California Department of Water Resources
Best Management Practices for the Sustainable Management of Groundwater

DRAFT
Groundwater Monitoring Protocols, Standards, and Sites Best Management Practice

California Department of Water Resources
Sustainable Groundwater Management Program
1416 Ninth Street
P.O. Box 942836
Sacramento, CA 94236-0001

www.water.ca.gov/groundwater

Groundwater Monitoring Protocols, Standards, and Sites
Best Management Practice

1. OBJECTIVE

The objective of this Best Management Practice (BMP) is to provide technical assistance on the development of Monitoring Protocols in accordance with Groundwater Sustainability Plan (GSP) Emergency Regulations (Regulations). Information provided in this BMP is meant to provide technical assistance and guidance to establish consistent data collection approach for each of the sustainability indicators.

This BMP includes the following sections:

1. Objective. A brief description of how and where monitoring protocols are required under SGMA and the overall objective of this BMP.
2. Use and Limitations. A brief description of the use and limitations of this BMP.
3. Monitoring Protocol Fundamentals. A description of the general approach and background of groundwater monitoring protocol.
4. Relationship of Monitoring Protocol to other BMPs. A description of how this BMP is connected with other BMPS.
5. Technical Assistance. Technical content of BMP providing guidance for regulatory sections.
6. Key Definitions. Descriptions of those definitions identified in the GSP Regulations, SGMA, or Basin Boundary Regulations.
7. Related Materials. References and other materials that provide supporting information related to the development of Groundwater Monitoring Protocol.

This BMP provides guidance to Groundwater Sustainability Agencies (GSAs) on groundwater monitoring protocols that provide accurate and reproducible data. The desired outcome of this BMP is for GSAs to adopt a set of sampling and measuring procedures that will yield similar data regardless of the monitoring personnel.

2. USE AND LIMITATIONS

BMPs developed by the Department are intended to provide technical guidance to GSAs and other stakeholders. Practices described in these BMPs do not replace or serve as a substitute for the GSP Regulations, nor do they create new requirements or obligations for GSAs or other stakeholders. While the use of BMPs is encouraged, adoption of BMPs does not guarantee that a GSP will be approved by the Department.

3. MONITORING PROTOCOL FUNDAMENTALS

Establishment of protocol or convention for the collection of data in support of demonstration of successful implementation of SGMA is essential and should be based on the best available scientific methods. The use of protocol that can be applied consistently across all basins within the state will provide for the collection of comparable data. Consistency of the data collection methods will reduce uncertainty in the comparison of data and provide for a more robust set of observations to facilitate communication within basins as well as between basins.

Providing a basic minimum technical standard for accuracy will provide quality data to support implementation of GSPs to meet sustainability goals.

