



# Technical Assistance Document (TAD) for Delineating "Other Sensitive Ground Water Areas"

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## I. Introduction

### I.A. Purpose of this Technical Assistance Document

This Technical Assistance Document (TAD) provides guidance to EPA Regions and States with primary enforcement responsibility under the Safe Drinking Water Act (SDWA) regarding EPA's interpretation of the requirement to delineate "other sensitive ground water areas" (OSGWAs), as related to the *Revisions to the Underground Injection Control Regulations for Class V Injection Wells* (40 CFR 145.23(f)(12)). The guidance is designed to implement national policy on this issue in a consistent fashion.

The SDWA provisions and EPA regulations described in this document contain legally-binding requirements. This document does not substitute for those provisions or regulations, nor is it a regulation itself. Therefore, this document does not impose legally-binding requirements on EPA, States, or the regulated community, and it may not apply to a particular situation based upon the circumstances. EPA and State decisionmakers retain the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate. Any decisions regarding a particular facility will be made based on the applicable statutes and regulations. Interested parties are therefore free to raise questions and objections about the appropriateness of the application of this guidance to a particular situation, and EPA will consider whether or not the recommendations or interpretations in the guidance are appropriate in that situation. EPA may change this guidance in the future.

This TAD provides Underground Injection Control (UIC) Programs with guidance on how to identify and delineate OSGWAs. Exercising the option to identify and incorporate these OSGWAs can be of great benefit in targeting a State's resources and strengthening the overall approach to comprehensive drinking water source protection.

EPA recommends that persons using this TAD familiarize themselves with both the Class V rule requirements applicable to motor vehicle waste disposal wells, as well as the provisions of the EPA-approved Source Water Assessment and Protection (SWAP) Program for their respective State.

### I.B. Background

*The Revisions to the Underground Injection Control Regulations for Class V Injection Wells* (hereinafter referred to as "the Class V Rule") bans existing motor vehicle waste disposal wells in areas critical for the protection of ground water. Owners or operators of existing motor vehicle waste disposal wells may seek a waiver from the ban and obtain a permit (40 CFR 144.88(b)(1)). (Note: The reader is referred to Chapter 5 of EPA's State Implementation Guide for the Class V Rule [EPA 816-R-00-008] for an expanded discussion of these permitting and closure requirements).

The new Class V Rule requirements apply only to owners and operators of **existing** motor

vehicle waste disposal wells in two areas:

- (1) ground water protection areas assessed under the State Source Water Assessment and Protection (SWAP) Programs (40 CFR 144.88(b)(1)(i)), and
- (2) other sensitive ground water areas (OSGWAs) as delineated by the UIC Program (40 CFR 144.88(b)(1)(ii)).

Initially, the Class V Rule requirements for existing motor vehicle waste disposal wells apply to wells in ground water protection areas that are local assessment areas for community and non-transient non-community water systems that use ground water as a source (40 CFR 144.87(b)(i)). States must then delineate OSGWAs where the rule will apply next (40 CFR 144.87(c)). States may, as an option, apply the rule statewide without delineating OSGWAs (40 CFR 144.87(f)). These OSGWAs are critical in the protection of underground sources of drinking water (USDW) from contamination by Class V wells, but are not designated as ground water protection areas. These areas may include highly productive aquifers that supply transient non-community water systems (i.e., delineated as part of the State SWAP Programs) or private wells, areas overlying sole-source aquifers, aquifer recharge areas, karst aquifers, or other hydrogeologically vulnerable areas (40 CFR 144.86(g)).

#### I.C. Linkages Between Class V Wells and Ground Water Protection Areas

A ground water protection area is a geographic area near and/or surrounding community and non-transient non-community water systems that use ground water as a source of drinking water. These areas receive priority for the protection of drinking water supplies. Section 1453 of the SDWA requires States to delineate and assess these areas as part of their State SWAP Programs. An assessment requires three main components:

- delineation of source water protection areas,
- inventory of potential contaminant sources in the delineated protection areas, and
- determination of susceptibility of the water systems to contamination.

Upon completion of these steps, the results of a source water assessment must be made available to the public. **A local source water assessment is considered completed when the results of the assessment are made available to the public.**

A detailed description of the delineation approach for ground water protection areas is presented in each State's EPA-approved SWAP Program. In many States, the delineation approaches for these areas are the same as their approved approaches for delineating well-head protection areas. In cases where the State delineated zones or areas representing various levels of protection, the State will need to determine which areas correspond to ground water protection areas for the purpose of the Class V Rule.

As a part of the State SWAP Program, each State is required to complete assessments of all transient non-community water systems in addition to community and non-transient non-community water systems. The Class V Rule does not include source water assessment areas of transient non-community water systems that use ground water as a source; however, a State may include these areas as OSGWAs, if determined to be appropriate.

#### I.D. Identifying and Delineating OSGWAs

In the Class V Rule, the requirements for motor vehicle waste disposal wells are expanded beyond ground water protection areas to include OSGWAs as designated by the States, or in the case of direct implementation (DI) programs, the EPA Regional Offices. Expanding the rule to OSGWAs will give UIC Programs the flexibility to identify critical areas, in addition to ground water protection areas, that require additional protection. The addition of these areas in the rule gives the UIC Program authority (if it does not exist in current State statute or regulation) to protect other important aquifers from potential damage by motor vehicle waste disposal wells located in areas outside of ground water protection areas.

If determined to be unnecessary, a State has the flexibility not to delineate OSGWAs (40 CFR 144.87(f)). The State should be aware that if the decision is made not to delineate OSGWAs, all motor vehicle waste disposal wells (except those wells located in ground water protection areas) will be required to close or seek a waiver from the ban and obtain a permit by January 1, 2007 (40 CFR 144.87(f)). States should notify the EPA by December 29, 2000 of their decision not to delineate OSGWA (as part of the UIC primacy revision packages) and apply the rule statewide by January 1, 2007 (40 CFR 145.23(f)(12)). A State may decide not to delineate additional sensitive ground water areas for a variety of reasons that include:

- existing statewide ban of motor vehicle waste disposal wells,
- new statewide ban of motor vehicle waste disposal wells (through revised rules),
- absence of motor vehicle waste disposal wells across the State, and
- the entire State consists of sensitive ground water areas.

