, battery-only, and rechargeable solar power.



Figure 3. Example Automated Meter Infrastructure

Source: McCrometer 2017

2.3.2 Typical Installation Configurations

Many wells in the Subbasin already have flow meters installed; however, many wells will require new flow meter installation, retrofits, or meter calibration. Installing each flow meter typically requires 4-8 hours, and must be performed by a licensed pump contractor. Well owners may have the option to allow installation of the flow meter through the GSA for a limited time with a subsidized program, or through an independent pump company at the expense of the well owner.

The meters must be installed in accordance with manufacturer's specifications. A typical installation configuration is depicted in Figure 4.

Groundwater Extraction Metering Plan

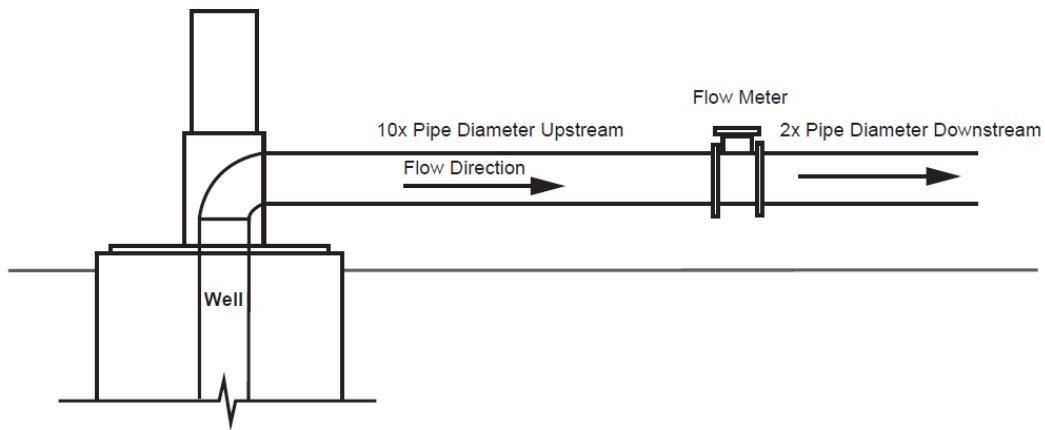


Figure 4. Typical Flowmeter Configuration

2.3.3 Maintenance and Calibration Considerations

Propeller flow meters are considered to be reliable for long-term use; however, routine maintenance of the flow meter will be required, and will be the responsibility of the well owner. Calibration will be conducted as needed semi-annually for propeller type flow meters, and annual meter accuracy checks must be conducted by a GSA-approved vendor. Calibration specifications are presented in Section 3 of this Metering Plan.

Groundwater Extraction Metering Plan

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3 GROUNDWATER METERING COMPLIANCE REQUIREMENTS

3.1 Calibration and Validation

Proper calibration and verification is important for ensuring data quality, and necessary for meeting the objectives of the Metering Plan. Well owners are responsible for costs for installation (if needed), calibration, verification, and maintenance of meters. Under certain parameters, a flow meter may be deemed “commercial.” The County of San Diego, Department of Agriculture, Weights and Measures (AWM) considers a meter to be commercial if it is being used to determine a fee or penalty charged to pumpers, and the meter is owned by the property owner. AWM requires commercial meters to be tested and sealed at the AWM testing facility prior to installation, and to be retested every ten years.

The AWM testing facility has the capability of testing flow meters up to two inches in diameter. Most of the meters subject to the Metering Plan are larger than two inches, and therefore, cannot be tested at the AWM laboratory. In lieu of AWM facility testing, flow meter testing and calibration shall be conducted by the meter manufacturer in conformance with National Institute of Standards and Technology (NIST) Handbook 44, as referenced in California Code of Regulations, Title 4, Division 9 Weights and Measures Field Reference Manual (2018) Section 3.36 Water Meters. Based on the GSA’s review of existing, accessible meters in the Subbasin, most meters are manufactured by McCrometer, based in Hemet, California. McCrometer’s calibration Standard Operating Procedure for applicable meters has been reviewed by the GSA and determined to be compliant with above-referenced NIST standards. Therefore, McCrometer’s two California calibration facilities (Hemet and Porterville) are considered acceptable for meter calibration. Other meter manufacturers may also be acceptable for calibration procedures pending confirmation of NIST compliance.

