Attachment 5. Work Plan

Work Plan Purpose and Target Objectives

The primary purpose of the proposed work plan is to expand the District's current groundwater monitoring network to better delineate factors that currently, and may in the future, limit groundwater use for both its conjunctive use program and for local communities (including Disadvantaged Communities) that rely on groundwater through small water systems. The proposed work will support long-range water supply planning, including expanded conjunctive management of surface and groundwater resources as described in this application.

The target objectives of the work plan are to obtain additional, zone-specific groundwater level and water quality data where data gaps exist, especially in the deeper portion of the aquifer system. The data will be made available to regional water supply entities including member agencies of the East County Water Management Association, the state Department of Water Resources, such as through the CASGEM program, and the general public. The data are needed to improve the understanding of present groundwater conditions and establish a baseline against which to assess the response of the aquifer system to future groundwater withdrawals. It is also a goal of the work to obtain additional geologic information to be used in updating cross sections through the subbasin prepared in a 1999 groundwater resources investigation (LSCE) and specifically for future use in calculating safe yield for the portion of the Tracy subbasin that underlies the east County area.

Sites selected for exploration and expanded monitoring are targeted to address specific technical issues to be accomplished through the work plan. Each monitoring facility will be constructed and equipped to meet the individual data requirements for each site in support of the overall project purpose. The proposed sites and target objectives are outlined below:

> ***Bethel Island (M-26)*:** Well M-26 is the primary source of drinking water for approximately 25 residences in a small Disadvantaged Community on the northeast corner of Bethel Island. Groundwater produced by this well is of poor quality, primarily due to naturally high arsenic levels, typically ranging from 29 to 33 ug/L, which is above the drinking water MCL of 10 ug/L. The California Department of Public Health has ordered treatment of the water, or that a new source of water be identified for this community. The prohibitively high cost of treatment, or replacing the supply via a pipeline from another source, represents a significant hardship to the community, limiting its ability to comply with the CDPH order.
>
> *Target Objectives: Investigate the occurrence and quality of groundwater in the deeper portion of the aquifer system at this location as a potential replacement drinking water source. Also, provide water level and quality data at the northeastern extent of the District's sphere of influence and GWMP plan area where no monitoring is presently conducted.*

Actions: The monitoring facility at this location is projected to consist of two 2-inch piezometers completed in a single borehole. Screened intervals will be selected based on test hole lithologic samples and a geophysical log. Screens will be located within distinct water-bearing units between 270 and 400 feet, which are deeper than the existing supply well with high arsenic and within zones known to have favorable water quality in other areas of the District. Both monitoring well piezometers and the existing production well will be sampled following well development and equipped with pressure transducers.

Diablo Water District Corporation Yard: The District's Corporation Yard is located in the northern portion of the District where limited lithologic and groundwater data is currently available. At this site, the District's Corporation Yard Well was decommissioned due to high and increasing dissolved mineral content. It is completed in shallow to intermediate aquifer units (see **Attachment 4**) and has a total depth of 165 feet. The well currently serves as an emergency well for the District's water system.

The occurrence and source of groundwater degradation is unknown for this site, although evaporation ponds used historically by the adjacent wastewater plant may be a source of past salt loading. The conditions at the site pose a constraint on ultimate development of its conjunctive use program in the absence of an understanding of the degradation mechanisms for groundwater at the site. Through test hole drilling, geophysical logging, and monitoring well installation, the District seeks to characterize the conditions that affect groundwater quality at this location and vicinity.

