

# **TECHNICAL PROVISIONS FOR TEST HOLE DRILLING AND MONITORING WELL CONSTRUCTION**

## **GENERAL REQUIREMENTS**

### **1.1 SCOPE OF WORK**

**A. Purpose** -- Test holes and monitoring wells are to be drilled and constructed at the specified project sites. The test holes shall serve to evaluate the lithologic character of subsurface formations and aquifers and to determine characteristics of the aquifer materials through geophysical surveys and measurements. The monitoring wells will be used to sample groundwater and measure groundwater levels.

#### **B. Test Hole Drilling and Monitoring Well Construction**

1. The work to be completed shall consist of obtaining all required drilling and construction permits, furnishing materials, labor, equipment, fuel, tools, transportation, and services for the drilling, sampling and logging of test holes at selected sites. According to the conditions encountered at each site, test holes shall be converted to permanent monitoring wells. Up to three individual piezometers may be installed in a monitoring well completion. In the event that the Owner does not elect to convert a test hole to a monitoring well, the test hole shall be destroyed in the manner specified herein.

2. The method of drilling shall be direct circulation rotary.

3. The test holes shall be drilled to the depths specified in the Plans. The actual depth of the test hole will depend on the lithology encountered. A drilling log shall be prepared to report the lithology encountered during construction, drill cuttings of the formations encountered shall be collected and retained, and electric geophysical logging surveys conducted in all boreholes. The test hole locations will be staked by the Owner.

4. The final design for the monitoring wells will be prepared after evaluating the test hole data.

5. Cuttings, drilling fluids, and development water shall be contained and removed by the Contractor as part of the contract.

#### **C. Preliminary Monitoring Well Design**

1. A preliminary monitoring well design is depicted in the Plans. Up to three piezometers may be installed at a site with a combination of intermediate and surface seals as shown conceptually on the preliminary profile. The piezometer assemblies will be equipped with an approved centralizer system to ensure that the screen intervals are adequately spaced from the borehole wall and that the intermediate annular seals hydraulically isolate each piezometer completion.
2. A graded gravel envelope will be placed between the casing assemblies and the borehole from the bottom of the well to the surface by the tremie pipe method. Annular seals, consisting of graded bentonite chips, may be specified to isolate screened intervals. A surface sanitary seal shall consist of a sand/cement grout. Each screen interval will be swabbed and airlifted to remove residual drilling fluid.
3. The monitoring wells will be completed with either an above-ground or flush-mount (vault) surface completion in accordance with the Plans.

#### **D. Local and State Standards**

1. All drilling and well construction activities shall comply with local and State standards. If a conflict arises between these Technical Provisions and regulatory requirements, the Contractor shall immediately notify the Owner and not proceed until the conflict is resolved.
2. It is the Contractor's responsibility to satisfy the well permitting requirements.

### **1.2 LOCATION AND LOCAL CONDITIONS**

1. The project sites are located in Contra Costa County.
2. The project sites are situated within the Tracy Groundwater Subbasin as delineated by the state Department of Water Resources. The subsurface geology consists of unconsolidated Quaternary alluvium overlying older sedimentary deposits. For the targeted well completions, depth to water is estimated to be approximately 10 to 60 feet below ground surface.

### **1.3 DRILLING FLUID CONTROL PROGRAM**

A drilling fluid program shall be employed by the Contractor according to the following general requirements.

1. A drilling fluid control program shall be submitted for approval by the Owner. Selection and use of the drilling fluid materials shall be a part of the contract work. The Contractor shall be responsible for maintaining the quality of the drilling fluid to assure the ability to obtain reliable representative samples of the formation materials, a geophysical survey, and to protect water bearing and potential water bearing formations encountered in the test hole for sampling and water level measurements.

2. Material used by the Contractor to prepare the drilling fluid shall be composed of water from the assigned source and drilling additives that meet or surpass the specification in the American Petroleum Institute "Std. 13-A for Drilling Fluid Materials." All drilling fluid additives shall comply with drilling industry standards and practices and they shall be used as prescribed by the manufacturer. Toxic and/or hazardous substances shall not be added to the drilling fluid.

3. The drilling fluid shall be made up of high grade bentonite clay or organic polymer additives in common drilling usage in the water well industry, and shall possess such characteristics as required to condition the walls of the borehole to prevent caving of formations and excessive loss of circulation, facilitate removal of the cuttings, and produce an easily removed thin filter cake.

