NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

MONITORING WELL

(No.)

CODE 353

DEFINITION

A well, or wells, designed and installed to obtain representative groundwater samples and hydrogeologic information.

PURPOSE

To provide controlled access for sampling groundwater near an agricultural waste storage facility, waste treatment facility or other area of concern to detect the occurrence of seepage and to monitor groundwater quality through time.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to the design, installation, and development of monitoring wells near components of an agricultural waste management system.

This practice does not apply to:

- Methods for developing a groundwater monitoring plan
- Methods for collection of groundwater samples
- Analysis or interpretation of laboratory test results
- Monitoring of subsurface waters in the vadose (unsaturated) zone
- Installation of wells for any other purpose
- Temporary exploratory drill holes.

CRITERIA

General Criteria Applicable to All Purposes

Permits. The landowner is responsible for obtaining all necessary permits for the work prior to construction. The contractor is responsible for locating all buried utilities in the project area, including drainage tile and other structural measures.

Laws and Regulations. Monitoring wells shall be planned, designed, constructed, operated and maintained in a manner that meets all local, State, Tribal and Federal laws and regulations.

Refer to the Oklahoma Water Resources Board (OWRB) Rules and Regulations, Chapter 35, Subchapter 7-2 “Minimum Standards for Construction of Wells”. The (OWRB) rules are minimum standards and other laws and regulations which are more stringent may be applicable.

Refer to the Oklahoma Department of Agriculture, Food, and Forestry – Agricultural Environmental Services Division rules and regulations for minimum installation requirements for monitoring wells.

Criteria, where not in conflict with, or less stringent than that required in, the OWRB or ODAFF rules, shall conform to the ASTM guidance below.

Hydrogeologic Site Characterization. Use guidance provided in ASTM D5092, “Standard Practice for Design and Installation of Groundwater Monitoring Wells,” to conduct surface and subsurface investigations within the area of concern prior to the design of a monitoring well. Use this information to develop a conceptual hydrogeologic model of the site, identify probable groundwater flow paths, and determine the target monitoring zone(s).

Use National Engineering Handbook 631 (NEH-631), Geology, for methodologies for identification, field-testing, and interpretation of geologic material and mass factors that affect movement and flow direction of groundwater within the area of concern.

At a minimum the hydrogeological investigation shall address the following;

- Include the mapping, identification and description of soil and rock masses that affect the movement and transport of subsurface water occurring within a minimum of 100 feet from the footprint of the facility of interest.
- Identify and describe all characteristics and properties of geologic units that can influence subsurface water flow paths or produce preferred flow paths such as karst development, joint sets, fracture systems, faults, lineaments, and other similar discontinuities. These shall be located on a geologic evaluation map of the site.
- Identify and describe any tile lines, subsurface drains, surface drains, irrigation ditches, irrigation wells, water supply wells, septic drain fields, infiltration strips, 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.
- 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).
- Identify and describe any seasonal changes in the potentiometric surface and direction of subsurface water flow paths.
- 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.

Planning. Locate and describe any tile lines, subsurface drains, surface drains, irrigation ditches, irrigation wells, water supply wells, septic drain fields, infiltration strips, quarries, mines, and other water control/management features that influence the flow of local subsurface and surface water.

Identify and describe other relevant 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, or permafrost.

Estimate the vertical and lateral seasonal variability in the water table using guidance provided in NEH 651, Agricultural Waste Management Field Handbook, Chapter 7.

Write a report of the hydrogeologic investigation and include a geologic evaluation map or sketches of all identified features and interpretations.

Layout. Use the hydrogeologic investigation report to determine the optimum location(s) of monitoring wells, both up-gradient and down-gradient of the waste storage facility or in the area of concern.

In highly fractured-rock and in karst aquifers, locate the monitoring wells in the zones of highest permeability, even if locations are offsite.

Design. The design of all components of the monitoring well must conform to criteria provided in ASTM D5092.

Materials. Materials used for the construction of monitoring wells must not chemically react with the groundwater and must not leach substances into the groundwater. Avoid quick-setting cements containing additives that may leach from the cement and influence the chemistry of water samples collected from the monitoring well.

For conventionally screened and filter-packed groundwater monitoring wells located in sand and gravel aquifers and other granular materials, ensure the grain size distribution contains less than 50% finer than the 200 sieve and less than 20% clay sized material.

Ensure all materials used in construction, development, and sealing are free of contaminants prior to installation.

Use only commercial well screens or slotted pipe.

Use only threaded jointed pipe or casing. Do not use glued or solvent-welded joints.