Water quality test data for samples taken from the Corporation well in 1997 and 2008 show degradation over that 10 year span (**Table 5-1**):

Table 5-1. Summary of Water Quality Results for Corporation Yard Well

Constituent	Units	12/8/1997	6/18/2008
Arsenic	ug/L	< 2	4.5
Hardness (Total)	mg/L	516	740
Manganese	ug/L	62	400
Sodium	mg/L	150	190
Specific Conductance	µmhos/cm	1,780	2,400
Total Dissolved Solids (TDS)	mg/L	1,020	-

The District has considered expanding its conjunctive use program to include groundwater produced at the Corporation Yard site. The location will provide good spacing to minimize mutual interference from groundwater supply wells and existing infrastructure could be utilized to connect the source to the District's water supply system. While the poor quality of groundwater in the existing well limits water supply from the shallow to intermediate zones at the site, a lithologic log in the area indicates the presence of a thick sand unit from approximately 220 to 320 feet that may extend into the Corporation Yard vicinity. This zone may represent a source of better quality

groundwater to expand the District's conjunctive use program. A combination test-hole/monitoring facility constructed at the Corporation Yard site will provide valuable information necessary to investigate the existence and extent (vertical) of apparent groundwater degradation and the potential for expanded groundwater production from the deeper aquifer system (> 200 feet) at this site.

Target Objectives: Investigate the occurrence, extent, and possible source of groundwater degradation at this site and the potential for expanded conjunctive management by producing additional groundwater from the deeper portion of the aquifer at this location.

Actions: The monitoring facility at this location will consist of two 2-inch piezometers completed in a single borehole along with and the existing production well. Screened intervals will be selected based on test hole lithologic samples and a geophysical log. Screens will be located within distinct water-bearing units between 200 and 400 feet. Both monitoring well piezometers and the existing production well will be sampled following well development and equipped with pressure transducers. The pressure transducer installed in the existing production well will also measure specific conductivity on a regular interval to assess possible seasonal variations in dissolved solids.

Future High School Site: This site is located on the boundary between Diablo Water District and the City of Brentwood. In the District's 2011 groundwater conditions report, it was noted that TDS and chloride in City of Brentwood wells located southwest of the District's production wells have increased. If these observations indicate a trend, they may ultimately limit and adversely impact the District's conjunctive use project. A factor that will be investigated at this site is the infiltration of treated wastewater released to Marsh Creek by the City of Brentwood upstream of the District's wells. The proposed monitoring facility will include a shallow piezometer completed in the water table aquifer that is hydraulically connected with the creek. The District has obtained written consent (**Appendix 5-1**) from the Oakley School District to construct a monitoring facility at the northwestern corner of the future high school site located on the eastern bank of Marsh Creek at the southern boundary of the District's sphere of influence.

Target Objectives: A monitoring facility at this location will be designed to 1) identify groundwater degradation that may affect the District's production wells, 2) analyze groundwater surface water interactions to determine the potential for infiltration from the Creek to influence groundwater quality in aquifers tapped for water supply in the area (both in small domestic wells and the District's conjunctive use wells), 3) investigate the potential for an additional production well at this location, and 4) as an educational resource for future science classes at the High School.

Actions: The monitoring facility at this location will consist of three two-inch piezometers completed in a single borehole and a separate single 2-inch piezometer next to Marsh

Creek. Screened intervals will be selected based on test hole lithologic samples and a geophysical log. Screens will be located in distinct water-bearing units between 150 and 400 feet to monitor conditions in the intermediate and deep aquifer systems. The single completion monitoring well will be completed just below the base of Marsh Creek and is intended to capture creek water levels and the quality of water potentially recharging the deeper aquifer system. Both monitoring wells and the existing production well will be sampled following well development and equipped with pressure transducers. The transducer installed in the single shallow monitoring well will also measure specific conductivity to assess possible salt loading in the shallower aquifer unit.

Baldocchi Property: A significant gap in available hydrogeologic data exists in the area between the District's Stonecreek production well and a standby production well at the South Park site. Filling this data gap will enable the District to more effectively monitoring the primary production aquifer tapped for its conjunctive use program and therefore aid the District's ability to make informed management decisions. Geologically, this area represents the transition between two depositional environments; the eolian/alluvial Marginal Delta Dunes and fluvial Delta Islands environments (see **Attachment 4**). This is also a zone of potential degrading water quality. Groundwater quality at the District's Glen Park and Stonecreek production wells is favorable for municipal supply purposes, while the South Park standby well exhibits manganese concentrations that exceed the state drinking water standard. In an effort to close this data gap, the District has identified the an open field formerly used for agriculture as a location for additional data collection and monitoring. The District has a cooperative relationship with the property owner who has given verbal consent to the District's use of a portion of the property.