#### I.E. Submission of Plans for Identifying and Delineating OSGWAs

The UIC Programs in Primacy States and EPA Regions (for DI States and Indian Tribes) will be responsible for completing the delineation of OSGWAs. Primacy States must first develop a plan for identifying OSGWAs (40 CFR 145.23(f)(12)).

In the case of DI Programs, the EPA Regions will work with their States and Tribes to complete their plans for delineating OSGWAs and make them available for public comments by December 29, 2000. This date was selected to correspond with the deadline established for Primacy States. Public notice will be given regarding the plans availability. EPA may provide technical assistance to the States and Tribes and/or enter into a Memorandum of

Understanding with them in developing the plans for delineating OSGWAs.

Upon approval by EPA, the States will have until January 1, 2004 to complete the delineation process. If a State is making reasonable progress in completing the delineations but needs additional time, the State may apply to EPA for an extension of up to one year to complete its delineations (40 CFR 144.87(c)).

In the case of DI Programs, the EPA Regions will work with the States and Tribes to complete the delineations by the January 1, 2004 deadline. EPA may provide technical assistance to the States and Tribes and/or enter into a Memorandum of Understanding with them in conducting the delineations of OSGWAs.

## I.F. Coordination with Other Programs and the Public

### *I.F.1. Completion of Source Water Assessments*

Information exchange between the UIC and SWAP Programs is essential to the implementation of the Class V Rule.

- For States with Primacy in both the Class V UIC and Drinking Water Programs, the two Programs should work closely to ensure that the results of local assessments are made known to the UIC Program and available to the public.
- For States with Primacy in the Class V UIC Program but not the Drinking Water Program, the State UIC Program should coordinate with EPA to ensure that the results of local source water assessments are made known to the State UIC Program and the public in a timely manner.
- For States with Primacy in the Drinking Water Program but not the Class V UIC Program, the EPA Regional Office will need to work closely with the State SWAP Program to ensure that the results of local assessments are made available to EPA and the public in a timely manner.

The results of local source water assessments will be made available to the general public under the SWAP Program. However, the affected motor vehicle waste disposal well owners and operators may not be aware that their wells are located in regulated areas and are subject to the new requirements. Therefore, upon the completion of a local source water assessment for a ground water protection area, the UIC Program is encouraged to notify owners and operators of motor vehicle waste disposal wells that have submitted an inventory to the UIC program regarding their responsibilities in meeting the Class V Rule requirements. In addition, outreach programs through trade organizations, building and plumbing inspectors, and local watershed associations can be used to make well owners and operators aware of their compliance requirements.

### *I.F.2. Delineation of OSGWAs*

For States with Primacy in the Class V UIC Program, the UIC Program should work with other appropriate State agencies (e.g., State Geological Surveys and State Drinking Water Programs) to develop the plans for delineating OSGWAs (i.e., assuming the UIC program and the drinking water programs are in separate agencies or offices). It is also important to consider experiences from the process of susceptibility determination (a part of the source water assessment process) to develop the delineation approach for sensitive ground water areas.

For DI Programs, EPA will work with the States and Tribes to develop plans for delineating sensitive ground water areas. EPA may provide technical assistance to the States and Tribes and/or enter into a Memorandum of Understanding with them in developing the plans and conducting the delineations.

Upon the completion of the delineation of OSGWAs, the UIC programs must make the delineation results available to the public (40 CFR 145.23(f)(12)). The results should be made public as soon as available but in any case no later than the completion date (i.e., January 1, 2004). Outreach efforts should be targeted to affected well owners and operators regarding their responsibilities in meeting the Class V Rule requirements. In addition, outreach programs through trade organizations, building and plumbing inspectors, and local watershed associations can be used to make well owners and operators aware of their compliance requirements.

### I.G. Extensions for Delineating OSGWAs

EPA believes that all States will complete their delineation of OSGWAs by the given deadline. If a State requires more time to complete the delineation, it may apply for an extension of up to one year (i.e., up to January 1, 2005). Such an extension will only be granted if a State has made reasonable progress in completing its delineation but requires more time to complete the task. A State must complete and submit the extension request to EPA by June 1, 2003 (40 CFR 144.87(c)).

### I.H. Where to Go for More Information

- **HOTLINE:** EPA operates the Safe Drinking Water Hotline [1-800-426-4791] which can answer questions about the regulations and programs developed under the Safe Drinking Water Act, and provide federal and State contacts for specific information. It can also provide information on drinking water publications.
- **INTERNET:** EPA's Drinking Water Web site [[www.epa.gov/safewater/](http://www.epa.gov/safewater/)] provides information on EPA's implementation of SDWA, the contaminants regulated under SDWA, educational activities and publications on drinking water, and links to other drinking water web sites.

## II. Developing a Plan to Identify and Delineate OSGWAs

40 CFR 145.23(f)(12) provides items that States are expected to consider in developing their other sensitive ground water area plan, including:

- geologic and hydrogeologic settings,
- ground water flow and occurrence,
- topographic and geographic features,
- depth to ground water,
- significance as a drinking water source,
- prevailing land use practices, and
- any other existing information relating to the susceptibility of ground water to contamination from Class V injection wells.

The following describes the plan elements:

- Identify Sensitive Geologic Conditions -- This section of the plan should include methods you will use to identify geographic areas in which Class V wells may penetrate or otherwise impact aquifers in areas such as karst, fractured bedrock or other shallow/unconsolidated aquifers.
- Identify Legal Designations -- This portion of the plan should discuss the criteria you will use in identifying aquifers or portions thereof that would be legally designated in your State, including sole source aquifers.
- Criteria used for Exclusion/Considerations for Final Designation of Other Sensitive Ground Water Areas -- A variety of factors could influence your decisions to include or exclude an area. A State may want to consider factors such as: the depth to ground water; the likelihood of use of the ground water resource; and the presence or absence of confining layers that may protect the USDW.
- Public Participation -- As part of the primacy revision package, a State's plan for designating OSGWAs is subject to public participation requirements. Public participation may include stakeholder meetings, statewide publication with opportunity to comment, public meetings, or other means.
- Plan for Making Designations Known to the Public -- Once the delineations are completed, it is critical that the public be aware of the delineations. A State can use a similar approach to that developed by the State's SWAP Program.