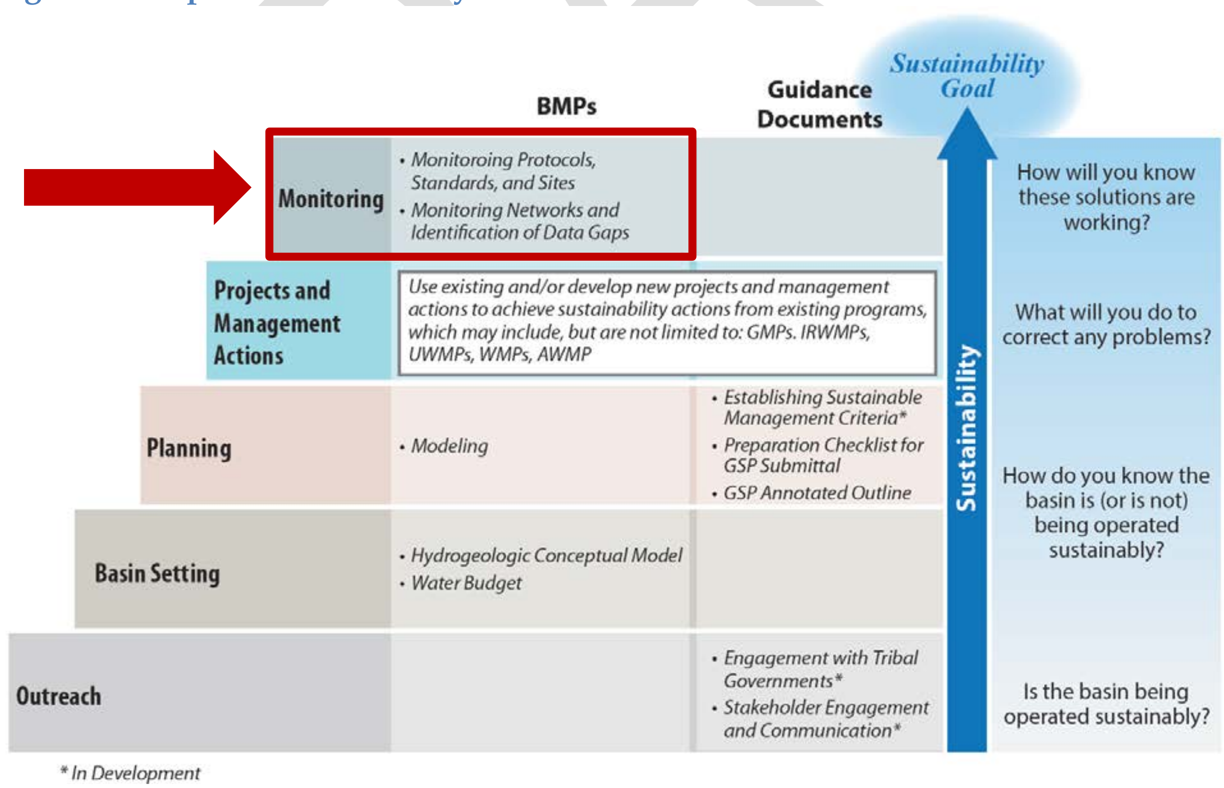
4. Relationship of Monitoring Protocol to other BMPs

Groundwater monitoring is a fundamental component of the SGMA as each GSP must include a sufficient network that provides the data that demonstrate the measured progress toward the achievement of the sustainability goal for each basin. For this reason, a standard set of protocols need to be developed and utilized to accomplish this fundamental component of SGMA.

Because the methods used to collect and report the data are fundamental to manage the basin and provide proof of sustainability, it is important that data is developed in a manner consistent with the basin setting, planning, and projects/management actions steps identified on **Figure 1** and the Regulations. The inclusion of monitoring protocols in the Regulations also emphasizes the importance of quality empirical data to support GSPs and provide comparable information from basin to basin.

Figure 1 provides an illustration as to how monitoring protocol is linked to other related BMPs. This figure also provides the context of the BMPs as they relate to various steps to sustainability as outlined in the regulations. The monitoring protocol BMP is part of the Monitoring development step in the regulations.

Figure 1 - Steps to Sustainability under SGMA



5. TECHNICAL ASSISTANCE

> *§ 352.2. Monitoring Protocols Each Plan shall include monitoring protocols adopted by the Agency for data collection and management, as follows:*
> *(a) Monitoring protocols shall be developed according to best management practices.*
> *(b) The Agency may rely on monitoring protocols included as part of the best management practices developed by the Department, or may adopt similar monitoring protocols that will yield comparable data.*
> *(c) Monitoring protocols shall be reviewed at least every five years as part of the periodic evaluation of the Plan, and modified as necessary.*

The Regulations specifically call out the need to utilize protocols identified in this BMP or develop similar protocols. The following technical protocols provide guidance based upon existing professional standards and are commonly adopted in various groundwater related programs. The intent of these protocols is to provide clear techniques that yield quality data for use in the various components of the GSP. These protocols can be further elaborated on by individual GSAs in the form of standard operating procedure which reflect specific local requirements as they may relate to local conditions.

PROTOCOLS FOR ESTABLISHING MONITORING SITES

The protocol for establishment of monitoring sites should be evaluated in conjunction with the Monitoring Network and Identification of Data Gaps BMP, but in general some specific protocols can be applied and are described below.

- Monitoring locations should be established with clear long term access agreements in place. Each location should be accessible year round to address any need for increased monitoring frequency.
- Each monitoring location must have a unique identifier developed with a general written description of the location, date established, access concerns and point of contact (if necessary), type of information to be collected, latitude, longitude, and elevation.
  - Each monitoring location should also track all modifications to the site in a modification log.
- Where wells are being installed, the following should be performed:
  - Log borehole cuttings under the supervision of a California Professional Geologist. Where possible collection of samples in chip trays will aid in developing comparative analysis tools within the basin.

