

## Water Well Decommissioning (NO) 351

Michigan Water Well Construction and Pump Installation Code.

For information on properties of common well plugging materials, refer to ASTM D 5299-99, "Standard Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities."

It is recommended that the well sealing work be completed by a water well drilling contractor registered with the state of Michigan.

The following criteria are allowable limits for design parameters, acceptable installation processes, or minimum performance requirements for accomplishing the identified purpose.

**Data Collection.** All available data for the well, such as as-built construction and maintenance records, shall be collected and reviewed to determine the casing material schedule, length and diameter of casing, types of liners and presence of screens, total well depth, static water level, and geologic material encountered in the bore hole.

The existing conditions of the well shall be documented as shown in the "Plans and Specifications" section.

**Well Preparation.** The well shall be cleared of all pumping equipment, valves, pipelines, drop pipes, seals, debris, and other foreign material.

**Sealing Materials.** All materials used for sealing any portion of the well shall have a hydraulic conductivity (saturated condition) that is less than that of the lowest hydraulic conductivity of the geologic materials being sealed. Properties of plugging materials shall conform to characteristics listed in ASTM D 5299-99.

Sealing materials for use in drilled and driven wells screened in glacial drift can include neat cement (various forms of portland cement), concrete grout, bentonite slurry, or bentonite chips or pellets. If bentonite chips or pellets are used, they shall be screened to remove dust and fine particles before being placed in the well. The minimum size of the chips and pellets shall be 1/4 inch (6.35 mm) in diameter.

### DEFINITION

*The sealing and permanent closure of an inactive, abandoned, or unusable water well.*

### PURPOSE

- *Eliminate physical hazard to people, animals, and farm machinery; and to prevent entry of animals, debris, or other foreign substances*
- *Prevent contamination of groundwater by surface water inflow*
- *Restore the natural hydrogeologic conditions, to the extent possible, by preventing vertical cross-contamination or commingling of groundwaters between separate water bearing zones*
- *Eliminate the possibility of the water well being used for any other purpose*
- *Allow future alternative use or management of the site*

### CONDITIONS WHERE PRACTICE APPLIES

This practice applies to any drilled, driven, dug, bored, or otherwise constructed vertical water supply well determined to have no further beneficial use.

This practice does not apply to wells that were used for waste disposal, and for which evidence of contamination still exists.

### CRITERIA

All planned work shall comply with General Manual Title 450, Part 405, Subpart A, Compliance with Federal, State, and Local Laws and Regulations. The plugging of water wells in Michigan is regulated under authority of Part 127, Act 368 PA 1978. Refer to the promulgation of rules contained within the

Materials suitable for use in plugging the rock portion of bedrock wells include neat cement or concrete grout which shall be placed from the bottom of the well to not less than 20 feet (6.1 m) above the top of bedrock.

Sealing of Dug Wells. Soil backfill separated by layers of bentonite chips can be used to plug dug wells and some large diameter, 18 inches (0.46 m) or larger, bored wells. Backfill shall be clean and free of foreign matter. Topsoil or organic soil shall not be used as backfill in the portion of the well that is 4 feet or more below grade. The placement of backfill and bentonite shall be accomplished in a manner that prevents bridging or formation of void spaces. Layers of backfill shall not exceed 10 feet (3.0 m) in thickness. Layers of bentonite chips separating the fill layers shall be a minimum of 6 inches (150 mm) thick.

Plugging Sequence: All obstructions, including pumping equipment and debris shall be removed from the dug well prior to plugging. If a steel well casing has been installed in the bottom of the dug well, the steel casing must be properly sealed using the methods defined above for sealing cased wells, before beginning to plug the dug or bored well.

Beginning at the bottom of the dug or bored well, a 6 inch (150 mm) layer of bentonite chips shall be placed at the bottom of the well, and then a 10 foot (3.0 m) or less layer of backfill shall be placed. This sequence of a 6 inch layer of bentonite followed by a 10 foot (3.0 m) or less layer of backfill shall be installed, in repeating, upward intervals, to the static water table. At the static water table, another six inch layer of bentonite shall be placed. The area above the water table shall be sealed using the same interval of layered backfill and bentonite as the lower section, up to a point 4 feet (1.2 m) below grade. The crock, brick, stone, or tile curbing in the top 4 feet (1.2 m) of the well shall be removed, and then a 6 inch (150 mm) layer of bentonite shall be placed. The remainder of the well, up to ground surface may be backfilled with native soil. This backfill shall be crowned in a manner that will allow for settling and will prevent water from ponding over the former well site. Seeding of the area disturbed by the plugging operation is recommended.

Placement of Materials for Plugging Drilled Wells. All slurry-form materials shall be placed from the bottom upward, using a tremie pipe in a manner that

ensures continuous placement without bridging or formation of void spaces.

Surface Seal. The casing shall be completely removed from the well or cut off at a depth not less than 4 feet (1.2 m) below ground surface. The interval between the ground surface and the top of the cut-off casing or curbing shall be filled with soil materials that achieve an in-place hydraulic conductivity that is comparable to or less than that of the surface soil surrounding the well. The ground surface at the sealed well site shall be mounded, graded, and seeded in a manner that prevents ponding of surface runoff.

## CONSIDERATIONS

This practice may be part of a ground water protection system that includes water and chemical management practices.

To the extent practicable, an abandoned well should be decommissioned in a manner that assures that the original hydrogeologic conditions of the well site are not compromised, and does not preclude the use of the site for future land management practices.

Decommissioning requires special consideration of specific geological, biological, physical, and climatic conditions; well construction practices; and chemical composition of the surrounding soil, rock, and ground water at the well site. The selection of appropriate procedures, fill, and sealing materials should be made according to these considerations.

## PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

Support data documentation requirements are as follows:

- Inventory and evaluation records
  - Assistance notes or special report
- Survey notes, where applicable
  - Design survey
  - Construction layout survey
  - Construction check survey
- Design records
  - Physical data, functional requirements and site constraints, where applicable

- Soils/subsurface investigation report, where applicable
- Design and quantity calculations
- Construction drawings/specifications with:
  - Location map
  - “Designed by” and “Checked by” names or initials
  - Approval signature
  - Job class designation
  - Initials from preconstruction conference
  - As-built notes
- Construction inspection records
  - Assistance notes or separate inspection records
  - Construction approval signature
- Record of any variances approved, where applicable
- Record of approvals of in-field changes affecting function and/or job class, where applicable.
- A record of the installation of this practice shall be made using form EQP 2044 “Abandoned Well Plugging Record” provided by the Michigan Department of Environmental Quality.
- The completed plugging record shall be signed and submitted to the local health department by the individual that performed the well plugging procedure, within 60 days of completion of the plugging procedure.
- Registered well drillers also have the option of submitting the plugging record on-line through the “Wellopic” system, in lieu of submitting form EQP 2044 to the local health department.

#### **OPERATION AND MAINTENANCE**

An operation and maintenance (O&M) plan shall be developed for this practice. The O&M plan shall be consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for the design.