The rule (40 CFR 145.23(f)(12)) specifically states that a State's OSGWA delineation plan must include a commitment from the State to:

- complete all delineations of OSGWAs by January 1, 2004,
- make the delineations available to the public after they are complete, and
- implement the new Class V regulations in the delineated sensitive ground water areas by January 1, 2007.

A primacy revision package that does not include a plan for the delineation of OSGWAs will be considered incomplete unless the State indicates in the application that it does not intend to delineate OSGWAs. If a State does not delineate OSGWAs, the motor vehicle waste disposal well requirements of the Federal rule will then apply statewide to all owners and operators on January 1, 2004, and they will be required to fully comply with the rule by January 1, 2007 (40 CFR 144.87(f)).

### **III. Delineating "Other Sensitive Ground Water Areas"**

OSGWAs are areas that are hydrogeologically sensitive, and areas where maintaining the high quality of ground water is critical. These latter areas could include: all or portions of sole-source aquifer areas; areas with transient non-community water wells and/or clusters of domestic wells; and areas that contribute baseflow to streams or reservoirs that supply, or may in the future supply, public drinking water.

Designation of OSGWAs is described below. For the purpose of discussion, OSGWAs are categorized into three broad types: areas relative to USDWs, areas with transient non-community or domestic drinking-water wells, and areas supplying ground water to surface water supplies of public drinking water.

#### **III.A. Areas Relative to Underground Sources of Drinking Water (USDWs)**

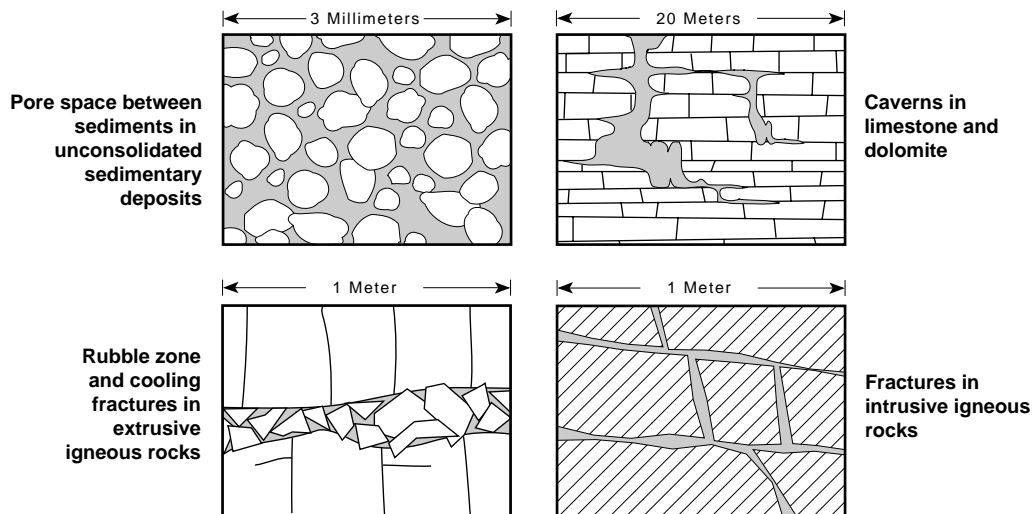
Contamination of a USDW can occur when motor vehicle wastes percolate to a USDW, or when wastes, already in a USDW, expand laterally within it. This TAD addresses only downward percolation of motor vehicle waste to a USDW<sup>1</sup>.

##### *III.A.1. Aquifer Areas*

The identification of sensitive aquifers is perhaps the most critical concept in this TAD. Some areas are prone to contamination by Class V wells, solely as a result of the nature of the underlying aquifer.

<sup>1</sup> In the very rare instances of deep Class V wells, States are directed to the document "Regional Assessment of Aquifer Vulnerability and Sensitivity in the Coterminous United States" [EPA/600/2-91/043] for State maps showing aquifers and portions of aquifers whose transmissivity makes them sensitive/vulnerable. States may also find EPA/600/2-91/043 helpful in identifying areas where existing contaminants are most likely to spread laterally.

Highly permeable aquifers are particularly at risk of contamination. This risk results from the ease with which contaminant-laden water can percolate downward from the motor vehicle waste disposal well to the saturated zone. Contamination is therefore caused by vertical movement of water and contaminants from the waste disposal well to the saturated zone. Large conduits such as well-developed fractures or karst features, or large and well-sorted sediments, can provide rapid pathways for contaminants to reach the saturated zone of an aquifer (Figure 1).



**Figure 1. Types of Openings in Selected Water-Bearing Rocks**

States delineating OSGWAs may choose to begin by identifying aquifer areas. The Class V Rule lists karst, fractured volcanics, and unconsolidated sedimentary aquifers, such as glacial outwash deposits and eolian sands, as examples of aquifer types. The EPA urges States to consider all aquifer types that, based on their inherent characteristics, are likely to be moderately to highly sensitive. Such aquifer types are those that potentially have high permeability, such as fractured aquifers; porous media aquifers with a grain-size of sand or larger, including not only unconsolidated aquifers, but sandstone as well; and karst aquifers. State implementing agencies will need to discuss the selection of sensitive aquifer types with their technical staff and/or professionals at such agencies as the State or Federal geological surveys.