- Develop written criteria for logging of borehole cuttings for comparison to known geologic formations, principal aquifers and aquitards/aquicludes, or specific marker beds.
- Conduct borehole geophysical surveys of resistivity, spontaneous potential, spectral gamma, or other method as appropriate for the conditions. A caliper log should also be performed to evaluate borehole diameter.
- Prepare and submit state well completion report, include geophysical logs, detailed geologic log, and formation identification as attachment.

PROTOCOLS FOR MEASURING GROUNDWATER LEVELS

Groundwater level measuring protocols should ensure that:

- Groundwater level data are taken from the correct location, including well id, screen interval depth.
- Groundwater level data are accurate and reproducible
- Groundwater level data represent conditions that inform appropriate basin management
- All salient information is recorded to normalize, if necessary, and compare data
- Data are handled in a way that preserves data integrity

The following BMPs must be incorporated into a GSP's monitoring protocols for collecting groundwater elevation data. A GSP that adopts protocols that deviate from these BMPs must demonstrate that the adopted protocols will yield comparable data.

General Well Monitoring Information

- Groundwater elevations will form the basis of basin-wide piezometric maps, and should approximate conditions at a specific point in time. Therefore, all groundwater levels in a basin should be collected within as short a time as possible, preferably within a few days.
- Each well used for measuring groundwater levels must have a unique identifier. This identifier must appear on the well housing or the well casing to avoid confusion.
- Depth to groundwater must be measured relative to an established Reference Point (RP) on the well casing. The RP is usually identified with a permanent marker, paint spot, or a notch in the lip of the well casing. By convention in open casing monitoring wells, the RP reference point is located on the north side of the well casing. If no mark is apparent, the person performing the measurement should measure the depth to groundwater from the north side of the top of the well casing.
- The elevation of the RP of each well must be surveyed by a license surveyor to the North American Vertical Datum of 1988 (NAVD88), or a local datum that can be converted to NAVD88. The elevation of the RP must be accurate to within 0.5 feet. It is preferable for the RP elevation to be accurate to 0.1 feet or less.
- The sampler should remove the appropriate cap, lid, or plug that covers the monitoring access point. For dedicated monitoring wells, this may entail removing the entire well cap. For irrigation wells or municipal wells, this may entail removing a plug or cap to an access port.
- Where the well has been tightly capped and is under pressure, the sampler should allow groundwater elevations to equilibrate to atmospheric conditions. This will take a variable amount of time based on well condition and aquifer properties.
- The sampler must use a measuring device capable of measuring depth to groundwater to an accuracy of 0.1 foot to obtain the depth to groundwater below the RP. It is preferable to measure depth to groundwater to an accuracy of 0.01 feet. Common measuring devices include electronic sounders and chalked steel survey tapes. Other measuring devices may provide similarly accurate data: each device should be assessed to ensure that the data are of sufficient accuracy to conform to the Emergency Regulations, and that the data are reproducible. Air lines and poppers generally do not provide depth to groundwater information at accuracy of 0.1 foot or better and therefore are not recommended for use as it relates to this BMP.
- The sampling device should be cleaned to avoid introducing oil or other contaminants into a well. If monitoring wells are part of a groundwater remediation program, the sampling device must be disinfected in accordance with the remediation program's sampling plan.