Target Objectives: A monitoring location at the Baldocchi Property will serve to 1) better define the relationship between two depositional environments, 2) the extent and character of primary water supply aquifer units, 3) the nature of transition between favorable to poorer groundwater quality in the area, and 4) aquifer response to the District's current groundwater production.

Actions: The monitoring facility at this location will consist of one 2-inch piezometer completed in the primary production aquifer (approximately 220 to 300 feet). The primary aquifer will be identified through lithologic samples and a geophysical log conducted in the test hole. The monitoring well will be sampled following well development and equipped with a pressure transducer. It should be noted that only a single monitoring well will be necessary since the target objectives for this site are related to production in the deep aquifer system under the District's conjunctive use program.

As indicated above, pressure transducers with data loggers will be installed in each completion of the new monitoring facilities (total of 9), plus the existing M-26 and Corporation Yard wells. Transducers installed in the shallow monitoring well at the High School Site and the Corporation

Yard well will have the added capability of measuring specific conductivity. Transducers will be programmed to collect 1 to 6 measurements per day (i.e., on 4 to 24 hour frequencies). Collection of these data will allow pumping impacts from existing municipal and other large-capacity wells to be quantified. The continuous nature of the transducer data will enable distinguishing seasonal influences and long-term trends. Periodic manual water level measurements will also be made for quality assurance of the transducer data. These will be performed monthly with transducer downloads conducted on a quarterly basis during the grant application period to ensure that the equipment is working properly. Quality assurance and quality control (QA/QC) protocols are specified for collection of water level data in this application.

Initial water quality samples will be collected from each monitoring well following construction and development activities. Samples will also be collected from the existing M-26 and Corporation Yard wells. Groundwater sampling methods will meet EPA guidelines and be delivered to a state/EPA certified laboratory to be analyzed for general minerals, general physical, and drinking water metals. Following an initial round of groundwater quality sampling, additional samples will be collected semi-annually. Only the first round of water quality sampling will be paid for with the grant. Subsequent sampling will be performed at the District's expense.

An existing database will be expanded to manage all data collected as part of this project. The database will include all manual and automated water level data along with water quality, construction, and reference point survey data for all wells in the monitoring program. Queries will be prepared to allow water level hydrographs and tables to be generated from the database. Procedures for periodically transmitting data to ECWMA member agencies and DWR will be part of database management performed by the District. At the conclusion of the proposed work, as-built drawings and a summary of construction activities will be prepared for each monitoring facility. A summary work performed under this grant application, including procedures for retrieving data and performing manual measurements, QA/QC of data, reporting, and data transfer will be included in the District's groundwater monitoring reports. These reports will be provided to the District and DWR for review and comment. Construction details and water level data collected for the new monitoring facilities will be added to the District's existing CASGEM Monitoring Plan (LSCE, 2012) and online reporting.

Work Plan

The proposed work plan will be administered, managed, and performed according to the following tasks:

Task 1 – Design and Installation of Monitoring Facilities

Work Item 1.1 – Finalize monitoring facility locations including access and egress, water for drilling, and disposition of cuttings. Preliminary verbal and/or written consent has been obtained for each proposed monitoring location where the District does not already own or have access to the land (i.e., at the Baldocchi and Future High School sites). The District will obtain access to the monitoring locations for the life of the facility. As part of this work item, the District will mark and survey facility locations and address any site specific conditions to be included in the construction subcontract (e.g., drilling rig access and disposal of drilling fluids and cuttings).