State and Federal geological surveys have numerous geological maps and technical reports that can be helpful in the identification of areas of sensitive aquifers. University geology and earth science departments and consulting company reports may also have helpful information. Because most States maps are likely to depict very generalized hydrogeologic information, probably the best place for the Class V implementing agency to begin obtaining information is the generalized geologic maps available for many States<sup>2</sup>. Consultation with hydrogeologists or geologists at the State and Federal geological surveys can help

<sup>2</sup> The U. S. Geological Survey (USGS), as part of its ongoing Regional Aquifer-System Analysis (RASA) and National Water Quality Assessment programs produces maps showing basic hydrogeologic data at various scales. The RASA program is systematically studying 28 major aquifer systems across the country. A Ground Water Atlas for the United States is being developed. Most of the 13 planned multi-State atlas sections have been published. More detailed maps are available from the USGS and from State geological surveys.

interpret and refine the geological maps, especially to identify areas where mitigating factors reduce the permeability of aquifers (see "Mitigating Factors" section below).

#### III.A.1.a. Mitigating Factors: Hydrogeologic

Any factors that prevent contaminated waste water from a motor vehicle waste disposal well from entering a USDW could potentially serve as a mitigating factor. Although all aquifer types have the potential to become contaminated by motor vehicle waste disposal wells, mitigating factors such as a confining unit above the aquifer may exist that reduce the likelihood of such contamination. Other factors include great depth to ground water; poorly developed and/or connected geologic formations; formations with very fine fractures or small grain size; and formations with poor sediment-size sorting and/or high silt/clay content.

It is important to recognize that the threshold values for the effectiveness of mitigating factors (e.g., thickness of a confining unit or depth to ground water) are generally unknown. Additionally, threshold values will vary from location to location. For example, an unsaturated zone "x" feet thick may be protective of the aquifer in some settings, but not in others. State agencies implementing the Class V Rule will likely need to confer with technical professionals while selecting mitigating factors and threshold values.

#### III.A.1.b. Mitigating Factors: Land Use

A State may choose to delete a portion of a sensitive aquifer from consideration as an OSGWA based on other criteria such as population density in different areas of the aquifer or potential commercial/industrial development, etc.

### III.A.2. *Sole Source Aquifers (SSAs)*

Some States may choose to designate a Sole Source Aquifers (SSAs) as sensitive. By definition, a SSA contains highly valued ground water. If a State chooses to designate only a portion of the SSA, the State will need to select the criteria by which to identify the non-sensitive portion of the SSA.

#### III.A.2.a. Mitigating Factors: Hydrogeologic

If a State chooses to identify only portions of the SSA that are hydrogeologically sensitive, the approach used should be similar to the discussion of highly permeable aquifers (see Section III.A.1.a. above).

#### III.A.2.b. Mitigating Factors: Land Use

If a State chooses to designate a portion of a SSA based on other-than-hydrogeologic criteria, the criteria that could be used include population density in different areas

of the aquifer or potential commercial/industrial development.

### *III.A.3. Aquifer Recharge Areas*

Identification of recharge areas of confined aquifers will require technical consultation. Aquifer recharge areas of unconfined aquifers may be difficult to distinguish from aquifer discharge areas. Where this difficulty exists, it may be necessary to undertake hydrogeologic studies or consultation with technical experts on staff or in the State or Federal geological surveys.

#### *III.A.3.a. Mitigating Factors*

In most cases, recharge areas of confined aquifers are sensitive. States may, however, be able to identify factors that support the State's decision to not designate a recharge area as an OSGWA. These factors might be hydrogeologic in nature, for example, low productivity of the aquifer, or very long ground water travel time to any area likely to have, or to develop, drinking water wells. Factors may also be based on land use, for example, very low population density, or land uses that preclude development of drinking water wells.

### *III.B. Areas Associated With Transient Non-Community (TNC) Public Water Supply (PWS) Wells or Domestic Water Supply Wells*

The Class V Rule does not define source water assessment areas of transient non-community (TNC) public water system (PWS) wells and the area of ground water contribution to domestic drinking water wells as sensitive. However, States may want to designate the source water contribution area for such wells.

#### *III.B.1. Transient Non-Community Public Water System Wells*

The source water assessment area of TNC wells will be delineated as part of a State's SWAP Program. Additionally, the 1997 SWAP Program Guidance gives States the option of designating "area-wide source water protection areas," which are delineated areas from which more than one PWS receive water. For the purpose of the Class V Rule, States could, in an analogous fashion, identify as sensitive, individual TNC wells and/or those areas with numerous TNC wells in the same hydrogeologic setting.

#### *III.B.1.a. Mitigating Factors*

If States choose to refine the initial area-wide assessments for TNC PWSs, hydrogeologic mitigating factors could be applied. The factors could include those discussed above in Section III.A.1.a. Additionally, a State might wish to fine-tune by considering other-than-hydrogeologic factors, such as those discussed above in Section III.A.1.b.

### III.B.2. Areas of Domestic Wells

Some States may want to identify areas of domestic wells, in a manner analogous to area-wide delineations for TNC PWS wells. A State could define areas containing numerous domestic wells as OSGWAs. Because the discharge of domestic wells is low, the boundary of such an OSGWA might only be tens of feet from the outermost domestic wells in the cluster.

#### III.B.2.a. Mitigating Factors

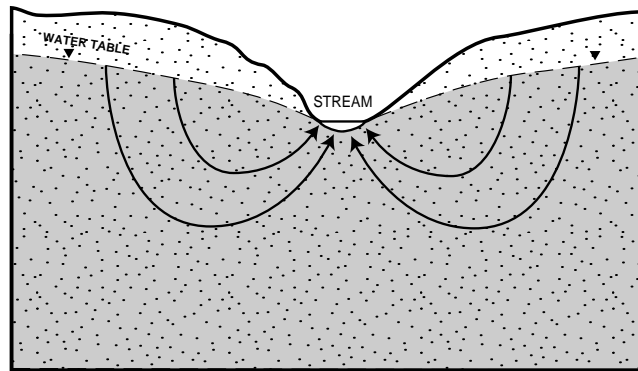
Hydrogeologic mitigating factors could include those discussed above in Section III.A.1.a. Additionally, a State might wish to consider other factors, such as those discussed above in Section III.A.1.b.

