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Standard Practice for Monitoring Well Protection[1]

This standard is issued under the fixed designation D 5787; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

This practice for monitoring well protection is provided to promote durable and reliable protection of installed monitoring wells against natural and man caused damage. The practices contained promote the development and planning of monitoring well protection during the design and installation stage.

1. Scope

1.1 This practice identifies design and construction considerations to be applied to monitoring wells for protection from natural and man caused damage or impacts.

1.2 The installation and development of a well is a costly and detailed activity with the goal of providing representative samples and data throughout the design life of the well. Damages to the well at the surface frequently result in loss of the well or changes in the data. This standard provides for access control so that tampering with the installation should be evident. The design and installation of appropriate surface protection will mitigate the likelihood of damage or loss.

1.3 This practice may be applied to other surface or subsurface monitoring device locations, such as piezometers, permeameters, temperature or moisture monitors, or seismic devices to provide protection.

1.4 *This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 150 Specification for Portland Cement[2]

C 294 Descriptive Nomenclature of Constituents of Natural Mineral Aggregates[3]

D 5092 Design and Installation of Ground Water Monitoring Wells in Aquifers[4]

3. Terminology

3.1 *Definitions:*

3.1.1 *barrier*—any device that physically prevents access or damage to an area.

3.1.2 *barrier markers*—plastic, or metal posts, often in bright colors, placed around a monitoring well to aid in identifying or locating the well.

3.1.3 *barrier posts*—steel pipe, typically from 4 to 12 inches in diameter and normally filled with concrete or grout that are placed around a well location to protect the well from physical damage, such as from vehicles.

3.1.4 *borehole*—a circular open or uncased subsurface hole created by drilling.

3.1.5 *casing*—pipe, finished in sections with either threaded connections or bevelled edges to be field welded, which is installed temporarily or permanently to counteract caving, to advance the borehole, or to isolate the zone being monitored, or a combination thereof.

3.1.6 *casing, protective*—a section of larger diameter pipe that is emplaced over the upper end of a smaller diameter monitoring well riser or casing to provide structural protection to the well and restrict unauthorized access into the well.

3.1.7 *riser*—the pipe extending from the well screen to or above the ground surface.

3.1.8 *sealed cap*—a sealable riser cap, normally gasketed or sealed, that is designed to prevent water or other substances from entering into, or out of the well riser.

3.1.9 *vented cap*—a cap with a small hole that is installed on top of the riser.

[1] This practice is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Ground Water and Vadose Zone Investigations.

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[2] *Annual Book of ASTM Standards,* Vol 04.01.

[3] *Annual Book of ASTM Standards,* Vol 04.02.

[4] *Annual Book of ASTM Standards,* Vol 04.08.

4. Significance and Use

4.1 An adequately designed and installed surface protection system will mitigate the consequences of naturally or man caused damages which could otherwise occur and result in either changes to the data, or complete loss of the monitoring well.

4.2 The extent of application of this practice may depend upon the importance of the monitoring data, cost of monitoring well replacement, expected or design life of the monitoring well, the presence or absence of potential risks, and setting or location of the well.

4.3 Monitoring well surface protection should be a part of the well design process, and installation of the protective system should be completed at the time of monitoring well installation and development.

4.4 Information determined at the time of installation of the protective system will form a baseline for future monitoring well inspection and maintenance. Additionally, elements of the protection system will satisfy some regulatory requirements such as for protection of near surface ground water and well identification.

5. Design Considerations

5.1 The design of a monitoring well protective system is like other design processes, where the input considerations are determined and the design output seeks to remedy or mitigate the negative possibilities, while taking advantage of the site characteristics.

5.2 The factors identified in this practice should be considered during the design of the monitoring well protective system. The final design should be included in the monitoring well design and installation documentation and be completed and verified during the final completion and development of the well.