Work Item 1.2 – Preparation of construction specifications for use in bidding process. The District will prepare specifications providing detailed protocol for all aspects of the work including:

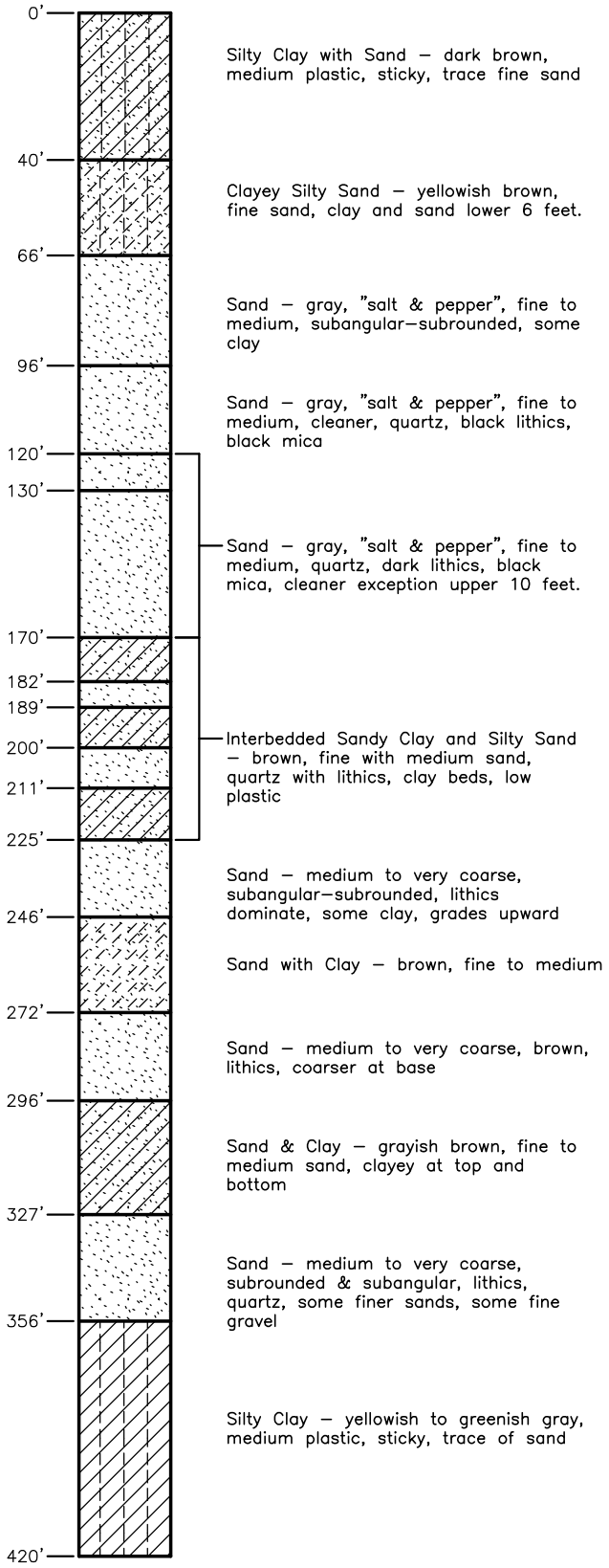
- Drilling fluid control;
- Materials to be incorporated in to the work;
- Methods for drilling and well installation;
- Criteria for acceptance;
- Formation sampling methods;
- Standards for geophysical logging;
- Control and prosecution of the work; and
- Requirements for well development.

Construction specifications will be incorporated into bidding and contract documents. A typical monitoring well profile based on conditions encountered at the District's Stonecreek well site is presented in **Figure 5-1**. Technical provisions for test hole drilling and monitoring well construction are discussed and included in **Attachment 8 Quality Assurance**.