#### III.B.2.b. Individual Domestic Wells

States also have the option of designating as an OSGWA, the contribution area about an individual domestic well. However, the small size of the ground water contribution area combined with the lack, or imprecision of, locational information for these wells, would likely render the mapping of these OSGWAs of little protective value.

### III.C. Areas Supplying Ground Water Discharge to Surface Water Supplies of Drinking Water.

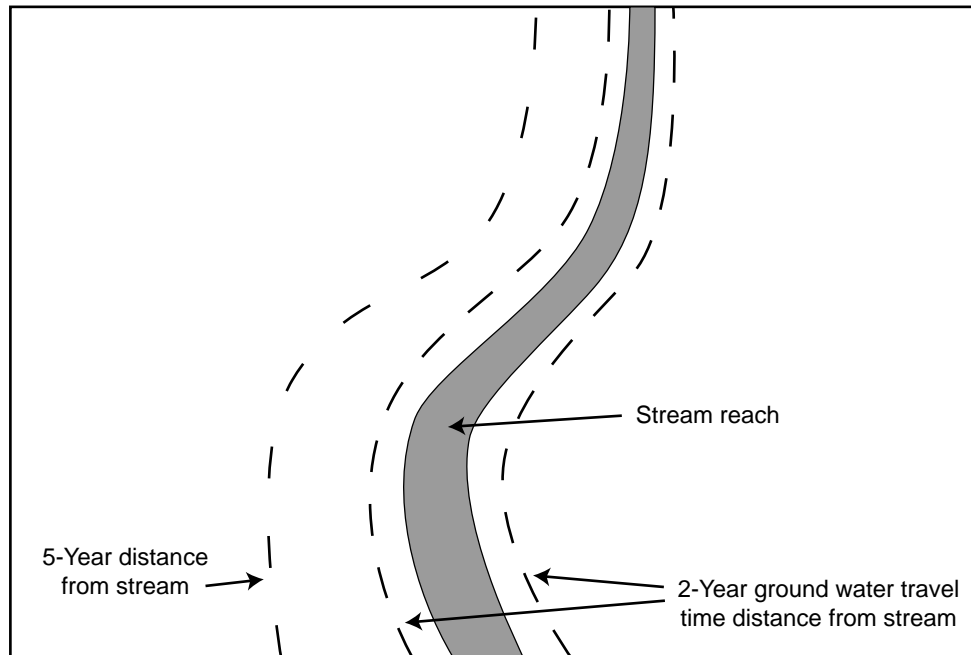
The areas of ground water contribution to hydraulically connected surface water underlie and border rivers, lakes and reservoirs. Protection of PWS surface-water intakes should recognize that ground water, via baseflow to streams, is generally a component, possibly a major one (and during some parts of the year, possibly the only component), of streamflow (Figure 2).



**Figure 2. Ground Water Entering Stream Via Baseflow**

As a result of the relationship between ground water and surface water, States may be concerned about the quality of ground water that discharges to streams or reservoirs that supply, or may in the future supply, water to PWS intakes. States may choose to designate all, or some portion of, the ground water discharge area as an OSGWA. The difficulty that accompanies the identification of the boundary between recharge and discharge areas may confound the designation of discharge areas as OSGWAs in the absence of hydrogeologic studies. However, numerous options exist for a "managerial" decision regarding the area to be so designated. These options are identified in the EPA document "Delineation of Source Water Protection Areas, A Discussion for Managers, Part 1: A Conjunctive Approach for Ground Water and Surface Water" [EPA 816-R-97-012] published in October 1997 and they include:

- Floodplain boundary setback for perhaps the 20-, 50-, or 100-year flood. However, the extent of the floodplain is not related to the areas through which ground water contributes to surface water.
- Hyporheic zone boundary setback that may be defined by specific biological or physical parameters. The boundary of this zone can vary, depending on the defining parameter used. The size of the zone can vary seasonally and in response to droughts; where biological parameters are used, the extent of the zone may depend on how rapidly the microorganisms recolonize.



**Figure 3. Two and Five Year Ground Water Travel Times to Reach Stream**

- Ground water travel time (Figure 3) and fixed distance setbacks rely on the ability of soil and rock to improve water quality with time and ground water travel distance. Given the current level of knowledge, specific distances needed for sufficient in-situ remediation are generally unknown. These approaches are analogous to the travel-time and fixed-distance approaches used in the SWAP and Wellhead Protection (WHP) programs for wells.
- Ground water basin boundary that marks the furthest locations from which ground water will flow to a stream or other drain. The position of the boundary may vary seasonally and with climatic changes. The position of the boundary is often assumed to coincide with the position of the watershed boundary. While this assumption is not always true, it may be a sufficiently reasonable assumption for the purposes of the Class V Rule for most settings except karst.

### III.D. Process for Identifying OSGWAs

This subsection provides a process that States can use for identifying OSGWAs. This process can be stopped at any step. Additional steps will provide smaller, more fine-tuned OSGWAs.

#### ***Step One: Selecting Criteria to Identify Inherently Sensitive Areas***

States decide which types of hydrogeologic and/or land use features would make an area inherently sensitive. It is these features that, when mapped, will constitute the broad, first-round delineation of OSGWAs.

##### *Hydrogeologic Features:*

States may identify the aquifer types within their borders that are inherently sensitive. States should consider including sandstone aquifers, karstic aquifers, fractured aquifers, and unconsolidated aquifers (except those of very fine grain materials). States should also consider identifying highly productive aquifers as sensitive.

##### *Land Use:*

States may identify the land uses that are considered inherently sensitive. Land uses may include areas of highly valued water, areas of high-population density, etc., that could be adversely impacted by the presence of motor vehicle waste disposal wells. For example, many States will likely include SSAs in their list of inherently sensitive features.

#### ***Step 2: Delineation of Broad Inherently Sensitive OSGWAs***

States map the selected features identified in Step 1; that is, the boundaries of all inherently sensitive areas are drawn on a base map. Statewide geologic or hydrogeologic maps exist for many States and are available from the State or Federal geological surveys. Using a geological map as the base map will likely be easier than transferring geologic information to another base map.

