Attachment 8: Quality Assurance

PROCEDURAL ASSURANCES

Many of the quality assurance practices are included in the Work Plan (Attachment 5), including the following:

- Using standardized soil classification schemes to describe the lithology of the boreholes. Lithology will be logged in the field and then rechecked in the office by a second geologist.
- Using drilling contractors that possess valid C-57 licenses.
- Drilling and installing wells in adherence with to California DWR bulletins 74-81 and 74-90.
- Testing the accuracy of each data logger prior to installation.
- Water quality analysis will be performed by a certified laboratory with an established QA/QC plan (see Att8_LGA12_SqCWD_2of2.pdf).

PERSONNEL QUALIFICATIONS

The personnel for this project will consist of qualified SqCWD staff, and their existing consultants. The project will be managed by Taj Dufour, the SqCWD interim General Manager. Previously, as Chief Engineer of SqCWD, Mr. Dufour has recently overseen the successful completion of a monitoring well installation and replacement projects of similar scope. Technical assistance will be provided by the following personnel:

TAJ DUFOUR – SOQUEL CREEK WATER DISTRICT

- California Professional Engineer # C 66725
- BS, Mechanical Engineering, California Polytechnic State University San Luis Obispo, 1999
- Certified California Water Treatment Operator Grade T3 and Water Distribution Operator Grade D4
- 12 years public water sector experience including 9 years in Engineering and 3 years in Operations and Maintenance. Experience includes well installation and project management.
- Interim General Manager

DERRIK WILLIAMS – HYDROMETRICS WRI

- California Professional Geologist #6044
- California Certified Hydrogeologist #35
- BS Geology, UC Davis, 1982
- MS Hydrology, University of Arizona, 1987
- 25 years of professional groundwater consulting in California
- Currently President of HydroMetrics WRI

CAMERON TANA – HYDROMETRICS WRI

- California Professional Engineer # C 65822
- BS, Civil and Environmental Engineering, Stanford, 1998, with Distinction
- MS, Civil and Environmental Engineering, MIT, 1999
- Over 12 years professional environmental and groundwater consulting in California
- Currently Vice-President of HydroMetrics WRI

MARTIN FEENEY – HYDROMETRICS WRI

- California Professional Geologist #4634
- California Certified Engineering Geologist #1454
- California Certified Hydrogeologist #145
- B.S., Earth Science (Geology), University of California, Santa Cruz, 1976
- M.A., Environmental Planning (Groundwater), California State University, 1987
- Graduate Program, Water Science, University of California, Davis, 1981-1982
- Over 28 years of professional groundwater consulting in California
- Mr. Feeney will oversee all field work.

GEORGINA KING – HYDROMETRICS WRI

- California Professional Geologist #8023
- California Certified Hydrogeologist #874
- BS, Engineering Geology, University of Natal, Durban, South Africa, 1992
- MS, Geohydrology, Rhodes University, South Africa, 1997
- 20 years of hydrogeologic experience, with 12 of those years in groundwater consulting experience in California. Includes well installation and project management.

MATERIAL AND SUPPLIES

Many requirements for materials will be included in the drilling and well construction specifications. The specifications will be written to ensure the monitoring wells are appropriately built, and provide representative groundwater level data. Example text for the drilling specifications includes the following:

- The wells will be drilled by conventional direct-rotary drilling methods with drilling equipment of sufficient capacity to drill the 8¾-inch diameter borehole required by these specifications to a maximum depth of 900 feet.
- Monitoring well casing material shall be Schedule 80 PVC for all wells. Casing joints shall be flush threaded.
- Well screens shall consist of horizontal machine-cut 0.040-inch slots. Unless directed otherwise by the Engineer, screens should be between 40-60 feet in length for each well. Casing joints shall be flush threaded with no adhesives. Monitoring well screen strength shall be sufficient to withstand all anticipated forces imposed on the screens during installation, isolation seal placement, well development, and use.
- All filter pack material shall be 8x16 Filter Pack manufactured by RMC, Silica Resources, or equivalent. Filter pack material shall be clean, hard, predominantly (>90%) siliceous, water-worn, and sub-rounded to rounded. Delivery and storage methods should ensure that materials are protected from the weather and do not come in contact with the ground or other contaminating materials.
- Sealing material above the bentonite seal and below the surface seal shall consist of cement-bentonite grout for all seals. To reduce the heat of hydration, the cement-bentonite grout shall include approximately 5% bentonite by weight. No accelerators will be accepted.
- The grout shall be placed through a tremie pipe, by positive displacement pumping. The discharge end of the tremie pipe shall remain below the level of the grout in the borehole throughout the placement. The tremie pipe shall be maintained full of grout at all times.