5.3 In determining the level or degree of protection required, the costs and consequences, such as loss of data or replacement of the well, must be weighed against the probability of occurrence and the desired life of the well. For monitoring wells which will be used to obtain data over a short time period, the protection system may be minimal. For wells which are expected to be used for an indefinite period, are in a vulnerable location, and for which the costs of lost data could be high, the protective system should be extensive. Factors to consider and methods of mitigating them are presented in the following sections.

5.3.1 *Impact Damages*—Physical damages resulting from construction equipment, livestock, or vehicles striking the monitoring well casing frequently occur. Protective devices and approaches include:

5.3.1.1 Extra heavy protective casings with a reinforced concrete apron extending several feet around the casing may be an acceptable design in those areas where frost heave is not a problem. The principle behind this is to design the protective casing so that it will be able to withstand the impact of vehicles without damage to the riser within.

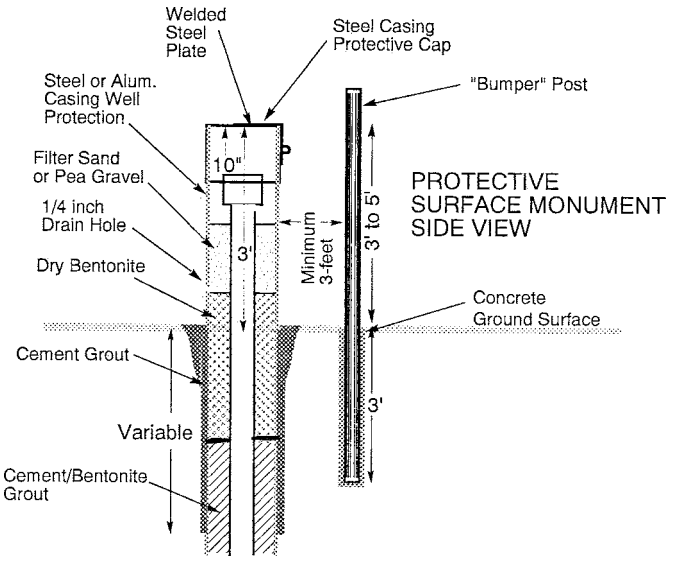

FIG. 1 Example of Protective Design

5.3.1.2 Barrier Posts placed in an array such that any anticipated vehicle can not pass between them to strike the protective casing. Barrier posts are typically filled with concrete and set in post holes several feet deep which are backfilled with concrete. Barrier posts typically extend from 3 to 5 feet above the ground surface. Barrier posts are frequently used in and around industrial or high vehicle traffic areas. Costs for installation can be substantial however they provide a high degree of protection for exposed wells. Cost of removal at decommissioning can also be substantial.

NOTE 1—Cattle frequently rub against above ground completions leading to damage of unprotected casings. Concrete filled posts or driven T-posts, wrapped with barbed wire, are frequently used.

5.3.1.3 Barrier Markers are relatively lightweight metal or often plastic posts which provide minimal impact resistance but which by their color, location, and height, warn individuals of the well presence. The use of barrier markers is effective in areas that are well protected from impact type damage by other features, such as surrounding structures or fences. They are relatively inexpensive to install.

5.3.1.4 *Signs*—An inexpensive means of identifying the presence of a monitoring well. Signs provide protection only by warning of the well presence. Signs may be required in some circumstances and appropriate in others. Wells known to contain hazardous, radioactive, or explosive compounds should be marked to warn sampling personnel of potential dangers. When a potential exists for water usage, signage indicating that the water is non-potable and is utilized strictly as a monitoring well, and not for any other purpose, may be appropriate. Disadvantages of signs are that they may be ignored, are often difficult to maintain, and may invite vandalism to the well.

5.3.1.5 Recessed or Subsurface casings may be used to mitigate impact damage by allowing the vehicles to pass over. Frequently used techniques include recessing the casing below ground level, using commercially available covers. These may take the form of valve pits or manholes, as examples. Advantages include both protecting the well while minimizing the interference to surface traffic, such as in parking lots or urban