Identification of inherently sensitive hydrogeologic features on geologic or hydrogeologic maps will likely require the assistance of staff professionals or geological survey professionals.

All SSAs have been mapped. Delineation of other land use features, such as areas of high population density, will likely need the cooperation of sister agencies.

#### ***Step 3: Selection of Mitigation Factors***

States, in consultation with experts in such fields as city planning, resource management, and hydrogeology, identify the critical factors that will allow the fine-tuning of the broad OSGWAs developed in Step 2. Among the criteria most likely to be considered are:

#### Technical

- confining units above the aquifer,
- depth to ground water,
- area is/is not an aquifer recharge area,
- area is/is not a source of ground water discharging to a surface water body that supplies, or in the future may supply, a PWS intake, and
- aquifer productivity.

#### Non-technical

- land use,
- likelihood of commercial/residential/industrial development,
- low population density, and
- significance of the aquifer as an existing or future drinking water source in the area.

#### ***Step 4: Second-Round Delineation of OSGWAs***

Consideration of the mitigating factors selected in Step 3 may result in portions of the initial OSGWAs no longer being considered sensitive. These areas are deleted from the base map.

#### ***Step 5: Decision to Continue the Refinement Process***

States evaluate the second-round OSGWA map and decides if the second-round map provides appropriately protective areas. The States have two choices:

- The map provides appropriately protective OSGWAs. The OSGWA selection process ends.
- The State identifies additional mitigating factors, repeats steps 3 and 4 to further refine OSGWAs.

#### III.E. Examples of the OSGWA-Identification Process

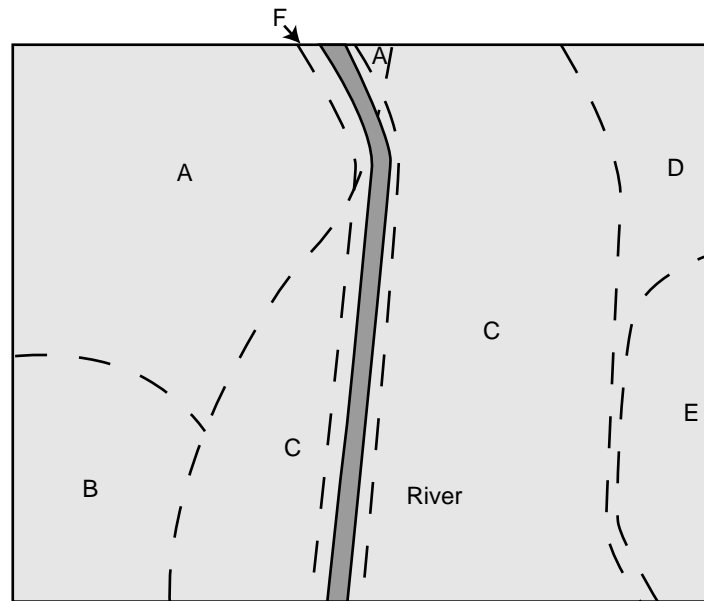
Attached are the case studies of hypothetical States applying the OSGWA-identification process described above.



## CASE STUDY: HYPOTHETICAL STATE A

### Introduction

State A (Map A) consists of six "sensitivity features." These have been identified by technical experts in the Class V implementing agency, in consultation with the U.S. Geological Survey. There is no statewide geologic map for the State and therefore the State will transfer information from existing maps and "fill in" generalized aquifer boundaries, where needed, through consultation with the State and Federal geologic surveys.



**Map A**

- Zone A consists of a vertical sequence of poorly fractured, low productivity aquifers, the shallowest of which has a deep water table.
- Zone B is an SSA consisting of moderately karstified limestone.
- Zone C is a highly productive, confined aquifer of alluvial sand and gravel.
- Zone D is the outcropping recharge area for the sand and gravel aquifer of zone C.
- Zone E is hydrogeologically the same as Zone D, but is a state park with primitive camping only, virtually no development and a very low population density.
- Zone F is alluvial sediments associated with the modern river that flows north-south through the center of the State. The river has cut through the confining layer of Zone D and most of the river's alluvium rests directly on the underlying aquifer. Only the edges of the alluvium lie on the confining unit.

The State has chosen to not separately delineate the area of ground-water recharge to the river.

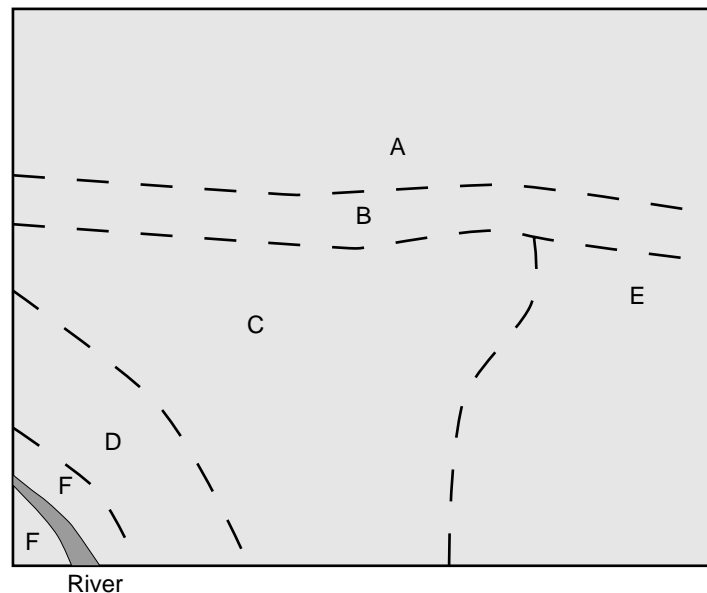
## **Process**

- Step 1: The implementing agency selected the features that it considered sensitive: SSAs, karstic aquifers, and coarse-, or moderately coarse-grained unconsolidated aquifers.
- Step 2: The State will then select mitigating factors.
- Step 3: Mitigating factors – the State identified confinement and the presence of a deep water table as the two primary factors that remove features from consideration as an OSGWA.
- Step 4: After discussion with, and assistance from, technical professionals, the State put together an OSGWA map, based on the mitigating factors selected in Step 2. This revised OSGWA map contains Zones B, D, E, and F. These zones cover about 30% of the State, however, the state park accounts for about one third of this area, and it has only two motor vehicle waste disposal wells that the State is already in the process of closing.
- Step 5: The State decides that the OSGWAs identified in Step 4 will be the final OSGWAs to satisfy the requirement of the Class V Rule.