STANDARDIZED METHODOLOGIES

The techniques and equipment proposed for this project are chosen based on successful use of the same approach on recent and past projects.

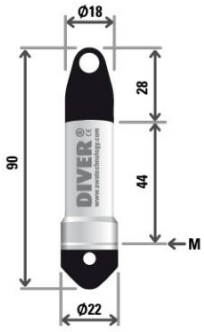
- Direct-rotary drilling. All wells will be drilled using conventional direct-rotary methods. This method has been used successfully recently and in the past to install a number of monitoring wells for SqCWD.
- Pressure transducer/data logger. The data loggers to be installed in the wells are will be Schlumberger's Mini Divers. These are models that have historically provided accurate data and are used throughout the SqCWD's monitoring network. The technical specifications for the logger are provided in Figure Att8-1.
- Transducer calibration. Testing and calibration is carried out by the manufacturer prior to delivery. During calibration, the Diver is completely submerged in a water bath. The temperature of the water bath is stabilized at 15°C and 35°C. The Diver is calibrated at both these temperatures. Variations in pressure are created at these two calibration temperatures. The variations in pressure consist of a series of increasing and decreasing pressure readings at 10%, 30%, 50%, 70% and 90% of the total range.
- Low-flow pump selection. The method of sampling the water quality from the monitoring wells will be by installing dedicated low-flow bladder pumps below the pressure transducers. The pumps will be supplied by QED Environmental who has supplied all other bladder pumps to SqCWD. Figure Att8-2 shows the features of a bladder pump. Bladder pumps are the sampling method of choice for SqCWD because of the following advantages:
    - Faster sampling time than high-flow methods.
    - Easy to use. Only need to connect compressed air supply to the fitting on the well cap and input the predetermined pumping parameters into the controller.
    - Equipment is dedicated, nothing needs to be removed or placed into the well.
    - Small purge volume.
    - Can sample deepest wells in the monitoring network.
    - Pumps resistant to corrosion are available for seawater intruded wells.
    - Equipment is relatively durable.

Schlumberger WATER SERVICES

Specifications

Mini-Diver®

Scale 1:1



M = membrane
Dimensions are expressed in mm.

DI 501 - 10 meter water column	
Pressure	
range	10 mH_2O
accuracy	±0.5 cmH_2O
resolution	0.2 cmH_2O
DI 502 - 20 meter water column	
Pressure	
range	20 mH_2O
accuracy	±1.0 cmH_2O
resolution	0.4 cmH_2O
DI 505 - 50 meter water column	
Pressure	
range	50 mH_2O
accuracy	±2.5 cmH_2O
resolution	1.0 cmH_2O
DI 510 - 100 meter water column	
Pressure	
range	100 mH_2O
accuracy	±5.0 cmH_2O
resolution	2.0 cmH_2O
Temperature	
range	-20 °C to 80 °C
compensated range	0 °C to 50 °C
accuracy	±0.1 °C
resolution	0.01 °C
Wetted materials	
housing	Stainless steel (316L)
O-ring	Viton®
pressure sensor	Ceramic (Al_2O_3)
cap/nose cone	Nylon PA6 30% glass fibre
Other	
operating elevation range	-300 to 5,000 m MSL
memory	2 x 24,000 measurements
battery life	10 years with 1 minute or greater sample interval within the compensated temperature range
weight	55 grams
sample interval	0.5 second to 99 hour
sample method	fixed

Other specifications according to the Diver manual.