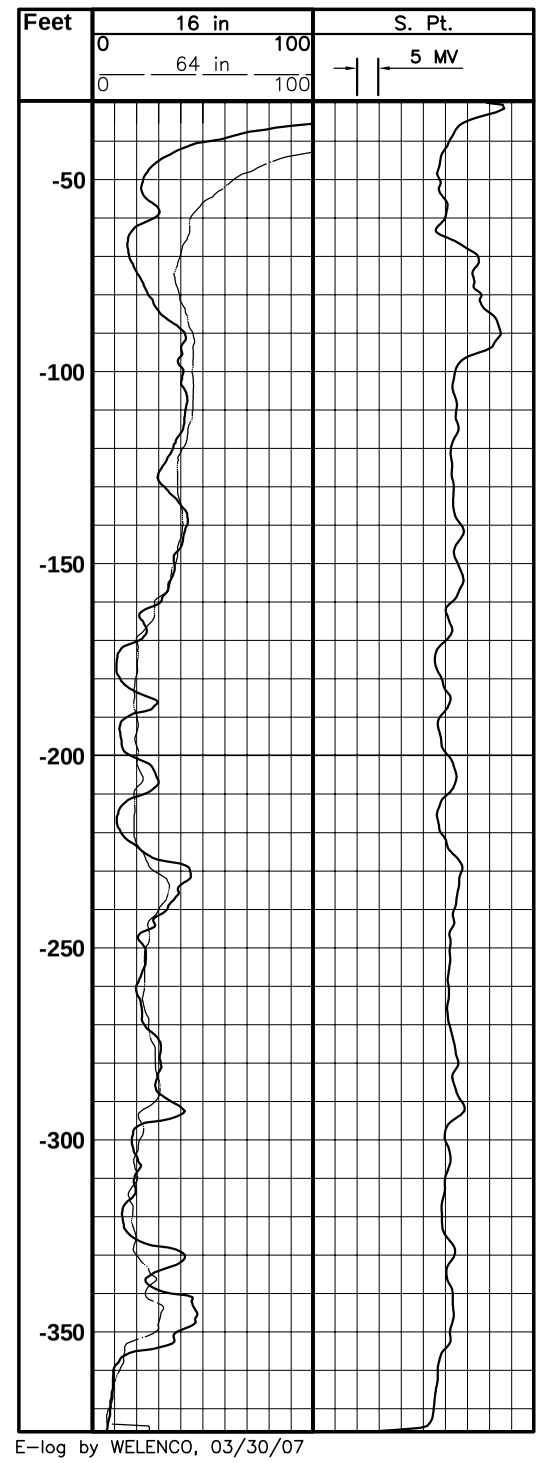
Work Item 1.3 – Bid solicitation and pre-construction services. The District's consultant will assist the District in soliciting competitive bids from qualified, licensed contractors. A pre-bid conference will be held to answer questions of prospective bidders to eliminate uncertainties regarding pending construction procedures and requirements. Following bid solicitation LSCE will evaluate the bids and provide a recommendation for contract award.

LSCE will review submittals required of the selected contractor, including the construction schedule, site plans, report forms, and list of supervisory personnel, to ensure the contractor's compliance with plans and specifications. A preconstruction conference, including site visitation, will be held with the selected contractor to review work schedules and site access, confirm the contractor's understanding of the intent of

