

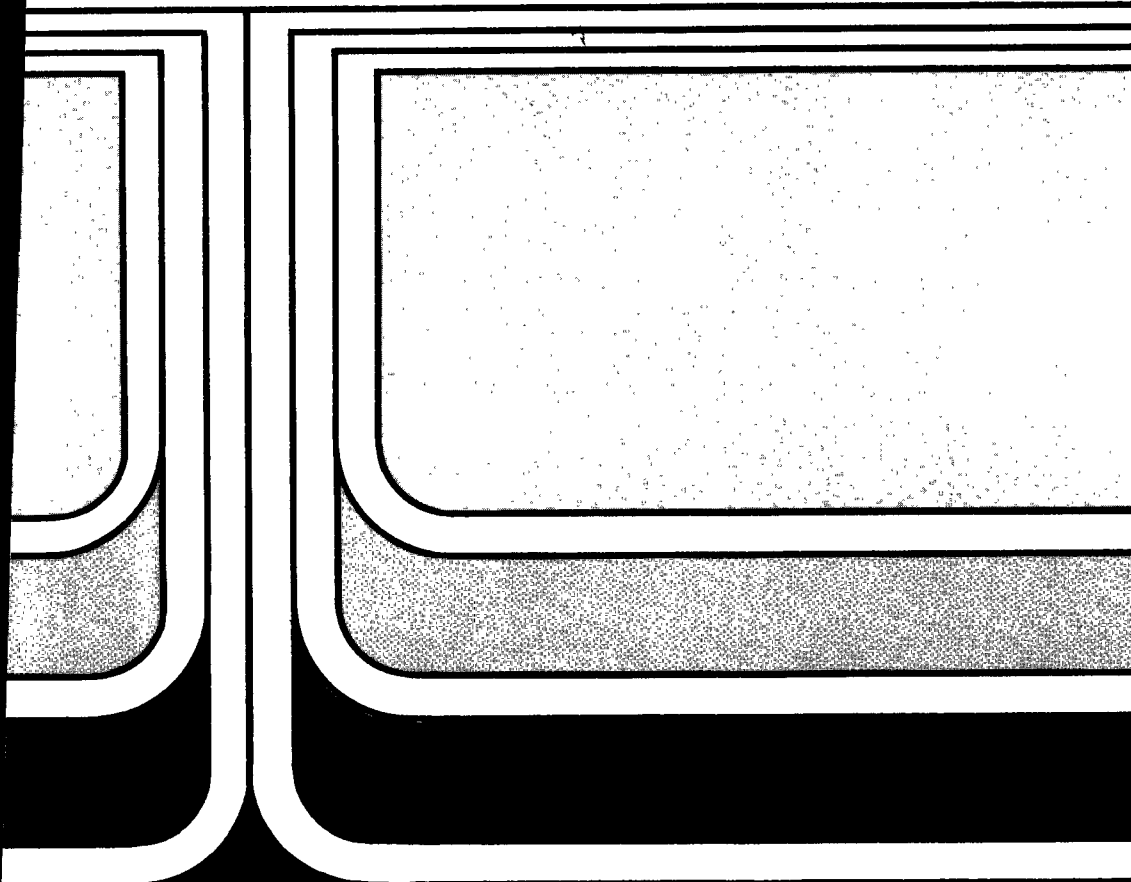
Office of Water



**EPA**

# **Wellhead Protection**

## **A Decision-Makers' Guide**



# Wellhead Protection A Decision-Makers' Guide

Perhaps you are a State legislator, whose constituents have been voicing their concerns to you about the contamination and closing of their local water supply wells. Or maybe you head a State public health or pollution control agency and see a need for better coordination of your State's ground-water protection activities. You could be chairman of a local zoning board making decisions on future development and wor-

ried that lack of potable water will limit the growth of your town.