4. Approved drilling fluid additives are Quik-Gel and EZ-Mud, as manufactured by the NL Baroid Division of the NL Industries, Inc. and Drispac as manufactured by Drilling Specialties Company.

5. In accordance with these Technical Provisions, the Contractor shall submit a drilling fluid program for approval prior to construction. The submittal shall include the recommendations for make-up water conditioning, quantities of clay and other additives required to maintain a drilling fluid having properties within the ranges specified below for test hole drilling and reaming operations.

- |                               |                   |
|-------------------------------|-------------------|
| a) Weight:                    | 8.7 - 9.3 lbs/gal |
| b) Marsh Funnel Viscosity:    | 28 - 35 sec/qt    |
| c) API Filter Cake Thickness: | 1/32 - 3/32 inch  |
| d) Sand Content of Returns:   | 0 - 2% by volume  |

The drilling fluid shall be maintained in such a manner as not to exceed the properties

specified above for weight, viscosity, and sand content without the approval of the Owner. In addition, the Contractor shall maintain the minimum viscosity of the drilling fluid that will raise cuttings and adequately condition the walls of the holes. At the completion of all drilling operations, the drilling fluid shall be conditioned and meet the following property ranges for monitoring well construction.

- a) Weight: 8.5 - 8.9 lbs/gal
- b) Marsh Funnel Viscosity: 26 - 30 sec/qt
- c) API Filter Cake Thickness: < 3/32 inch
- d) Sand Content of Returns: < 1/2% by volume

6. The drilling rig must be provided with equipment to measure the drilling fluid weight, viscosity, API filter cake, and sand content.

7. The Contractor shall maintain a log describing the condition of the drilling fluid on the site. The log shall include the following:

- a) Time, depth and results of all drilling fluid tests.
- b) Materials added to the system; type, quantity, time, and depth.
- c) Variances or modifications from approved drilling fluid program (e.g., time, depth, reason, and authorization).

8. Proper control of the drilling fluid must be maintained to the satisfaction of the Owner. The Contractor will be required, at the Contractor's expense, to retain or employ an experienced, qualified drilling fluid, or mud, engineer to supervise and maintain drilling fluid characteristics to the satisfaction of the Owner if such control cannot be accomplished by the Contractor.

9. If at any time the drilling fluid does not comply with these Technical Provisions or the recommendations of the drilling fluid engineer, as approved by the Owner, the properties shall be adjusted and the tests rerun until the drilling fluid obtains the specified characteristics. If the specified properties cannot be maintained, the drilling fluid shall be replaced.

10. A drilling fluid tank will be used for the drilling and well construction operations.

The tank must be of sufficient capacity to provide a volume equal to the final borehole volume and be equipped with a shale shaker and de-sanding cones.

## **2 MATERIALS**

### **2.1 CERTIFICATES OF COMPLIANCE**

As requested by the Owner, the Contractor shall provide certificates of compliance as specified herein.

#### **A. Items Requiring a Certificate of Compliance**

1. Certificates of compliance are required for the following materials:

- a) Starter Pipe (NOT USED)
- b) Cement-Grout Sealing Material
- c) Blank PVC Well Casing
- d) PVC Well Screen
- e) Casing Centralizers
- f) Gravel Envelope Material
- g) Disinfection Agent
- h) Surface Completion Components

2. No material shall be incorporated into the work until certificates of compliance have been approved by the Owner.

#### **B. Content of Certificates of Compliance**

1. Certificates of compliance from the Contractor, suppliers, and/or manufacturers, shall clearly indicate that the material to be delivered to the job site will meet all requirements of these Technical Provisions. A certificate of compliance shall include, but not be limited to the project title, delivery location, date (or approximate date) of delivery, name of the material with appropriate

classification or model numbers, quantity, name of the manufacturers, statement of compliance, and the name, title and signature of the certifying agent.

2. A factory or mill certification (laboratory test report) shall be submitted with the certificates of compliance for all components of the casing assembly. The factory or mill certification shall not be a substitute for the certificate of compliance, unless it contains all information required for a certificate of compliance as described above.

3. Insufficient, incomplete, or unclear certificates will be rejected and the Contractor shall be responsible for all delays caused by any need for re-submittal.