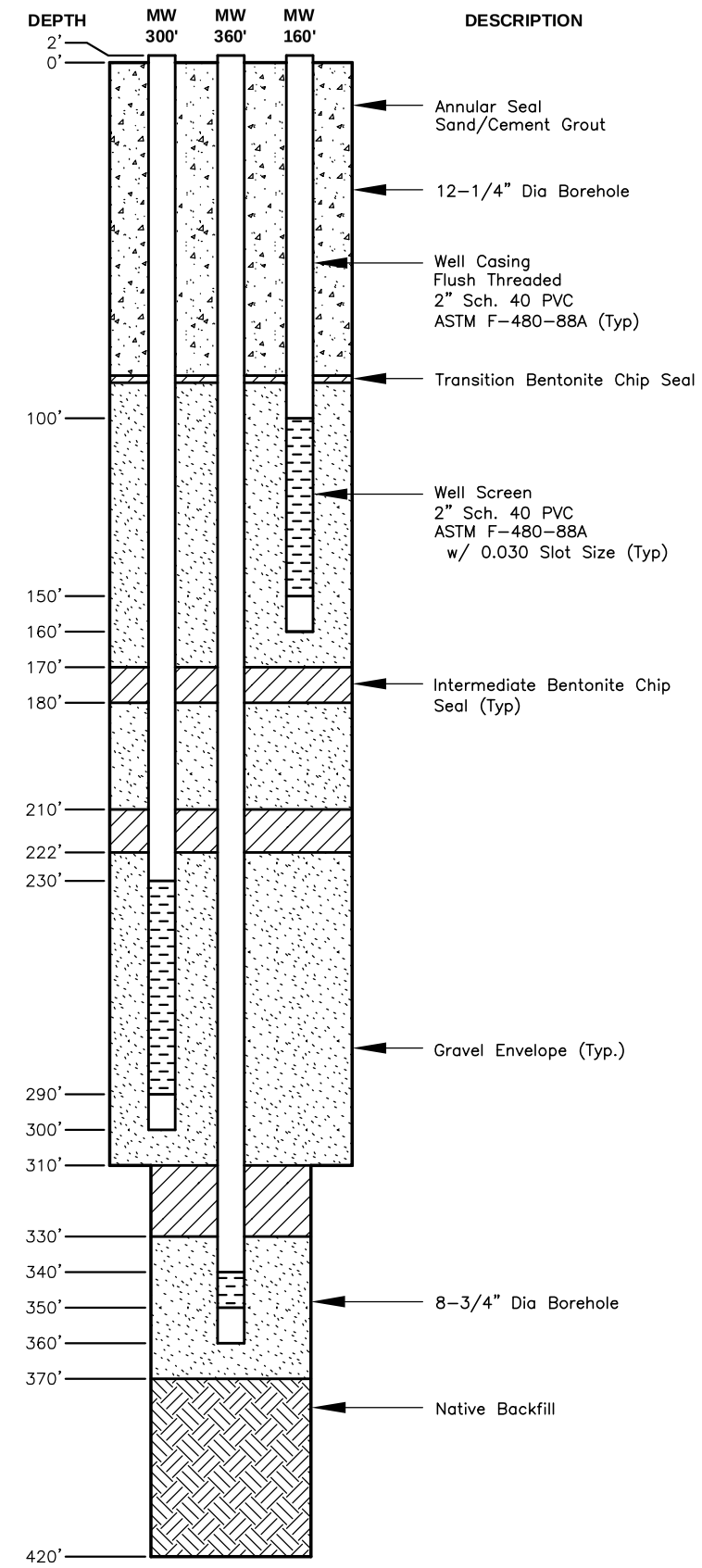
TEST HOLE LITHOLOGY (STONECREEK SITE)



TESTHOLE ELECTRIC LOG (STONECREEK SITE)



TYPICAL MONITORING WELL PROFILE



CAD FILE: G:/Projects/Diablo Water District/12–1–059/Typical Monitoring Well.dwg CFG FILE: LSCE2500.PCP_MRG DATE: 07–12–12 8:11am

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 5-1
Typical Monitoring Well Profile
Diablo Water District

the contract documents, and address any questions of the contractor prior to equipment arrival.

Assumptions: It is assumed under this task that the District will administer the contract with the selected drilling contractor.

Work Item 1.4 – The District's consultant will provide inspection services and provide oversight and quality assurance for the construction and development of the proposed monitoring facilities. A qualified inspector will assist in the layout of the monitoring facilities, help plan for any site specific construction/development requirements (as specified above), and oversee well construction and development activities. A geologist under the supervision of a registered senior professional will collect and describe drill cuttings, witness the geophysical well survey, and ensure submittal of necessary paperwork following monitoring well construction (e.g., DWR Well Completion Report).

Task 2 – Design and Installation of Monitoring Equipment

Work Item 2.1 - Design and purchase pressure transducers. A total of nine transducers will be purchased for the new multiple-completion monitoring well sites so that transducers could be installed in each of the completions. Two additional transducers will be purchased for installation in existing M-26 and Corporation Yard wells. Transducers purchased for the Corporation Yard well and shallow monitoring well at the High School site will have the added capability of measuring specific conductance.

