NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

MONITORING WELL

(No.)
CODE 353

DEFINITION

A well designed and installed to obtain representative ground water quality samples and hydrogeologic information from an aquifer.

PURPOSE

To provide controlled access for sampling ground water near an agricultural waste storage or treatment facility in order to detect seepage and monitor the effects of contaminants in seepage on ground water quality.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to the design, installation, and development of monitoring wells where

- contamination of ground water from an agricultural waste storage or treatment facility is a concern; and
- the facility is a component of an agricultural waste management system.

This practice does **not** apply to:

- methods for the collection and analysis of ground water samples or ground water information from the well;
- monitoring of subsurface waters in the vadose zone;
- the installation of wells for any other purpose;
- temporary exploratory drill holes or borings; and
- the decommissioning of monitoring wells.

CRITERIA

Laws and Regulations. Monitoring wells shall be planned, designed, constructed, operated and maintained in a manner that meets all applicable local, state, federal, and tribal laws and regulations.

In California, the Department of Water Resources (DWR) has responsibility for developing standards for wells for the protection of water quality under California Water Code Section 231. Senate Bill 1817 (1986) amended the Water Code to specifically include monitoring wells. All counties, cities, and water agencies have adopted well standards that equal or exceed DWR standards.

DWR well standards (Bulletins 74-81 and 74-90) are online at http://wwwdpla.water.ca.gov/sd/groundwater/california_well_standards/well_standards.html

Hydrogeologic Investigation. Prior to the design of a monitoring well, a surface and subsurface investigation shall be conducted to develop a conceptual hydrogeologic model of the site, to identify potential ground water flow paths, and to determine the location of the target monitoring zone(s).

The hydrogeologic investigation shall include the mapping, identification, and description of soil and rock units and discontinuities that affect the movement and transport of subsurface water occurring within at least 100 feet of the perimeter of the facility of interest.

The investigation shall identify and describe the hydrogeologic properties of geologic units, and of stratigraphic and structural discontinuities that can influence local subsurface water flow paths, including those that serve as conduits for subsurface flow, including karst development, joint sets, fracture systems, faults and lineaments. These shall be located on a geologic evaluation map of the site.

The hydrogeologic investigation shall identify and describe any tile lines, subsurface drains, surface drains, irrigation ditches, irrigation wells, water supply wells, septic drain fields, infiltration strips, subsurface quarries, mines, or other water control/management related features that have the potential to alter the native subsurface water flow paths. Such features shall be located on a geologic evaluation map of the site.

The hydrogeologic investigation shall be of sufficient detail to map the potentiometric surface

to a one-foot contour interval. The map of the potentiometric surface shall be used to determine the hydraulic gradient and direction of flow within the target monitoring zone(s).

The hydrogeologic investigation shall identify and describe any seasonal changes in the potentiometric surface and direction of subsurface water flow paths.

The hydrogeologic investigation shall identify and describe other features that influence subsurface water flow such as hard pans, sand boils, animal burrows, seasonal desiccation, high shrink/swell soils, dense till, depth of frost line, and permafrost.

Layout. The layout of the monitoring wells shall be based on the conceptual hydrogeologic model, to intercept representative subsurface water flow path(s) of the target monitoring zone(s).

Monitoring wells shall be located an adequate distance from known or potential sources of pollution and contamination, unless regulatory or legitimate data requirements necessitate they be located closer.

Monitoring wells shall be located both up- and downgradient of the waste storage facility, at a distance and depth based on the results of the hydrogeologic investigation of the site. At a minimum, one monitoring well shall be placed upgradient, and three monitoring wells shall be placed downgradient of the waste storage facility.

When seasonal changes in the direction of subsurface water flow are possible, monitoring wells shall be placed in such a manner as to capture both up gradient and down gradient flow during any time of year.

The placement of monitoring wells in fractured-rock and karst aquifers shall be based on the location of zones of relatively high permeability, even if they are located offsite.

Design. The design of all components of monitoring wells in granular aquifers shall conform to ASTM D5092 “Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers.”

The design of all components of monitoring wells in karst or fractured-rock aquifers shall conform to ASTM D5717 “Standard Guide for Design of Ground-Water Monitoring Systems in Karst and Fractured-Rock Aquifers.”

Planning, design, and installation of nested monitoring wells, where two or more casing strings are located in the same borehole, require review by and concurrence of, the State Conservation Engineer.

Materials. Materials used for the construction of monitoring wells shall be in conformance with state and local regulations.

Materials shall be non-reactive with subsurface water, and shall not leach substances into the subsurface water.

Materials shall be free of contaminants prior to installation.

Well screens shall be made by machine.

All joints shall be threaded. Glued or solvent welded joints shall not be used.

Materials shall have adequate strength to withstand the forces of installation and development.

Installation. Installation methods shall be selected based on site-specific conditions and shall be in conformance with state and local regulations.

Installation methods shall be in conformance with ASTM D5092 for granular aquifers, and ASTM D5717 for karst and fractured-rock aquifers.