**C. New Materials** -- All materials provided by the Contractor shall be new.

## **2.2 MATERIALS SPECIFICATIONS**

**A. Sealing Material** -- Sealing material consisting of sand-cement grout may be employed for abandonment purposes and for surface sealing in the wells. Bentonite chip seals may be employed in the wells for intermediate seals and to limit infiltration of cement grout into the gravel envelope.

1. The sealing material shall be composed of sand-cement grout slurry. The grout shall consist of a sand-cement mixture in accordance with California Department of Water Resources Well Standards, Bulletin 74-81/Supplement 74-90.

2. The mixture for the surface, or sanitary, seal shall conform to State standards and local ordinances for sanitary seals.

3. Bentonite sealing material shall be a graded chip bentonite with granules ranging from 1/4 inch to 3/8 inch. An approved product for the bentonite seals is "HOLEPLUG" as manufactured by the NL Baroid Division of NL Industries, Inc.

**B. Starter Pipe (NOT USED)**

**C. Well Casing and Screen Material**

1. All well casing and screen shall be leak proof, flush threaded with two threads per inch as manufactured by Aardvark Corporation of Puyallup, Washington, or approved equal. The PVC flush threaded casing pipe and screen shall be manufactured from Type 1, Grade 1 PVC resins as specified in ASTM D1784.

PVC filler material must consist only of finely ground (No. 200 mesh) calcium carbonate to provide high-impact strength, uniform dimension, and a consistent known chemical matrix material.

- a) PVC Well Casing -- The blank casing will be 2-inch Schedule 40 PVC, ASTM F480-88a.
- b) PVC Well Screen -- The well screen shall be fabricated from the same material as the blank casing. The perforations shall be machine-cut horizontal slots, with openings of 0.030 inch.
- c) Threaded Plug -- The bottom of each casing assembly shall be furnished with a PVC threaded female plug of the same schedule and size as the casing and the same specifications as described herein.

2. All flush threaded PVC well casing pipe and screen shall meet or exceed the physical requirements of ASTM F480-88a or the latest version of ASTM F480 for thermoplastic water well casing. The threaded joints must also conform to tables 3c and 3d of ASTM F480-88a. All joints must remain leak proof for 24 hours at a minimum of 25 psi without the use of sealant, "O" rings, tape, or pipe dope.

3. All PVC flush-threaded pipe shall be provided with "O" rings and shall make-up in stated lengths, shoulder to shoulder when assembled.

4. The pipe shoulders are to be beveled to provide a fully butting interference compression fit, to increase the compression strength of the pipe and the threaded joints, and to provide a leak proof seal.

5. The finished well casing and screen must be received in visibly clean condition, free of oil, grease, dirt, fingerprints, or other external contaminants.

6. The well casing and screen shall be packaged in new, heavy wall, water resistant, corrugated boxes to maintain product cleanliness and must be clearly labeled with the brand name and contents.

7. To prevent ultraviolet degradation of the PVC by sunlight and to reduce contamination, all finished and unfinished PVC pipe and screen is to be stored indoors by the manufacturer or distributor.

8. The top of each casing shall be furnished with a watertight and locking security plug.

**D. Gravel Envelope** -- All gravel or coarse-grained sand for packing shall be hard, water worn, and washed clean of silt, fine sand, dirt, and foreign matter (crushed gravel will not be accepted). It shall be well-rounded, graded, and selected. The gravel envelope material is specified to be 8 x 16 Monterey-type sand, or approved equal. A description and sieve analysis of gravel packing materials to be delivered to the site must be submitted prior to the use of the material in the work. The gravel shall be provided in sacks and protected and kept free of foreign matter.

**E. Disinfection Agent** -- Sodium hypochlorite shall be used as a disinfectant and shall be delivered to each well site in original closed containers bearing the original label indicating the percentage of available chlorine. The disinfectant shall be recently purchased. Storage of the liquid chlorine shall not exceed 60 days. During storage, disinfectants shall not be exposed to the atmosphere or to direct sunlight.

### 3 TEST HOLE DRILLING AND MONITORING WELL CONSTRUCTION

#### 3.1 MOBILIZATION

##### A. General

1. Mobilization shall include acquisition of all necessary permits; transportation of personnel, equipment, and operating supplies to and from the site(s), portable sanitary facilities, preparing a work site sufficient to support equipment and personnel in a safe and workman-like manner, and other preparatory work at the site(s) required by the Contractor for his/her operations.