Measuring Groundwater Levels

- Measure depth to water in the well using procedures appropriate for the measuring device. All equipment must be operated and maintained in accordance with manufacturer's instructions.
    - For electrical sounders, lower the sounder probe into the well until an audio signal, light indicator, or meter deflection is noted. Note, or pinch with fingers, the location on the sounder cable that corresponds to the well RP. For sounders that are not marked in 0.01 ft. intervals, use an engineer's measuring tape, marked in decimal feet, to measure the distance from the above-noted sounder cable location to the nearest mark on the cable, and calculate the depth to water. In situations where the electrical sounder is marked in 0.01' intervals, using an engineer's measuring tape is not necessary.
    - For steel tapes, coat the lower 5 to 10 feet of tape with carpenters chalk. Lower the tape into the well until the bottom 1 to 2 feet of tape is submerged and an even foot mark is at the elevation of the RP. Historic depth to water readings in the well will give you an idea of the approximate groundwater level in a particular well. By lowering the tape slowly in intervals of approximately 2 to 3 feet, the contact of the tape's weight with the water's surface can often be heard. For wells with deep water levels, it may be necessary to approximately know the depth to water, or to make several measurement attempts to ensure that the tape is submerged within its chalked length and a representative water mark is observed. Record the whole foot mark held at the RP, then slowly reel the tape in until the start of wetted tape is observed, as indicated by wet chalk. Record the measurement where the wetted tape began (i.e., the length of wetted tape, as indicated by wet chalk). The depth to water is determined by subtracting the length of wet tape from the total length of tape lowered into the well below the RP.
- For measuring wells that are under pressure, allow a period approximately 10 minutes for the water levels to stabilize. After allowing for equalization of pressure differential, collect and note an initial depth to water measurement, the sampler should obtain a second depth to water measurement to ensure that the groundwater elevation has equilibrated to atmospheric conditions, and has not changed from the first reading. If the depth to water has changed by more than 0.1 feet, the sampler should continue to take measurements until the depth to water varies by less than 0.1 feet between successive measurements. Every effort should be made to ensure that a representative stable depth to groundwater is recorded. If a well does not stabilize, the quality of the value should be noted indicating the measurement is questionable.

- The sampler should calculate the groundwater elevation as:

$$GWE = RPE - DTW$$

  Where:
  GWE = Groundwater Elevation
  RPE = Reference Point Elevation
  DTW = Depth to Water
  The sampler must ensure that all measurements are in consistent units of feet, tenths of feet, and hundredths of feet. Measurements and RPEs should not be recorded in feet and inches.

<u>Recording Groundwater Levels</u>

- The sampler should record the well identifier, date, time (24-hour format), RPE, height of RP above or below ground surface, DTW, GWE, and comments regarding any factors that may influence the depth to water readings such as weather, nearby irrigation, flooding, or well condition. If there is a questionable measurement or the measurement can't be obtained, it should be noted. An example of a field sheet with the required information is shown below. It includes questionable measurement and no measurement codes that should be noted.
- The sampler should replace any well caps or plugs, and lock any well buildings or covers.
- All data should be entered into the GSA data management system (DMS) as soon as possible. Care should be taken to avoid data entry mistakes and the entries should be checked by a second person.

STATE OF CALIFORNA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WELL DATA

STATE WELL NUMBER	COUNTY	REFERENCE POINT ELEV.	MEASURING AGENCY
			DWR

NO MEASUREMENT	QUESTIONABLE MEASUREMENT
0. Measurement discontinued	0. Caved or deepened
1. Pumping	1. Pumping
2. Pump house locked	2. Nearby pump operating
3. Tape hung up	3. Casing leaky or wet
4. Can't get tape in casing	4. Pumped recently
5. Unable to locate well	5. Air or pressure gauge measurement
6. Well has been destroyed	6. Other
7. Special	7. Recharge operation at or nearby well
8. Casing leaky or wet	8. Oil in casing
9. Temporarily inaccessible	

DATE	N M	Q M	TAPE AT RP	TAPE AT WS	RP to WS	OBSR VR	COMMENTS

DWR 1213

Pressure Transducers

Groundwater elevations may be recorded using pressure transducers equipped with data loggers that are permanently installed in monitoring wells. When installing such pressure transducers, care must be exercised to ensure that the data recorded by the transducers is confirmed with hand measurements. The following general protocols must be followed when installing a pressure transducer in a monitoring well.