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Figure Att8-1: Mini Diver Specifications

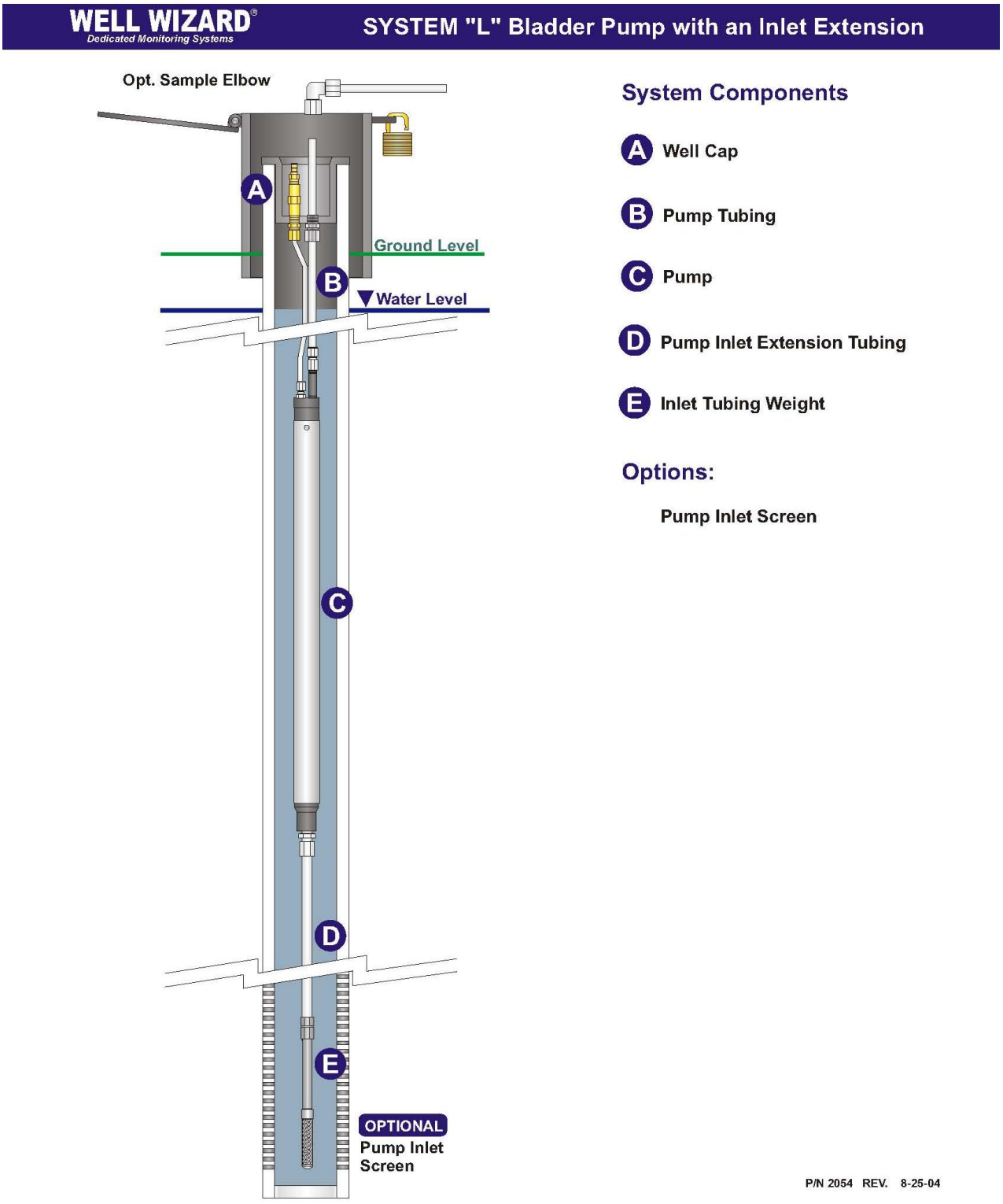

Figure Att8-2: Low-Flow Bladder Pump