2. The Contractor shall provide one complete direct rotary drilling unit with shaker and de-sanding cones and containment facilities. The Contractor shall also provide all tools, accessories, power, fuel, materials, supplies, lighting, conduct efficient drilling operations. The drilling unit shall be in good condition and of sufficient capacity to perform the specified drilling and well construction.

#### 3.2 STARTER PIPE INSTALLATION (NOT USED)

#### 3.3 TEST HOLE DRILLING

**A. Scope** -- A test hole shall be drilled using the direct rotary method. The hole shall be drilled at a diameter of 8-3/4 inches. The final depth of the test hole will depend on the lithology encountered while drilling and will be determined by the Owner. The target test hole depths for the project wells are specified in the Plans.

##### B. Methods

1. The test hole shall be drilled using the direct circulation rotary drilling method of construction. The drilling fluid for the direct rotary drilling operation shall conform to the approved drilling fluid program.
2. The drilling operations shall be conducted using equipment that is adequate to reach the specified borehole depths and diameters. If, in the opinion of the Owner, the Contractor's equipment is not capable of satisfactorily performing the specified work, the Contractor, at his/her own expense, shall substitute equipment satisfactory to the Owner.
3. The Contractor shall take all measures necessary to protect the top portions of the test hole from caving or raveling.
4. The Contractor shall maintain records providing the following information:
  - a) A record of construction activities for each shift.
  - b) A time drilling log of the test hole recording the time (in minutes) required to drill down each section of drill pipe.
  - c) A log of drilling bit types and depths of changes.
  - d) Record of drilling fluid properties at 4-hour intervals during drilling operations. The record shall show drilling fluid weights, Marsh Funnel viscosity, sand content, drilling fluid losses, and any additives used.
  - e) A drilling log which defines and classifies the type of formations encountered during the drilling. The log will consist of the depth at which each change in formation is encountered, the classification of the material encountered, its color and particle size. Classification of silt, sand, gravel, cobbles, etc. shall be based on the size of material encountered in accordance with the established and accepted geologic standard for classification of these materials. If more than one size of material is encountered in a formation such as "sand and clay", an estimate of the quantity of each shall be recorded, such as "20% sand, 80% clay".
  - f) All measurements for depths shall be referenced to the existing ground surface at the well site.
5. During the drilling of the test hole, the Contractor shall collect representative samples of the rotary drill cuttings at 10-foot intervals and at formation changes.

The Owner may direct the Contractor to collect samples at more frequent intervals to adequately delineate the formations encountered in the test hole boring. The cuttings shall be taken from a steel or plastic flow line between the borehole and the drilling fluid/shaker. The samples collected shall not be washed and shall be carefully drained of excess drilling fluid but in a manner which will preserve the finer particle size of the sample. Two portions, one pint each, of each sample taken, shall be preserved in quart-size Zip-lock plastic freezer bags and marked as to date, depth, and well number. One set of samples shall be retained on the job for inspection. The Contractor shall deliver one set of samples to the Owner. The samples shall be properly stored by the Contractor in a manner as to prevent breakage or loss until they are accepted by the Owner.

6. Upon completion of the test hole drilling, a geophysical log shall be conducted.

### **3.4 GEOPHYSICAL LOGGING**

**A. Scope** -- This item shall consist of conditioning the bore hole and conducting geophysical surveys in the test hole. The geophysical surveys to be run in the test holes are the spontaneous potential and resistivity surveys.

#### **B. Methods**

1. The Contractor shall furnish services for logging the test holes. Acceptable geophysical logging service companies are Welenco, Inc. and Newman Well Surveys. Borehole geophysical logs, consisting of spontaneous potential (SP) and multiple resistivity, shall be conducted in the test hole.

2. The spontaneous potential survey shall be plotted on a scale of one-inch equal to plus or minus 20 millivolts. The multiple resistivity survey shall consist of a point resistivity curve and multiple resistivity curves employing 16-inch short normal and 64-inch long normal spacing on a one-inch equal to 20 or 40 ohm scale. All surveys will be plotted on a footage scale of one-inch equal to 20 feet in accordance with the American Petroleum Institute standard.

3. The Contractor is responsible for the integrity of the borehole to assure that the geophysical logging can be successfully conducted. The Contractor shall maintain circulation in the borehole with tools on the bottom of the hole until the logging equipment is on location and prepared to conduct the survey. The logging service company shall obtain a ditch sample of the circulating fluid for calibration of the logs prior to the securing of the circulating pump. Tools shall then be pulled by the Contractor and the logging services immediately commenced. If the logging tool fails to descend to the desired depth, the Contractor, at his/her own expense,

shall run the drilling tools to the target depth to recondition the hole.