- The sampler must use an electronic sounder or chalked steel tape and follow the protocols listed above to calculate the groundwater elevation in the monitoring well.
- The sampler must note the well identifier, the associated transducer serial number, transducer range, transducer accuracy, and cable serial number.
- The transducer range is the length of water column above the submerged transducer that it is capable of reading. This is determined by the highest and the lowest groundwater levels recorded in the well. The transducer should be set in the well below the lowest recorded water level and have the capability to measure the pressure of the highest recorded water level. Transducer range is given in pounds per square inch (psi). The sampler should convert these to feet using the formula:

  $$Range_{Feet} = 2.31 \times Range_{PSI}$$

  Transducer accuracy is often given in percentage. The sampler should convert these to feet using the formula:

  $$Accuracy_{Feet} = \frac{Range_{Feet} \times Range_{Percentage}}{100}$$

  Transducers with an accuracy of greater than 0.1 feet should not be used.
- The sampler must note whether the pressure transducer uses a vented or non-vented cable for barometric compensation. Vented cables are preferred.
- The sampler must estimate likely or anticipated groundwater level fluctuations. The depth of the selected transducer must be greater than the lowest anticipated groundwater elevation, as noted above.
- The sampler must set the correct transducer conversion factors, including factors such as range, linearity, and offset for proper conversion of electric signal to feet of water.
- The sampler should set and note in the field notes if the transducer is reporting depth to water or groundwater elevation.
- The sampler should check the accuracy of the transducer and the conversion factors using the following procedure:
  - Lower the transducer into the well until it is submerged to approximately half its full range. For example, a 100 PSI transducer (231-foot range) should be submerged under approximately 115 feet of water.

    - Record the depth to water transmitted by the transducer.
    - To validate the transducer functionality:
        - Using a measuring tape position, raise the cable and transducer 1.00 ft.
        - Record the depth to water transmitted by the transducer and verify that it is 1.00 ft. higher.
        - Lower the cable 2.00 feet, so the transducer is one foot below its original position.
        - Record the depth to water transmitted by the transducer and verify that it is 1.00 ft. lower.
        - Each measurement should be within about 0.02 ft. of the 1.00 ft. raising and lowering increments.
- Measure the cable length for placing the transducer at the correct depth. The depth of the transducer below the water surface can also be checked by reading the transducer. The transducer should be positioned so that it is below the lowest expected water level, but not so low that the transducer range cannot account for the highest expected water level. If this can't be accomplished, a transducer with a greater range and longer cable is required. However, if the accuracy of the readings exceed 0.1 ft. due to a high range of water levels and required transducer pressure range, a transducer may not be practical for this particular monitoring well.
- Secure the cable to the well head with a well dock or another reliable method. Mark the cable at the elevation of the reference point with tape or an indelible marker. This will allow estimates of future cable slippage.
- Re-measure the depth to water with a steel or electric tape. The transducer cable may stretch when it is installed (particularly new cables which have been on a spool for a length of time), and the transducer reading may not match the hand measured reading. Either re-position the transducer, or set the correct reference depth in data logger. In some cases, stretch in the cable may take over night to equilibrate. In this case, the transducer will need to be reset the following day.
- The transducer data should periodically be checked against hand measured data to monitor electronic drift or cable movement. This should be happen during routine site visits.
- Follow manufacture specifications for data storage capacity to ensure data downloads are performed prior to filling. Each time data downloads are performed a check of the depth measurement should be performed and evaluation of the data logger software specifically date and time.
- The data should be downloaded a minimum of two times per year and entered into the basin's DMS as soon as possible. The downloaded data should be graphed and analyzed to look for any anomalies or unexplained drift in data.

Data collected with non-vented data logger cables should be barometrically compensated. After the sampler is confident that the transducer data have been safely downloaded and stored, the data should be deleted from the data logger to ensure that adequate data logger memory remains.

PROTOCOLS FOR SAMPLING GROUNDWATER QUALITY

The following BMPs must be incorporated into a GSP's monitoring protocols for collecting groundwater quality data. More detailed sampling procedures and protocols are included in the standards and guidance documents listed at the end of this BMP. A GSP that adopts protocols that deviate from these BMPs must demonstrate that the adopted protocols will yield comparable data.

Groundwater sampling procedures should attempt to replicate the sampling and analysis methods of other groundwater quality in the basin's DMS. For example, if groundwater quality data in the DMS are derived from municipal well reports to the California Division of Drinking Water, the groundwater sampling protocols should replicate the sampling procedures and analysis methods used for drinking water quality reporting.

As part of compliance it may be necessary to collect additional samples for various water quality analyses. All analyses should be performed by a State certified Environmental Laboratory Accreditation Program. The specific analytical methods are beyond the scope of this BMP, but should be commiserate with other programs evaluating water quality within the basin for comparative purposes.