Work Item 2.2 – Program, install, and calibrate pressure transducers. Calibration procedures consist of checking that recorded data match manual water level measurements and that the internal data logger clock is set accurately.

Task 3 – Groundwater Level and Quality Monitoring

Work Item 3.1 – Manual groundwater level monitoring. The initial monitoring round will be conducted at the time of transducer installation. Subsequent manual measurements will be made monthly under the District's existing groundwater monitoring program (see 2011 Groundwater Monitoring Report, **Appendix 4-3**).

Work Item 3.2 – Automated groundwater level monitoring and downloads. Transducers will be programmed to collect 1 to 6 measurements per day, or 4 to 24-hour frequency. The transducer data will be downloaded after one month as an initial QA/QC measure, and then quarterly for the duration of the project following installation (total of 7 downloads). Subsequent downloads will be at least semi-annual based on observed changes in groundwater conditions evident from the transducer readings. Manual water level measurements will be made at each download event to verify transducer data.

Work Item 3.3 – Groundwater quality sampling. An initial groundwater quality sample event will be conducted following construction and development of all of the new multi-completion monitoring wells. Water quality samples will be collected from each completion of the new multi-completion monitoring wells and the existing M-26 and Corporation Yard wells. Samples will be transferred directly from a test-pump sampling port into the appropriate container as specifically prepared by the laboratory for each type of analysis. The samples will be labeled and placed on ice and transported under chain-of-custody to a California/EPA certified laboratory.

Laboratory analyses will be conducted for general minerals, general physical, and drinking water metals. Electrical conductance, pH, and temperature will be measured in the field as a QA/QC measure. **Table 5-2** lists the analytical method, practical quantitation limit, sample containers, preservatives, and holding time for each parameter.

All sampling equipment will be decontaminated prior to sample collection and all field test equipment will be calibrated according to manufacturer's specifications.

Table 5-2. Analytical Methods for Groundwater Monitoring Well Samples

Parameter	Analytical Method	Quantitation Limit	Sample Container/Preservatives	Holding Times
TDS	EPA 160.1	10 mg/l	500 milliliter (ml) polyethylene, cool[1]	7 days
Nitrate as nitrogen	EPA 300.0	0.5 mg/l	500 ml, polyethylene cool[1]	2 days
Electrical conductance	EPA 120.1	10 µmhos/cm	500 ml, polyethylene cool[1]	28 days
pH	EPA 150.1	0.01 SU	500 ml, polyethylene cool[1]	1 day
Aluminum	EPA 6020/200.7	50 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Antimony	EPA 6020/200.8	6.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Arsenic	EPA 6020/200.8	2.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Barium	EPA 6020/200.7	100 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Beryllium	EPA 6020/200.8	1.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Cadmium	EPA 1638/200.8	1.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Boron	EPA 6020/200.7	100 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Chromium	EPA 6020/200.7	10 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Copper	EPA 6020/200.7	50 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Cyanide	EPA 9012A	100 µg/l	500-ml polyethylene, NaOH, pH < 14	14 days
Iron	EPA 6020/200.7	100 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Lead	EPA 6020/200.8	5.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Manganese	EPA 6020/200.7	10 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Mercury	EPA 245.2	1.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Nickel	EPA 6020/200.8	10 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Selenium	EPA 6020/200.8	5.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months