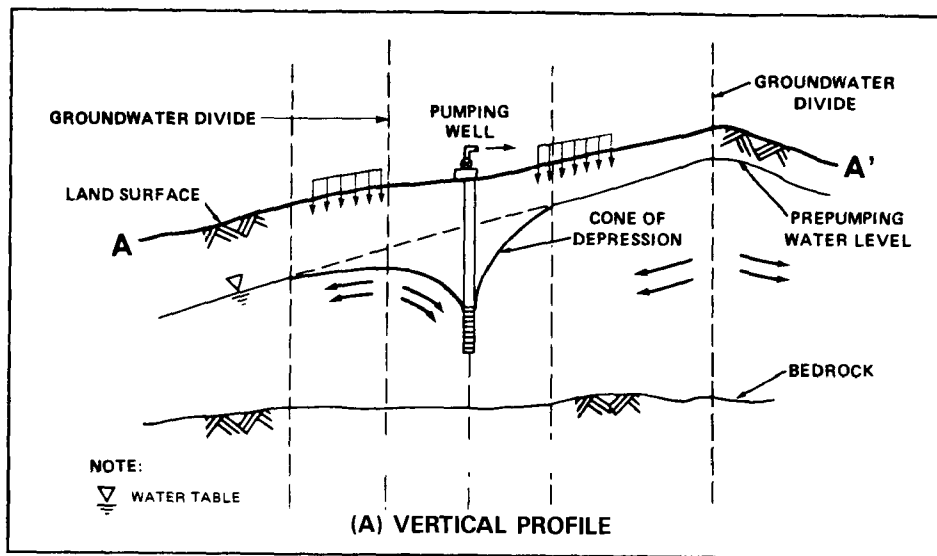
These are the kinds of problems that the Federal Wellhead Protection Program is meant to help States solve, and the reason the Program became part of the Safe Drinking Water Act Amendments of 1986. EPA has produced this booklet to explain how the Program works and how your State can benefit by participating.

---

## What is Wellhead Protection?

Wellhead protection is, by definition, protection of the area surrounding a well. So, first of all, we should explain what a "wellhead protection area" (WHPA) is. By statute, it is defined as the surface and subsurface area surrounding a well or wellfield that supplies a public water system through which contaminants are likely to pass and eventually reach the water well or wellfield.

WHPA boundaries are determined based on factors such as well pumping rates, time-of-travel of ground water flowing to the well, aquifer boundaries, and degree of confinement. All of these hydrogeologic characteristics have a direct effect on the likelihood and extent of contamination.



The ground-water surface around a pumping well is pulled down as water is drawn into the well, creating a cone of depression (COD) around the well. The extent of this cone can vary from only a few feet to many miles from the pumping well, depending on hydrogeological factors. Ground water drawn into the

pumping well is replaced by ground water further away, usually uphill (upgradient) from the well. The recharge area, which may be limited by physical or hydrologic boundaries, may consist of all or part of the cone of depression as well as the area from which the replacing water comes.