Groundwater quality sampling protocols should ensure that:

- Groundwater quality data are taken from the correct location
- Groundwater quality data are accurate and reproducible
- Groundwater quality data represent conditions that inform appropriate basin management
- All salient information is recorded to normalize, if necessary, and compare data
- Data are handled in a way that preserves data integrity

Standardized protocols include the following:

- Prior to sampling, the sampler must contact the 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.
- Samples should be collected at or near the wellhead. Samples should not be collected from storage tanks, at the end of long pipe runs, or after any water treatment.
- The sampler should clean the sampling port and/or sampling equipment and the sampling port and/or sampling equipment must be free of any contaminants.
- The sampler must decontaminate any sampling equipment used at multiple well sites to avoid cross-contamination between samples.
- The groundwater elevation in the well should be measured, following appropriate protocols.
- For any well not equipped with low-flow or passive sampling equipment, an adequate volume of water must be purged from the well to ensure that the groundwater sample represents native groundwater. Purging three to five well casing volumes is generally considered adequate. If pumping causes a well to be evacuated (go dry), it is not necessary to continue purging.
- The pH and electrical conductivity of the purging groundwater should stabilize before sampling. Stabilization occurs when, for at least three consecutive measurements, the pH remains constant within 0.1 Standard Unit (SU) and specific conductance varies no more than approximately 3 percent. Measurements of pH should only be measured in the field, lab analysis are typically unachievable due to short hold times. Other parameters, such as; oxidation-reduction potential (ORP), dissolved oxygen (DO) (in situ measurements preferable), or turbidity, may also be used as a purge adequacy parameter. All field instruments should be calibrated daily and evaluated for drift throughout the day.
- Sample containers should be labeled prior to sample collection. The sample label must include: the sample date, sample time, sample location, and sample constituents.
- Samples should be collected under laminar flow conditions. This may require reducing pumping rates prior to sample collection.
- Samples should be collected according to appropriate standards such as those listed in the *Standard Methods for the Examination of Water and Wastewater* or other appropriate guidance. The specific sample collection procedure should reflect the type of analysis to be performed.

- All samples requiring preservation must be preserved as soon as practically possible, ideally at the time of sample collection. Assure that, samples are appropriately filtered as recommended for the specific analyte. Entrained solids can be dissolved by preservative leading to inconsistent results of dissolve analytes. Specifically, samples to be analyzed for metals should be field filtered prior to preservation; do not collect an unfiltered sample in preserved container.
- Samples should be chilled to 4 °C to prevent degradation, as necessary. The laboratory's Quality Assurance Management Plan should detail appropriate chilling and shipping requirements.
- Samples must be shipped under chain of custody documentation to the appropriate laboratory promptly to avoid violating holding time restrictions.
- The sampler must record the sample location, sample date, sample time, number and type of sample containers, and any other pertinent data in a sampling log.
- Instruct laboratory to use reporting limits that are equal or less than the applicable water quality objectives/screening levels.

Special protocols for low-flow sampling equipment

In addition to the protocols listed above, sampling using low-flow sample equipment should adopt the following protocols derived from EPA's *Low-flow (minimal drawdown) ground-water sampling procedures* (Puls and Barcelona, 1996). These protocols apply to low-flow sampling equipment that generally pumps between 0.1 and 0.5 liters per minute. These protocols are not intended for bailers.

Special protocols for passive sampling equipment

In addition to the protocols listed above, passive diffusion samplers should follow protocols set forth in USGS Fact Sheet 088-00.

PROTOCOLS FOR MONITORING SEAWATER INTRUSION

Monitoring seawater intrusion requires analysis of the chloride concentrations within groundwater of each principal aquifer. While no significant standardized approach exists, the methodologies described above for degraded water quality can be applied for the collection of groundwater samples. In addition to the protocol described above, the following protocols should be followed:

- Water quality samples will be collected and analyzed at least semi-annually. Samples will be analyzed for dissolved chloride at a minimum. In areas of high groundwater extraction more frequent sampling may be necessary.
  - The development of surrogate measures of chloride concentration may facilitate cost-effective means to monitor more frequently to observe the

range of conditions and variability of the flow dynamics controlling seawater intrusion.
- Water levels will be collected at a frequency adequate to characterize changes in head in the vicinity of the leading edge of degraded water quality. Frequency may need to be increased in areas of known preferential pathways, groundwater pumping, or efficacy evaluation of mitigation projects.