4. Upon completion of logging operation, the Contractor will deliver six field prints to the Owner. Four final prints and an electronic ASCII file of the geophysical surveys shall be provided with the final records submittal. The field copies of the electrical log shall be approved by the Owner before the logging service is released from the site by the Contractor.

### **3.5 TEST HOLE REAMING**

**A. Scope --** This item shall consist of reaming the test hole to the final specified well depth in accordance with the Owner's final design. The drilling and reaming of the borehole will be conducted by the direct rotary drilling method to the depth and diameter specified in the Owner's final design. Drilling fluid properties must conform to those specified in the approved drilling fluid program.

#### **B. Methods**

1. Within 48 hours after the completion of test hole drilling and logging operations, the Owner will provide the final design of the monitoring wells and specify the depths of reaming.
2. The test hole shall be reamed to a minimum diameter of 12-1/4 inches to the depth specified in the Owner's final design. The drilling fluid for the direct rotary drilling operation shall conform to the approved drilling fluid program. The Contractor shall be responsible to protect the pilot hole from caving. The Contractor shall exercise caution to ensure that the hole remains straight and plumb during the reaming operations.
3. The Contractor shall maintain records providing the following information:
  - a) A record of construction activities for each shift.
  - b) A time drilling log of reaming operations recording the time (in minutes) required to drill down each section of drill pipe.
  - c) A log of drilling bit types and depths of changes.
  - d) Record of drilling fluid properties at 4-hour intervals during drilling operations. The record shall show drilling fluid weights, Marsh Funnel viscosity, sand content, drilling fluid losses, and any additives used.

All measurements for depths shall be referenced to the existing ground surface at the well site.

### 3.6 WELL CASING AND SCREEN

**A. Scope --** This item shall consist of furnishing and installing blank casing and well screen as specified in the Owner's final design.

**B. Methods**

1. At the determination of the Owner, a wiper pass shall be conducted if construction does not proceed immediately after completion of the electric log.
2. A tremie pipe of a minimum two-inch diameter shall be run into the borehole to the total depth of the casing installation. Circulation by pumping shall be commenced using fluid from the drilling fluid/mud tank of the same viscosity as that in the borehole. Circulation shall continue for a period of thirty minutes prior to casing installation.
3. With the tremie pipe remaining in the borehole, casing installation shall proceed in accordance with the final well design specified by the Owner.
4. The casing assembly shall be installed to the specified depth supported above the ground surface. The casing shall be capped to insure that foreign materials do not enter the casings.
5. The casing shall be suspended in tension from the surface by means of an appropriate hanger or clamp. The bottom of the casing shall be at a sufficient distance above the bottom of the reamed hole to ensure that none of the casing will be supported from the bottom of the hole.
6. Circulation through the tremie pipe shall continue during the casing installation.
7. If, for any reason, the casing cannot be landed in the correct position or at a depth acceptable to the Owner, the Contractor shall remove the casing, ream and recondition the borehole, and reinstall the casing to the specified depth. If the casing cannot be removed from the borehole the contractor shall construct another well immediately adjacent to the original location and complete the well in accordance with the Owner's specified design at no additional cost to the Owner. The abandoned boring shall be destroyed in accordance with all applicable regulations to well destruction at no additional cost to the Owner.

8. If any of the casing assemblies collapse prior to well completion, the remaining hole shall be destroyed in accordance with all applicable regulations to well destruction at no additional cost to the Owner. A replacement borehole and well shall be drilled and constructed at an adjacent location as directed by the Owner.

### **3.7 GRAVEL ENVELOPE AND ANNULAR SEAL**

**A. Scope --** This item shall consist of providing and installing a gravel pack within the screen intervals and annular seals between the screen intervals, as specified by the Owner, in the annulus between the casing and screens and the well bore of each well.

#### **B. Methods**

1. Prior to placement of the gravel pack and annular seals in the well, the drilling fluid shall be thinned with clean water. For direct rotary drilling operations, thinning shall be accomplished by reducing the viscosity of the drilling fluid in the sump to a maximum marsh funnel viscosity of 30 seconds and a maximum weight of 8.9 pounds per gallon by the addition of clean water to the sump. The Contractor shall avoid the direct injection of water into the well bore through the tremie pipe in order to prevent unbalancing the fluid consistency in the borehole.