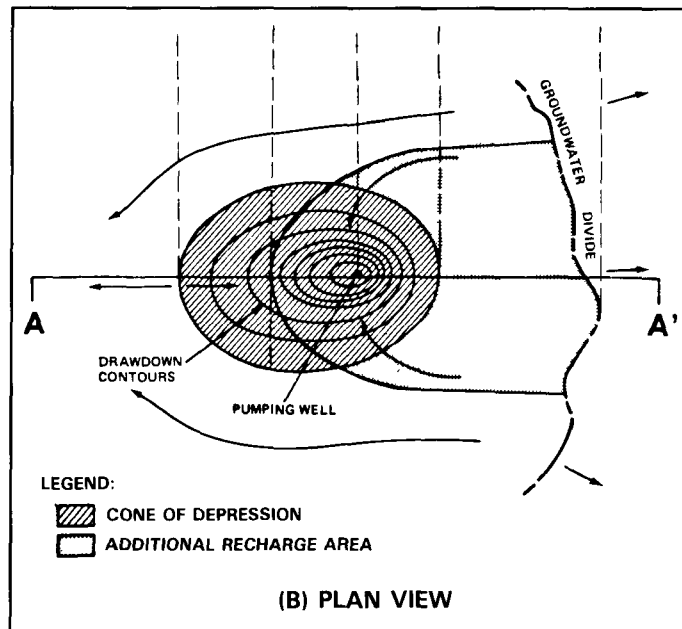
## A Well Contamination Incident

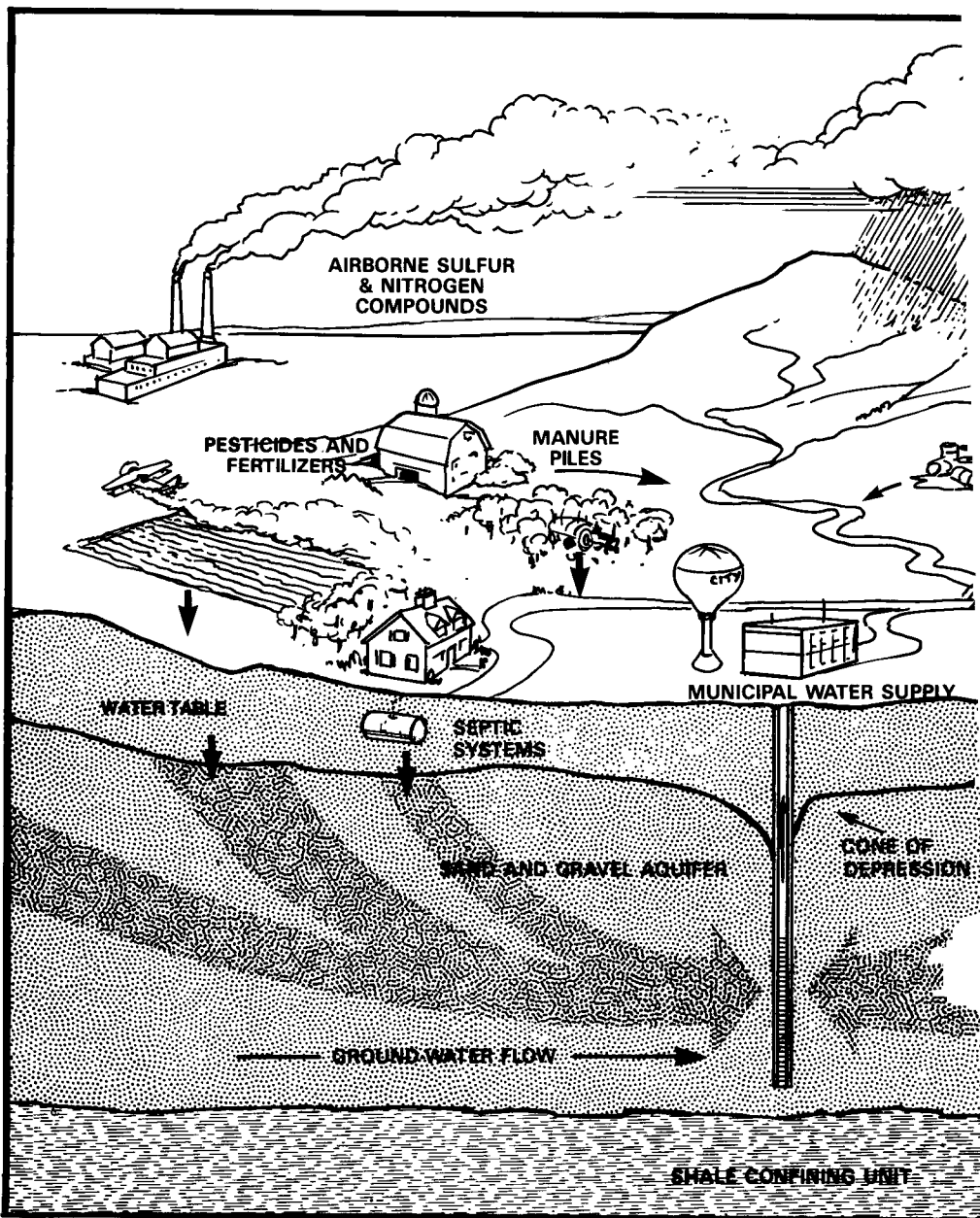
The problem of ground-water contamination is easy to define. If you pick up a newspaper in many communities, you may find an article describing a ground-water contamination incident and its effect on public water supplies. This is not surprising, since 95 percent of rural America and in total about half the U.S. population rely on ground water.