The use of geophysical surveys, electrical resistivity, or other methods, may provide for identification of preferential pathways and optimize monitoring well placement.

PROTOCOLS FOR MEASURING STREAMFLOW

All streamflow measurements should be collected, analyzed, and reported in accordance with the procedures outlined in USGS Water Supply Paper 2175, *Volume 1. - Measurement of Stage Discharge* and *Volume 2. - Computation of Discharge.*

PROTOCOLS FOR MEASURING SUBSIDENCE

Evaluating and monitoring inelastic land subsidence can utilize multiple data sources with increasing complexity to evaluate the specific conditions and associated causes. To the extent possible, the use of existing data should be collected and analyzed. Subsidence can be estimated from numerous techniques, including level surveying tied to known stable benchmarks or benchmarks located outside the area being studied for possible subsidence, installing and tracking changes in borehole extensometers, obtaining data from continuous GPS (CGPS) locations, static GPS surveys or Real-Time-Kinematic (RTK) surveys, or analyzing Interferometric Synthetic Aperture Radar (InSAR) data. No standard procedures exist for collecting data from the potential subsidence monitoring approaches, however, an approach may include:
- Identification of land subsidence conditions
    - Evaluate existing regional long-term levelling surveys of regional infrastructure, i.e. roadways, railroads, canals, and levees.
    - Inspect existing County and State well records where collapse has been noted for well repairs or replacement.
    - Identify potential for land subsidence by evaluation of geologic logs and the hydrogeologic conceptual model to determine if significant fine grained layers exist such that could suggest the potential for collapse of the units should significant depressurization occur.
    - Collect regional remote-sensing information such as InSAR, commonly provided by USGS and NASA. Data availability is limited currently, but future resources are being developed.

- Monitor regions of suspected subsidence where potential exists
    - Establish CGPS network to evaluate changes in land surface elevation, or
    - Establish leveling surveys transects to observe changes in land surface elevation, or
    - Establish extensometer network to observe land subsidence.

Various standards and guidance documents that must be adhered to when collecting data from the various approaches include:

- Levelling surveys must follow surveying standards set out in the California Department of Transportation's *Caltrans surveys Manual*.
- GPS surveys must follow surveying standards set out in the California Department of Transportation's *Caltrans surveys Manual*.
- The USGS has been performing subsidence surveys within several areas of California. These studies are sound examples for appropriate methods and should be utilized to the extent possible and where available:
    - http://ca.water.usgs.gov/land_subsidence/california-subsidence-measuring.html
- Instruments installed in borehole extensometers must follow the manufacturer's instructions for installation, care, and calibration.
- Availability of InSAR data is improving and will increase as programs are developed. This method requires expertise in analysis of the raw data and will likely be made available as an interpretative report for specific regions.

6. KEY DEFINITIONS

IMPORTANT DEFINITIONS

§ 351 (h) "Best available science" refers to the use of sufficient and credible information and data, specific to the decision being made and the time frame available for making that decision, that is consistent with scientific and engineering professional standards of practice.

§ 351 (i) "Best management practice" refers to a practice, or combination of practices, that are designed to achieve sustainable groundwater management and have been determined to be technologically and economically effective, practicable, and based on best available science.

SGMA REFERENCE

§ 10727.2. REQUIRED PLAN ELEMENTS (f) Monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin. The monitoring protocols shall be designed to generate information that promotes efficient and effective groundwater management.

GSP REFERENCE

§ 352.2. Monitoring Protocols
Each Plan shall include monitoring protocols adopted by the Agency for data collection and management, as follows:

(a) Monitoring protocols shall be developed according to best management practices.

(b) The Agency may rely on monitoring protocols included as part of the best management practices developed by the Department, or may adopt similar monitoring protocols that will yield comparable data.

(c) Monitoring protocols shall be reviewed at least every five years as part of the periodic evaluation of the Plan, and modified as necessary.

7. Related Materials

CASE STUDIES

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