Initial Calibration/Validation of Existing Meters

New meters will require a certificate of calibration which must be provided to the GSA and recorded. Existing meters in the Subbasin will need to be inspected and validated to ensure proper function and calibration. These activities must be conducted by a California-licensed pump contractor or GSA-approved vendor. This initial calibration and validation will be conducted at the beginning of the schedule of routine metering activities, and a certificate of calibration must be produced and recorded. Certificates of calibration for new and existing meters must be submitted with the initial semi-annual report (Section 3.4 of this Monitoring Plan).

Groundwater Extraction Metering Plan

Routine Calibration/Validation

Routine calibration checks (i.e., validation) must be conducted semi-annually. If variability exceeds 5% then manufacturer recalibration will be required. This typically involves removing the meter and having it factory calibrated. Routine validation can be conducted using either a temporary ultrasonic meter test to measure instantaneous flow rate, or other approved recalibration methods performed through professional services. Calibration can also include motor efficiency testing by the pump contractor or vendor to determine current efficiency and remaining useful life of the well motor. Replacing well motors when they become inefficient can save on electrical cost with the potential for regular maintenance resulting in cost savings to the pumper.

3.2 Meter Reads and Monthly Data Reporting

Upon GSP adoption, meter reads must be recorded monthly and submitted to the GSA team electronically on an annual basis with third party validated reports for pumpers who elect to not have GSA staff perform the meter reads. Compliance with GSA meter reading requirements can be achieved by one of two approaches:

3.2.1 Option 1 - GSA Performed Meter Reading

Provide access for the GSA to perform monthly visual meter reading. Enrollment in this approach requires execution of the access agreement provided in **Attachment A** of this Metering Plan. Currently numerous groundwater flow meters within the Subbasin are visually read and documented on a monthly basis.

3.2.2 Option 2 - Third-Party Contractor Performed Meter Reading

The property owner (or third-party contractor acceptable to the GSA) monitors/reads the meter on a monthly basis. A third-party contractor acceptable to the GSA would inspect and read the meter on a semi-annual basis to verify the accuracy of data including meter calibration. On behalf of the property owner, the third-party contractor would provide an annual statement to the GSA. Third party contractors shall possess an appropriate license, including Professional Geologist, Professional Engineer, California Well Drilling License (C-57), or other applicable professional license approved by the GSA.

3.3 Annual Reporting

Annual reports shall be submitted to the GSA on or before October 31st of each year. The reporting year will be defined as the water year from October 1st through September 30th. The water year is designated by the calendar year in which it ends.

Groundwater Extraction Metering Plan

Annual reports must contain the following:

- **Total Annual Water Use Per Well:** Tabulated results of monthly meter reads and cumulative annual water production amount.
- **Meter Calibration/Validation Documentation:** Semi-annual validation and annual calibration certificates produced by an appropriate pump or meter company.
- **Representative Parcel Numbers:** San Diego County APN for each parcel served by each well.
- **Farm Identification, if applicable:** Name of farm or farms served water by each well.
- **Meter Reading Method and Qualification:** Description of the meter reading method (e.g., visual read by Borrego Water District, remote automated reading infrastructure with confirmation by third party, etc.) and certification that the individual collecting that data meets the minimum qualifications of the GSA.

Annual reports shall be submitted electronically to the GSA in the required format. An example annual report template is provided as **Attachment B** to the Metering Plan which also specifies submittal details.

3.4 Data Confidentiality

To address concerns regarding the confidentiality of pumping data, the raw data will remain confidential pursuant to Government Code 6254(e). These data will be maintained for use by the GSA, and only publicly available as aggregate values by water use sector (i.e., Agriculture, Municipal, and Recreation).

3.5 Enforcement and Penalties

The GSA's enforcement of compliance with the Metering Plan is imperative to ensure effective implementation. Pump owners who fail to comply with the Metering Plan or who provide inaccurate data to the GSA will be subject to penalties. Specific enforcement and penalties will be outlined in a Fees and Penalties Plan to be approved by the GSA.

Groundwater Extraction Metering Plan

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4 REFERENCES

Advisory Committee (AC) Agenda. 2017. Borrego Valley Groundwater Basin: Borrego Springs Subbasin. Sustainable Groundwater Management Act (SGMA). AC Meeting. November 27, 2017

Dudek. 2017. *Borrego Springs Subbasin, Draft Interim Monitoring Plan*. August 21, 2017.

DWR. 2016. *Best Management Practices for the Sustainable Groundwater Management of Groundwater – Monitoring Protocols, Standards, and Sites*. California Department of Water Resources, Sustainable Groundwater Management Program. December 2016.