These incidents are especially sobering when

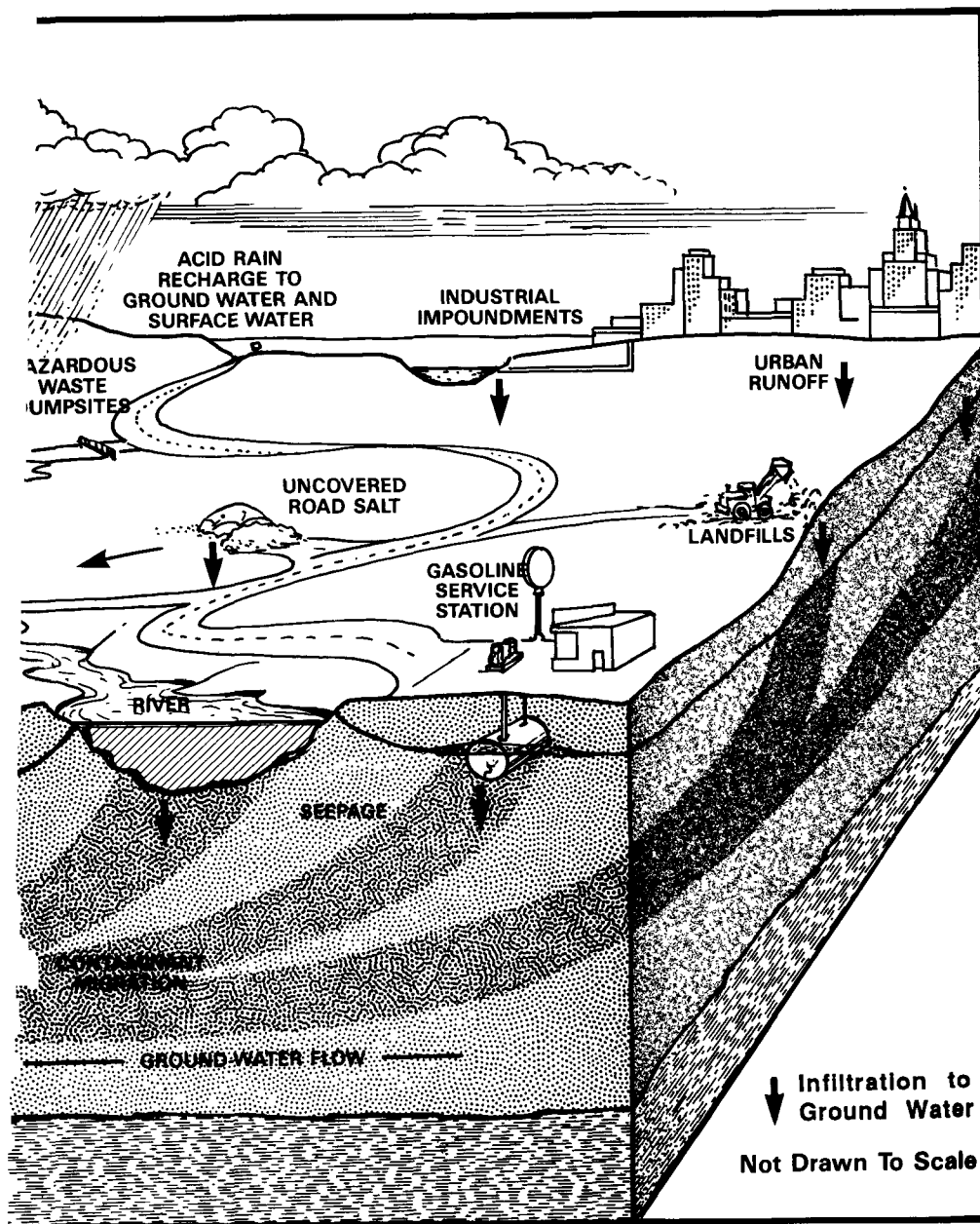
you realize the amount of time and money needed for clean up. For example, a leak in a gasoline storage tank in a community in Massachusetts made headlines in 1977 when it forced the shut-down of a nearby municipal wellfield, disrupting that community's only source of drinking water. When the tank was excavated, local officials estimated that between 2,000 and 3,000 gallons of high-test unleaded gasoline had leaked into the ground less than 600 feet from the nearest well in the municipal wellfield.