The equipment used shall be capable of creating a stable, open, vertical borehole for installation of the monitoring well.

Well Protection. Measures shall be installed to protect the monitoring well from damage from hazards such as frost action, surface drainage, animal or equipment traffic, and lack of visibility. Measures shall conform to ASTM D5092 and to state and local regulations.

Positive surface drainage away from the well heads shall be established.

Protection from natural- or human-caused damage shall be provided in conformance with ASTM D5787 “Standard Practice for Monitoring Well Protection.”

A buffer zone with a minimum radius of 30 feet shall be established around each well head. The buffer zone shall be fenced or otherwise protected from access by motor vehicles and livestock. Design and installation of component measures shall conform to the applicable NRCS Conservation Practice Standard (e.g. 382- Fence)

Within the buffer zone there shall be no storage, handling, mixing, or application of fertilizers, pesticides or other agricultural chemicals or cleaning of equipment used in the handling or application of such items.

Development. The monitoring well shall be developed to improve the hydraulic communication between the target hydrogeologic unit and the well screen, to minimize the interference of sediment with water quality samples, and to restore the ground water properties disturbed by the drilling process. Well completion shall ensure that only the targeted hydrogeologic unit contributes to the monitoring well and that the annular space is sealed to prevent cross contamination from other water sources.

The well development method shall be selected from alternatives provided in ASTM D5092. The selection of the method shall be based on the physical characteristics of the target hydrogeologic unit and the drilling method used.

For granular aquifers, well completion shall conform to ASTM D5521 "Standard Guide for Development of Ground Water Monitoring Wells in Granular Aquifers."

For fractured-rock and karst aquifers, well completion shall conform to ASTM D5717.

Record Keeping. Record keeping shall conform to:

- ASTM D5254 "Standard Practice for Minimum Set of Data Elements to identify Ground-Water Site";
- ASTM D5408 "Standard Guide for Set of Data Elements to Describe a Ground-Water Site: Part One – Additional Identification Descriptors"; and
- ASTM D5409 "Standard Guide for Set of Data Elements to Describe a Ground-Water Site: Part Two – Physical Descriptors".

Well completion reports for monitoring wells shall be completed on forms provided by the California Department of Water Resources (DWR) and submitted to DWR in accordance with relevant provisions of Sections 13750 through 13754 (Division 7, Chapter 10, Article 3) of the California Water Code. Information about DWR Well Completion Reports and blank forms are available at http://www.groundwater.water.ca.gov/technical_assistance/gw_wells/gww_complrept/index.cfm

CONSIDERATIONS

Cultural Resource Considerations

NRCS' objective is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice will have any effect on any cultural resources.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements Worksheet.

GM 420, Part 401, the California Environmental Handbook and the California Environmental Assessment Worksheet provide guidance on how the NRCS must account for cultural resources. The Field Office Technical Guide, Section II contains general information, with internet sites for additional information.

Endangered Species Considerations

Determine if installation of this practice with any others proposed will have any effect on any federal or state listed Rare, Threatened, or Endangered species or their habitat. NRCS' objective is to benefit these species and others of concern, or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicated the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments for installation; or at the request of the landowners, the NRCS may initiate consultation with the U.S. Fish and Wildlife Service, NOAA Fisheries (National Marine Fisheries Service), and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

Water Quality Considerations

California's DWR standards require that monitoring wells be located an adequate distance from known or potential sources of pollution and contamination, unless regulatory or legitimate data requirements necessitate they be located closer.

For example, a 100-foot minimum distance between the monitoring well and an animal or fowl enclosure is generally considered adequate where a significant layer of unsaturated, unconsolidated sediment less permeable than sand is encountered between the ground surface and ground water. Local conditions may require greater separation distances to ensure ground water quality protection.

In choosing monitoring well locations and designing components for wellhead protection, consider the relative flood hazard and the potential for flood-related contamination and pollution.

Other Considerations

Consider using geophysical tools in conjunction with penetrative exploratory techniques, to improve and refine the mapping of the location, shape orientation, and extent of subsurface hydrogeologic units.

Consider effects of geomorphic processes, geologic structures, regional stratigraphy, and soil and rock properties on subsurface flow patterns when developing a conceptual hydrogeologic model.

Consider the physical properties and methods of movement in the environment of the solutes, and the location and direction of movement of any potential contaminant plume.

Consider installing additional monitoring wells at other points as dictated by the results of the hydrogeologic investigation, to adequately monitor pollutants of interest when designing monitoring wells.

Consider evaluating alternative drilling methods for installing monitoring wells provided in ASTM D6286 “Standard Guide for Selection of Drilling Methods for Environmental Site Characterization.”

Where frost heave is a concern, consider design alternatives that reduce the potential for frost heave to damage the monitoring well.

Monitoring wells should be located to allow access for well maintenance, modification, repair, and destruction.

PLANS AND SPECIFICATIONS

Plans and specifications for constructing, installing, developing and completing monitoring wells shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

Provisions shall be made for operation and maintenance requirements in keeping with the purpose of this standard