Use only materials of adequate strength to withstand the forces of installation and well development.

Installation. Select the design protocol and installation method according to site-specific conditions identified during the hydrogeologic investigation.

Use only drilling or digging equipment capable of creating a stable, open, vertical hole for proper installation of the monitoring well.

Installation methods must conform to ASTM D5092, and ASTM D5787, "Standard Practice for Monitoring Well Protection."

Direct push methods for installation are allowable provided they are consistent with guidance provided in ASTM D6724, "Guide for Installation of Direct Push Groundwater Monitoring Wells," and ASTM D6725, "Practice for Direct Push Installation of Prepacked Screen Monitoring Wells in Unconsolidated Aquifers."

Well Protection. Protect the monitoring well from damage from hazards such as frost action, surface drainage, animal or equipment traffic, and lack of visibility.

Establish positive surface drainage away from the wellhead.

Establish a buffer zone with a minimum radius of 30 feet around the wellhead of the monitoring well. Use fencing or other types of protection that excludes motorized vehicle access and livestock.

Ensure that 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 occurs within the buffer zone at any time.

Development. Well development procedures must target the most productive hydrogeologic zones penetrated by the monitoring well. Seal the annular spaces adjacent to non-productive zones to prevent cross contamination and comingling of chemically or biologically different zones of underground or surface waters. Refer to ASTM D5521, "Standard Guide for Development of Groundwater Monitoring Wells in Granular Aquifers" for a description of the various development methods. Conduct the development process only after completion of well installation, fill and sealing operations, and wellhead protection measures.

Recordkeeping. When writing records to describe a groundwater site, refer to guidance provided in 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."

CONSIDERATIONS

In developing the conceptual hydrogeologic model, consider effects of geomorphic processes, geologic structures, regional stratigraphy, and soil and rock properties on subsurface flow patterns, location of groundwater recharge, and pollution potential. Consider the physical properties and methods of movement in the environment of solutes and pollutants of interest and potential impact of relevant soil properties (clay content, organic matter) when designing and locating the physical position and depth of a monitoring well. Also, consider inherent physical and conductive properties of relevant soil horizons (particle size, structure, kSAT).

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 installing additional monitoring wells at other locations and at appropriate depths to ensure identification of the location and direction of movement of any potential contaminant plume.

Consider alternative drilling or digging methods for installing monitoring wells as 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 damage of the monitoring well(s).

PLANS AND SPECIFICATIONS

Prepare plans and specifications for constructing, installing, completing, and developing monitoring wells that describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

Operation and maintenance requirements must comply with the purpose of this standard.

Maintenance and rehabilitation procedures must comply with criteria in ASTM D5978 to ensure acquisition of groundwater samples free of artificial turbidity, eliminate siltation of wells between sampling events, and permit acquisition of accurate groundwater levels and hydraulic conductivity test data from the zone screened by the well.

When no longer needed, close the well according to NRCS Conservation Practice Standard *Well Decommissioning (Code 351)*.

REFERENCES

American Society for Testing and Materials:

ASTM D5092 "Standard Practice for Design and Installation of Groundwater Monitoring Wells"

ASTM D5408, "Standard Guide for Set of Data Elements to Describe a Ground-Water Site: Part One – Additional Identification Descriptors"

ASTM D5409, "Standard Guide for Set of Data Elements to Describe a Ground-Water Site: Part Two – Physical Descriptors"

ASTM D5521, "Standard Guide for Development of Groundwater Monitoring Wells in Granular Aquifers"

ASTM D5787, "Standard Practice for Monitoring Well Protection"

ASTM D5978, "Guide for Maintenance and Rehabilitation of Groundwater Monitoring Wells

ASTM D6286, "Standard Guide for Selection of Drilling Methods for Environmental Site Characterization"

ASTM D6724, "Guide for Installation of Direct Push Groundwater Monitoring Wells"

ASTM D6725, "Practice for Direct Push Installation of Prepacked Screen Monitoring Wells in Unconsolidated Aquifers"

USDA, NRCS, 2012. National Engineering Handbook Part 631, Geology.

USDA, NRCS, 2010. NEH 651, Agricultural Waste Management Field Handbook, Chapter 7, Geology and Groundwater Considerations.

ODAFF – AEMS, AEMS Statutes and Rules, Retrieved from http://www.state.ok.us/~okag/aems/laws.htm

OWRB, Rules, Chapter 35 Well Driller and Pump Installer Licensing, Retrieved from http://www.owrb.ok.gov/util/rules/rules.php

NRCS, OK

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