Parameter	Analytical Method	Quantitation Limit	Sample Container/Preservatives	Holding Times
Silver	EPA 6020/200.7	10 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Thallium	EPA 6020/200.8	1.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Vanadium	EPA 6020/200.8	3.0 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Zinc	EPA 6020/200.7	50 µg/l	1-liter polyethylene, HNO_3, pH < 2	6 months
Alkalinity (total) as $CaCO_3$	EPA 310.1	1.0 mg/l	1-liter polyethylene	14 days
Bicarbonate Alkalinity as $CaCO_3$	EPA 310.1	1.0 mg/l	1-liter polyethylene	14 days
Carbonate Alkalinity as $CaCO_3$	EPA 310.1	1.0 mg/l	1-liter polyethylene	14 days
Hydroxide Alkalinity as $CaCO_3$	EPA 310.1	1.0 mg/l	1-liter polyethylene	14 days
Calcium	EPA 200.7	1.0 mg/l	1-liter polyethylene	6 months
Chloride	EPA 300	0.25 mg/l	1-liter polyethylene	28 days
Fluoride	EPA 300	0.1 mg/l	1-liter polyethylene	28 days
Foaming Agents (MBAS)	EPA 425.1	0.5 mg/l	1-liter polyethylene	2 days
Hardness (Total) AS $CACO_3$	EPA 200.7	1.0 mg/l	1-liter polyethylene	6 months
Magnesium	EPA 200.7	1.0 mg/l	1-liter polyethylene	6 months
Potassium	EPA 200.7	1.0 mg/l	1-liter polyethylene	6 months
Sodium	EPA 200.7	1.0 mg/l	1-liter polyethylene	6 months
Sulfate	EPA 300	0.5 mg/l	1-liter polyethylene	28 days
Color	EPA 140.1	NA[2]	1-liter polyethylene	2 days
Odor Threshold @ 60 C	EPA 110.2	NA[2]	1-liter glass	1 day
Turbidity	EPA 180.1	0.5 NTU	1-liter glass	2 days

1. A single 500 ml polyethylene bottle will provide sufficient volume for TDS, nitrate, electrical conductance and pH analyses.
2. Not Applicable.

Assumptions: It is assumed under this task that the District will administer the contract for laboratory services.

Task 4 – Data Management and Reporting

Work Item 4.1 – An existing District database will be expanded to manage new data under this proposed LGA grant project. The database will include all manual and automated water level data along with water quality, construction, and survey data for all

wells in the monitoring program. Queries will be prepared to allow water level hydrographs and tables to be generated from the database.

Work Item 4.2 – Establish protocols for water level data transfer to DWR:

- Diablo Water District agrees to waive the confidentiality provisions of Section 13752 of the California Water Code. The state shall make this data available to the public via the DWR web site.
- All monitoring well construction/monitoring information will be submitted to the CASGEM program. The well owner, local well identification, State Well Number, measurement frequency, well use, well depth (feet), screened interval (feet), and aquifer designation will be reported for each well.
- All water level measurements taken in each designated monitoring well shall be submitted to DWR via semi-annual CASGEM program reporting. Each reported measurement shall consist of the State Well Number, measurement date, measurement time (PST/PDT with military time/24-hour format), measuring point elevation (NAV88 vertical datum), ground surface elevation (NAV88 vertical datum), depth to water below the reference point (feet), method of measuring water depth, measurement quality codes, measuring agency identification, and comments about the measurement, if applicable.
- The construction of the well shall be reported in conformance with Section 13751 of the California Water Code. A log of the drilling activities shall be submitted containing information about type of well constructed (i.e., monitoring well), well depth, well construction details, etc., as delineated on DWR Form 188 (Well Completion Report). Copies of any geophysical logs run in the boring or well shall also be submitted.
- Water level data from the new monitoring wells shall be collected and reported to DWR indefinitely, i.e., for the life of the well and/or the District will provide access to DWR personnel to conduct monitoring.

Work Item 4.3 – A report on groundwater conditions will document construction activities including as-built drawings of new wells. Recommended procedures for retrieving data and performing manual measurements, QA/QC of data, reporting, and data transfer will be integrated into the District's groundwater monitoring reporting. LGA grant funds will not be used for the preparation of the reports.

Work Item 4.4 – Addition of new facilities to CASGEM Program. Under this work item, the District will revise its existing CASGEM Monitoring Plan (LSCE, 2012) and CASGEM reporting to include the new monitoring facilities and water level data. This work will be performed using only existing District funds.