Groundwater Extraction Metering Plan

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ATTACHMENT A
*Groundwater Extraction Facility
Registration Form*

Groundwater Extraction Facility Registration Form

Owner Information

Contact Name _____
Business Name _____
Farm/Entity _____
Address _____
City/State/Zip _____
Phone No. _____
Email Address _____

Operator Information (if different than above)

Contact Name _____
Business Name _____
Address _____
City/State/Zip _____
Phone No. _____
Email Address _____

Well Information

Owner's Well Name/No. _____
Well Location/Address _____
Public Land Survey Location; Township _____ Range _____ Section _____
GPS Coordinates; Latitude _____ Longitude _____
State Well No. (SWN) _____
State Well ID _____

Additional Well Information

County Well Permit No. _____
Date Drilled _____
Well Depth _____ feet
Casing Diameter _____ inches
Perforations _____ feet from ground surface

Groundwater Extraction Facility Registration Form

Motor Type: Submersible or Turbine (*circle one*)

Motor/Engine _____ HP

Existing Water Meter: Yes or No (*circle one*)

Manufacturer of Water Meter _____

Water Meter Size _____ inches

Water Flow Meter (state what flowmeter reads in: acre-feet (AF), gallons, cubic feet (CF))

Serial No. of Water Meter _____

Electric Meter No. _____

Assessor's Parcel No. (APN) _____

Hydrogeologic Data (If any of the below data are available, check box and please provide documentation.)

- Driller Well Completion Report Available
- Groundwater Quality Data Available
- Groundwater Level Data Available
- Geologist Log Available
- Aquifer Test Data Available
- Geophysical (E-log) Available

Well Water Use Type

- Agricultural/Irrigation (*list number of acres and crop category(ies)*) _____
- Stock Watering (*number and type of animals*) _____
- Domestic (*number of persons served*) _____
- Municipal or Industrial _____
- Other (*describe*) _____

Groundwater Extraction Facility Registration Form

Property Access for Meter Readings and Groundwater Level Monitoring

Please provide your printed name and signature to allow for monthly meter readings and approximately semi-annual groundwater level monitoring.

Contact information for property access notification:

Contact Name _____

Phone No. _____

Email Address _____

Signature _____ **Date** _____

Are additional active or inactive well located on the property? If so, provide number of well:

Number of Active Wells _____

Number of Inactive Wells _____

Please complete a separate Groundwater Extraction Facility Registration Form for each additional active well.

ATTACHMENT B
Example Data Submittal Format

**BORREGO VALLEY GROUNDWATER SUSTAINABILITY AGENCY
ANNUAL
GROUNDWATER EXTRACATION STATEMENT**

Contact: _____ **Telephone:** _____
Well Operator: _____ **Email:** _____
Address: _____ **Usage/Acreage:** _____
City, State, Zip: _____ Please check box if your well(s) is/are used for domestic purposes
 (human or animal consumption) and delineate which well(s) by
 highlighting, circling, or "*" - noting which well (if more than 1).

Please carefully fill out the fields (1 - 10) in this form. You have well(s) within the Borrego Springs Subbasin. The Borrego Valley GSA requires that this form be completed, signed and submitted by each well owner and/or operator within 45 days of the due date. If this completed form and required payment is not received by the due date, Ordinance requires that the Borrego Valley GSA charge you interest at X% per month, as well as a late penalty assessed at X% per month.

State Well Number	Flow Meter Readings								
N W	Current	-	Previous	=	Difference	x	Mult	=	Extraction (Units)
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
									Gallons _____
									Acre-feet _____

**** PLEASE CALCULATE ACRE-FEET (AF) TO THE 3rd DECIMAL PLACE ****
 If you get 50.0019 AF, correct entry = 50.002 AF

Annual Pumping Allocation	Extraction Charge
Baseline Pumping Allocation _____ AF	_____ AF x \$X.00/AF = \$ _____
Pumping Allocation _____ % Reduction	Interest 1.5% x Months: + \$ _____
Available Pumping Allocation _____ AF	Late Penalty: + \$ _____
Actual Groundwater Extraction _____ AF	Overpumping Surcharge: + \$ _____
	(see rate breakdown below)
	TOTAL AMOUNT ENCLOSED = \$ _____
	Overpumping Surcharge Rates
	_____ AF @ \$X = \$ _____

Payment must be received within 45 days of the date the Annual Statement is issued by Borrego Valley GSA to avoid late penalties and interest.

I DECLARE under penalties of perjury that this groundwater extraction statement has been examined by me, and to the best of my knowledge and belief is a true, correct and complete statement.

Print Name: _____ Date: _____

Signature: _____

THIS STATEMENT IS NOT COMPLETE UNLESS ALL QUESTIONS ARE ANSWERED AND SIGNATURE PROVIDED.