## CASE STUDY: HYPOTHETICAL STATE B

### Introduction

State B (Map B) consists of seven hydrogeologic settings. These settings were identified through discussions with the State geological survey. A 1:250,000 geologic map is available for State B. This scale allows the identification of major geologic features only. However, these major features are sufficient for the implementation of the Class V Rule.



**Map B**

- Zone A is an outcrop area of consolidated sandstone. The water table is shallow.
- Zone B is a finely fractured, low productivity aquifer. The area is one of rugged mountains and the population density is, and will most likely continue to be, quite low.
- Zone C consists of a highly productive, tightly confined sand and gravel aquifer. It is part of the SSA that includes Zones D and E.
- Zone D is part of the SSA and is hydrogeologically similar to Zone C, except that the confining layer is leaky. Ground water discharges from the aquifer to the stream throughout most of this zone.
- Zone E is the recharge area for the SSA and is included in the designated SSA.
- Zone F consists of unconsolidated sand and is essentially the 50-year floodplain of the modern river.

## **Process**

Step 1: After discussions with the State and Federal geological surveys and with resource managers, the State selects the criteria for identifying sensitive areas. The State will use hydrogeologic criteria and land use criteria:

- Hydrogeologic criteria -- fractured rocks, unconsolidated sediments and sandstones are considered inherently sensitive.
- Land use criteria -- SSAs are considered inherently sensitive.

Step 2: The State maps the broad, first-round OSGWAs and determines that, based on the criteria selected in Step 1, the entire State is an OSGWA.

Step 3: The State selects mitigating factors that will reduce the size of the OSGWAs. The State selects hydrogeologic factors and land use factors:

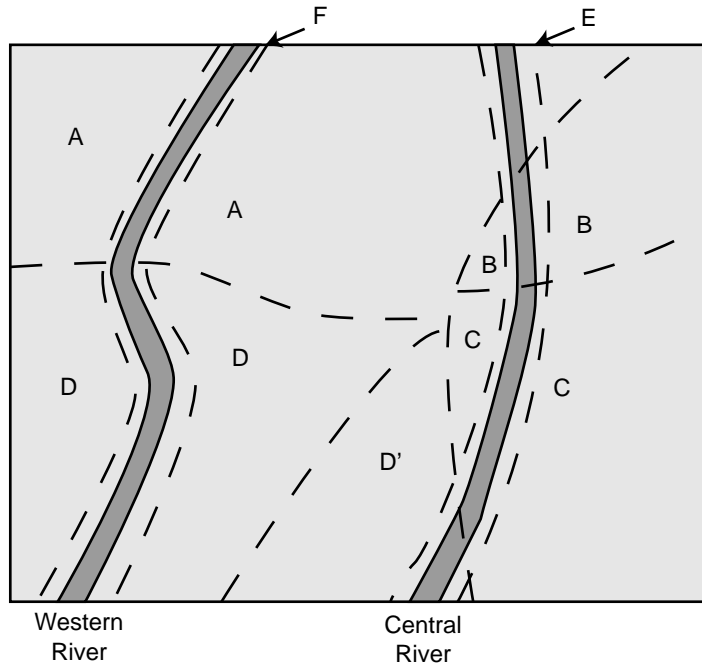
- Hydrogeologic -- areas that are highly confined are not sensitive.
- Land use -- areas with very low population density are not sensitive.

Step 4: Second-round delineation of OSGWAs. Based on the mitigating criteria selected in Step 3, the second-round OSGWAs consist of Zones A, D, E, and F. The OSGWA map shows that approximately half of the State is an OSGWA.

## CASE STUDY: HYPOTHETICAL STATE C

### Introduction

State C (Map C) consists of five sensitivity areas:



**Map C**

- Zone A consists of a highly productive, unconfined volcanic aquifer with a moderately deep water table. The topography is one of rolling hills. Over the last decade the population has been gradually increasing and the area is undergoing residential and commercial development.
- Zone B consists of a low productivity sequence of confined silty sand layers. The population density is about the mean for the State.
- Zone C consists of a low productivity sequence of unconfined silty sand layers. The population density is very low.
- Zone D is fairly flat, with a shallow water table. The aquifer is a highly productive sand and gravel. Zone D historically has had a very low population density and was almost entirely agricultural. However, the southeastern portion (D') is slowly undergoing urban sprawl; its population is growing and agriculture is giving way to development.
- Zone E is underlain by unconfined, coarse, alluvial sediments deposited by the river that flows through the central part of the State. The aquifer is highly productive and has a shallow water table. As is often the case, there is considerable development along the river and the population density is high. (Note that the alluvial valley of the western river is deep and too narrow to be shown on the map.)

- Subzone F consists of the area where aquifers contribute ground water to the western river. (Note that Subzone F is part of, and superimposed on other zones.) The position of the boundary of the area of ground water contribution to the river, was based on the position of a roughly calculated 10-year ground water-travel time to the stream (i.e., the same standard used in the WHP and the SWAP Programs). (Note: The 10-year travel time zone is not shown for the central river; this is because the 10-year zone is totally contained in the alluvial valley and will be incorporated into the floodplain area's designation as an OSGWA, as described below.)

No State geologic map exists. Map C is composed of the very generalized geologic boundary information pieced together from numerous maps. The geologic boundaries shown on Map C are only approximate, because the generalized nature and the scale of this map.