2. Gravel packing and grouting material shall be pumped or gravity fed through the tremie pipe. The gravel pumping system shall consist of a hopper which will allow for the calculation of the amount of gravel packing material entering the borehole. The Contractor shall provide the Owner with a schematic drawing of the system of gravel placement he intends to employ prior to the installation of casing.

3. The tremie pipe shall be removed in approximately 20-foot intervals when the gravel in the borehole reaches the tremie pipe.

4. The gravel shall be sterilized by continuously mixing at least one gallon of 5-1/4 percent sodium hypochlorite, or the equivalent amount of liquid chlorine compound, per 100 cubic feet of gravel as it is placed in the well.

5. The quantities of gravel placed in the annulus of each well shall not be less than the computed volume of the annulus. A quantity less than the computed value will be judged as an indication of voids, and corrective measures shall be taken by the Contractor.

6. If the volume of gravel installed in the annulus is less than the theoretical

volume, the well may be rejected by the Owner.

7. Gravel packing and bentonite seal placement shall continue uninterrupted until the gravel pack reaches the depth of the surface seal. The cement surface seal may be poured in lifts in order to prevent the heat of hydration from distorting the PVC casing. The upper 50 feet of the surface seal must be poured in one lift.

### 3.8 WELL DEVELOPMENT

**A. Scope --** This item shall consist of swabbing and airlift pumping the well following gravel packing and removal of materials introduced into the casing during swabbing by airlifting. The purpose of well development is to remove drilling fluids and to develop the gravel pack and aquifer to ensure that proper groundwater samples may be obtained from the facility.

#### **B. Methods**

1. The Contractor shall provide sufficient pipe and a mechanical swab assembly designed to be run in the screened intervals of the well. The swab assembly shall be approved by the Owner. Upon completion of the swabbing and airlift pumping operations, the Contractor shall airlift all fill material from the well.

2. The air compressor used during well development shall be fitted with in-line filters to prevent volatile organic compounds from entering the well casings from the compressor. A 0.3 micron pre-filter and a 0.01 micron filter run in series and verified compatible to the Contractor's compressor will be required during all phases of well development. The Contractor shall furnish the Owner with the make and model number of the air compressor to be used and the manufacturer and model number of the proposed filters to be used prior to the construction of the wells.

3. After the placement of the gravel envelope and annular seals has been completed, the gravel envelope shall be cleaned of all fluids, cake, and substances that would impair the flow of water into the well and the quality thereof. Cleaning shall be accomplished by airlift pumping and swabbing opposite the screen intervals until the gravel has been cleaned and consolidated.

4. The pumping and swabbing will be done with a minimum 3/8-inch diameter air line using the well casing as the eductor pipe. The air compressor and equipment used for airlift pumping shall be capable of pumping 20 gpm from a static water level of 75 feet during development. The swabbing and airlift pumping operations will be conducted alternately until the screen section is fully developed and

discharging clean groundwater.

5. The development shall continue until the well produces water free of sand and the following turbidity guidelines can be achieved after swabbing the screen intervals or surging the well:

- a) For piezometers that produce less than 2 gpm, a turbidity of 10 NTU within two casing volumes of purging.
- b) For piezometers that produce at least 2 gpm, a turbidity of 5 NTU must be achieved within two casing volumes of purging.

### 3.9 PLUMBNESS AND ALIGNMENT

**A. Scope** -- The completed well shall be sufficiently plumb and straight so that there will be no interference with installation, alignment, operation or removal of the sampling and monitoring equipment including, but not limited to, hand bailers, pressure transducers, and 1-1/2-inch submersible pumps.

**B. Methods** -- No separate testing shall be conducted as long as swabbing operations during well development can be performed with no apparent restrictions due to for plumbness and alignment. If the plumbness and/or alignment are not found to be adequate to permit well development operations or to install sampling and monitoring equipment, the monitoring well may be rejected and the Contractor may be required to construct another monitoring well immediately adjacent to the original location at no additional cost to the Owner. The abandoned boring shall be destroyed in accordance with all applicable regulations to well destruction at no additional cost to the Owner.

### 3.10 SURFACE COMPLETION

**A. Scope** -- This item shall consist of furnishing and installing an above ground or flush mount (vault) surface completion as shown on the Plans and in accordance with State and local standards.

