

## **Appendix D**

### **Well Installation Procedures**

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## **1.0 Well Installation Procedures**

New wells will be installed in hydrostratigraphic unit (HSU)-1 for groundwater monitoring purposes.

### **1.1 Drilling and Well Installation**

New HSU-1 wells will be installed using a hollow-stem auger drill rig to advance an 8-inch-diameter borehole for a 2-inch-diameter well to approximately 75 feet (ft) below ground surface (bgs). Soil samples from well borings will be collected and logged according to Standard Operating Procedure (SOP) 3.2, "Subsurface Soil Sampling While Drilling," and SOP 15.1, "Lithologic Logging" (Weiss 2001). The soil sample frequency will be not less than one sample per 5 ft of borehole from the surface to 45 ft bgs, with continuous soil core collected below 45 ft bgs. Soil cuttings and core generated during drilling activities shall be managed in accordance with the Soil Management Plan provided in Appendix A.

Wells will be installed in accordance with SOP 8.1, "Monitoring Well Installation." Volumes of grout, bentonite, and filter pack will be calculated based on borehole and well casing diameters. The monitoring wells will be designed and installed under the supervision of an experienced geologist working under the supervision of a California-certified professional geologist. To be consistent with previous wells, the HSU-1 wells will be constructed with threaded 2-inch-diameter schedule-40 PVC casings with 15-ft screen length. Assuming typical HSU-1 soil types are present, the wells will be constructed using 0.01-inch-slot PVC screen with a fine-grained sand pack. Soil core from the planned screened interval will be evaluated, however, and well construction will be modified if needed according to the procedure outlined in SOP 16.1, "Filter Pack and Well Screen Slot Size Determination."

Although the exact construction details will be based on the lithologic logging during drilling, the HSU-1 screened intervals are expected to extend from approximately 55 to 70 ft bgs. If the borehole is over-drilled, it will be grouted and plugged with bentonite to a depth corresponding to the depth of the well. The annular space will be filled with sand filter pack to 2 ft above the screened interval; a seal, at least 3 ft thick, consisting of hydrated bentonite chips will be placed above the filter pack, and a primary sanitary seal of neat Portland cement will be placed above the bentonite-chip seal to reach the surface. In addition to the steps outlined in SOP 8.1, the bentonite chips will be hydrated by adding water after each 4-inch-thick lift is placed to ensure hydration, unless the seal is definitely within the saturated zone. The wells will be completed with a locking well cap and either a traffic-rated flush-mount vault or a locking steel stove pipe with or without protective bollards, depending on the location.

### **1.2 Well Development**

A minimum of 24 hours will elapse between completing the wells and beginning well development activities, to allow concrete and grout to attain sufficient strength. Well development activities will be performed at the discretion of the field geologist and hydrogeologist.

Well development will be considered complete when the water is free of sediment; when specific conductance (SC), pH, and temperature are within the stabilization goals for three consecutive

readings; and when at least three times the water volume calculated to be in the well casing at the start of development has been removed. The stabilization goals are:

- Conductance:  $\pm 10$  percent.
- pH:  $\pm 0.2$ .
- Temperature:  $\pm 0.3$  °C.
- Turbidity: less than 10 nephelometric turbidity units (NTUs).

If the SC, pH, and temperature do not stabilize or the turbidity is not reduced below 10 NTUs due to low recharge, well development will be considered complete when a minimum of three well casing volumes are removed and development has proceeded for at least four hours. Well development purge water and decontamination water will be discharged to the campus wastewater treatment plant.