## **Process**

- Step 1: After discussions with the State and Federal geological surveys and with resource managers, the State selected hydrogeologic criteria for identifying sensitive areas as follows: areas with a coarse- or moderately coarse-grained, unconsolidated aquifer, areas with a fractured volcanic aquifer, and areas of ground water discharge to surface water sources of public drinking water. There are no karst aquifers or fractured aquifers, other than volcanic, in the State.
- Step 2: The State mapped the broad OSGWAs that met the selection criteria in Step 1. The OSGWA map consists of Zones A, D, E, and F. In total, the OSGWA areas cover about 60% of the State.
- Step 3: The State then selected mitigation criteria. The mitigating factor chosen to modify the initial OSGWA map was the presence of a deep water table.
- Step 4: Upon applying the mitigating factors in Step 3 to the first-round OSGWA map, the areas that remained OSGWAs are Zone D, Zone E, and the southern half of Subzone F, a total area of about 25% of the State.

The State was concerned that any further fine-tuning would result in underprotection. However, they did want to further prioritize area to be protected against motor vehicle waste disposal wells. Upon discussion of options with technical experts and resource managers, the State decided to carefully craft an additional mitigating factor. That is, the State decided to continue the process by returning to Step 3.

- Step 3: The State applied a final mitigating factor, very low population density (except for areas discharging ground water to streams supplying PWSs).
- Step 4: The OSGWA map was revised to reflect the additional mitigating factor. The remaining OSGWAs (Zones D', E, and the southern half of F) appeared to be protective and, occupying about 10% of the State, will facilitate implementation of the Class V Rule.

#### **IV. Time Line and Compliance Schedule for Delineating Other Sensitive Ground Water Areas**

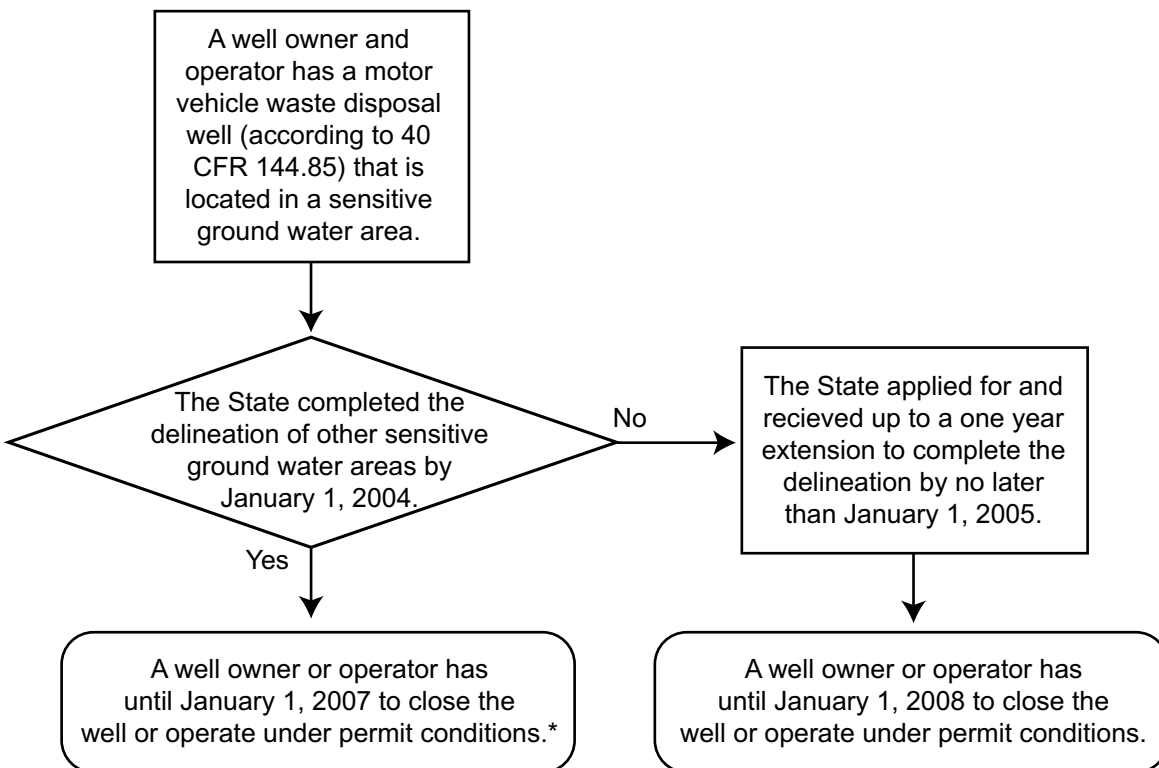
A summary of the time line for States to delineate OSGWAs is presented in the following table (40 CFR 144.87(c) and 40 CFR 145.23(f)(12)).

##### **Time Line for States to Delineate Other Sensitive Ground Water Areas**

Action Item	Requirement Date
Submission of Delineation Plan by Primacy State (with the Primacy Revision Package)	December 29, 2000
Application for Extending the Deadline to Delineate Other Sensitive Ground Water Areas by States (if needed)	June 1, 2003
Completion of the Delineation of Other Sensitive Ground Water Areas by States (without the one-year extension granted by EPA)	January 1, 2004
Completion of the Delineation of Other Sensitive Ground Water Areas by States (with up to a one-year extension granted by EPA)	Up to January 1, 2005

## Compliance Dates for Existing Motor Vehicle Disposal Wells in Other Sensitive Ground Water Areas

A State must complete the delineation of other sensitive ground water areas by January 1, 2004 unless it is granted a one-year extension to complete the delineation by no later than January 1, 2005.



\*The well owner or operator can apply for a one-year extension if his or her compliance option is connection to a sanitary sewer or installation of new treatment technologies. On a case by case basis, the State and EPA UIC Program will consider review the application for approval. This one-year extension, however, does not apply to the permit application deadline. In addition, this one-year extension is not available when a State is granted a one-year extension to complete its delineation of other sensitive ground water areas.