**B. Methods**

- 1. The Contractor shall provide a monitoring well pad according to local and State well standards.
- 2. Above-Ground Surface Completions -- A steel riser (minimum of 4-1/2 feet long) having a minimum outside diameter of 12 inches and a minimum wall thickness of 3/16 inches shall be used. A locking steel cover shall be attached to

the riser, as shown in the Plans. For a flush mount completion, a water tight vault having a minimum diameter of 12 inches shall be installed, as shown in the Plans. The finished concrete pedestal shall be 9 inches in thickness at 6 inches above grade. The riser set in the center of the pedestal will extend 2 feet above grade. The steel riser shall be painted with a high-grade rust-resistant paint of a color approved by the Owner.

3. Flush-Mount Surface Completions -- A steel riser (minimum of 4-1/2 feet long) having a minimum outside diameter of 12 inches and a minimum wall thickness of 3/16 inches shall be used. A locking steel cover shall be attached to the riser, as shown in the Plans.

### 3.11 TEST HOLE ABANDONMENT

**A. General** -- Following completion of geophysical logging operations, the test hole, or a lower portion of the test hole, shall be destroyed in accordance with state and local standards for the construction and destruction of wells and other deep excavations.

**B. Methods** -- Cement grout shall be pumped from the bottom of the borehole by means of pumping equipment and a tremie pipe. The tremie pipe may be raised as the grout is placed but the discharge end must be submerged in grout at all times until the grouting is completed. The test hole shall be filled with cement grout to within 5 feet of the ground surface. The balance of the hole shall be filled with native material to the ground surface.

### 3.12 REJECTED BOREHOLE OR WELL

**A. General** -- No payment will be made for any labor or materials involved in the construction of any borehole or well when such a hole fails to reach the specified or directed final depth and/or diameter for any preventable cause, or when such a test hole fails to meet these Technical Provisions. Such holes will be rejected and shall be replaced as specified herein. Preventable failures include any failure caused by faulty or inadequate drilling equipment, failure caused by negligence or improper drilling operations or techniques, failure caused by the installation of faulty or non-approved materials, or failure caused by improperly protecting drill holes and drilling work from the natural elements, including cave-ins resulting from existing soil conditions.

**B. Sealing and Replacement of a Rejected Borehole or Well** -- Any rejected borehole or well shall be destroyed at no additional cost to the Owner and in accordance with in accordance with all applicable regulations for well destruction. Any casing remaining in the hole shall be cut off at a depth of five feet and the upper portion thereof removed.

**C. Non-Payment for Borehole and Well Abandonment**

No payment will be made for the abandonment of a rejected borehole or well. The cost of abandonment shall be borne by the Contractor. Any rejected borehole shall be replaced by another hole adjacent to the first, or at a location as directed by the Owner.

### 3.13 STANDBY TIME

#### A. Scope

1. During the drilling operations, it may be necessary for the Owner to perform work or analysis that will require the drilling crew and equipment to stand idle. In such an event, the Owner shall request the Contractor to cease operations and shall state the anticipated extent or duration thereof. The Contractor shall promptly cease operations.
2. Within 48 hours after the completion of test hole drilling and logging operations, the Owner will provide the final design of the wells. Such time will not be considered standby time.

### 3.14 RECORDS

- A. Scope** -- The item consists of preparing final records of the drilling and well construction.
- B. Well Completion Records** -- Prior to final acceptance of a test hole or well, the Contractor shall prepare and deliver to the Owner a Well Completion Report in the format required by the State of California Department of Water Resources.
- C. Final Prints** -- The Contractor shall have prepared two (2) final prints of the daily tour reports, and drilling logs.

### 3.15 SITE CLEAN-UP AND RESTORATION

- A. Scope** -- This item shall consist of restoring each work site to its original condition after work is completed.
- B. Methods** -- The Contractor shall keep the premises free from accumulations of waste materials, rubbish, and other debris resulting from the work, and at completion of the work, he/she shall remove all waste materials, rubbish, and debris from and about the well site as well as all tools, construction equipment, fuel tanks, machinery and surplus materials. The Contractor shall leave each site clean and ready for use by the Owner. The Contractor shall restore to their original condition all temporary work areas. The

Contractor is responsible for any damages to properties adjacent to the sites caused by drilling or construction activities associated with the work described herein.