*A wellhead protection area (WHPA) can be established for any type of aquifer and can include all or part of the pumping well's cone of depression, the recharge area and the surrounding aquifer. The actual extent of the areas within WHPAs will vary depending upon the program goals of individual State programs and the hydrogeologic settings present in the State.*





*Potential Sources of  
Ground-Water Contamination*



*EPA has estimated that 20% of the one million underground petroleum storage tanks may be leaking and have the potential to contaminate water supplies.*

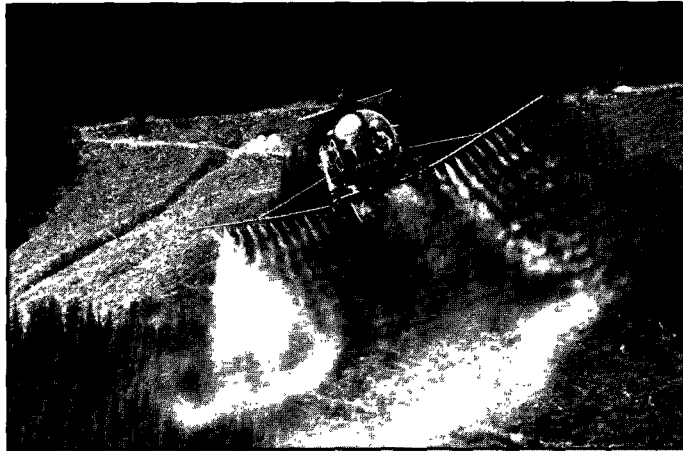


To address the problem, the town temporarily provided alternative water supplies, instituted a strict water conservation program, and began a two-phase clean-up process. The second phase, which began in 1985, consists of pumping and treating the contamination and then recharging the treated water back into the aquifer. This second phase will take three to five years to complete and will cost the town \$1.1 million; the Massachusetts Department of Environmental Quality Engineering, \$1.2 million; the Massachusetts Executive Office of Community Development, \$750,000; and the U.S. Department of Housing

and Urban Development, \$250,000. Many years of work and a total cost of \$3.3 million is a high price to pay for a leak in a gasoline storage tank.

This type of story, though a worst case example, is repeated in many States, and the more we look, the more problems we seem to find. For example, in California, 88 large public water supply system wells were closed because of organic chemical contamination including both solvents and pesticides. In Virginia, 27 public community supplies are on indefinite "boil water" notices, and in Iowa, 57

*Pesticide applications of all types are one of the many non-point sources of contamination.*



percent of the wells in alluvial areas have detectable pesticide residues.

It doesn't take too many incidents like these to recognize that cleaning up and treating contamination or siting and putting in new wells is a costly process.

### **Threats to Water Supply Wells**

Across the country, hundreds of types of potential sources of groundwater contamination have been identified. The magnitude of the potential problem begins to emerge when you consider just a few of these contaminant sources: 23 million septic tank systems;

9,000 municipal landfills; 190,000 surface impoundments; 280 million acres of cropland treated with pesticides annually; 50 million tons of fertilizer applied to crops and lawns annually; and over 10 million tons of dry salt and two million gallons of liquid salts applied to our highways every winter. These sources do not always threaten groundwater supplies, but always have the potential to do so, unless managed properly.

The areas surrounding water well supplies can be particularly vulnerable to these sources of contamination, since contaminants discharged within the recharge area to a pumping well may be drawn toward that

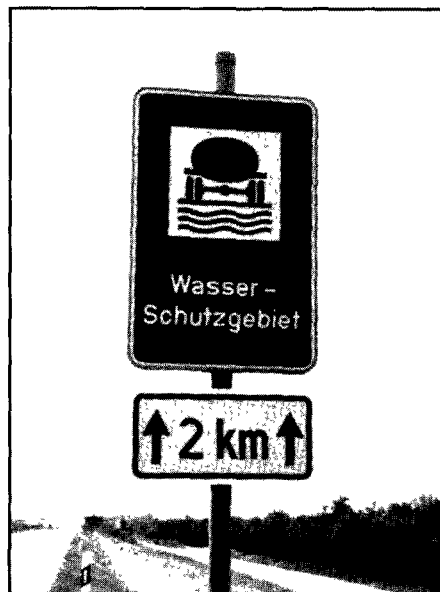


well. The proximity of most public water supply wells to the populations they serve, as well as to the every day activities of the community, also contribute to vulnerability. Sources as diverse as dry cleaners, septic tanks, industrial facilities, or road salting can cause well contamination. Contamination source controls and land management programs which address physical, microbial, and chemical threats to ground water are important tools that can help prevent well contamination.

*Road-side signs in Europe mark the boundaries of wellhead protection areas.*

## Wellhead Protection Measures

Designating protection areas around drinking water wells is one way to protect underground water supplies. Application of this concept is common in Europe. At least 11 European countries, including Germany, Switzerland, and the Netherlands have designated zones around their public water supplies. Within these zones, special controls are imposed on any number of potential hazards.

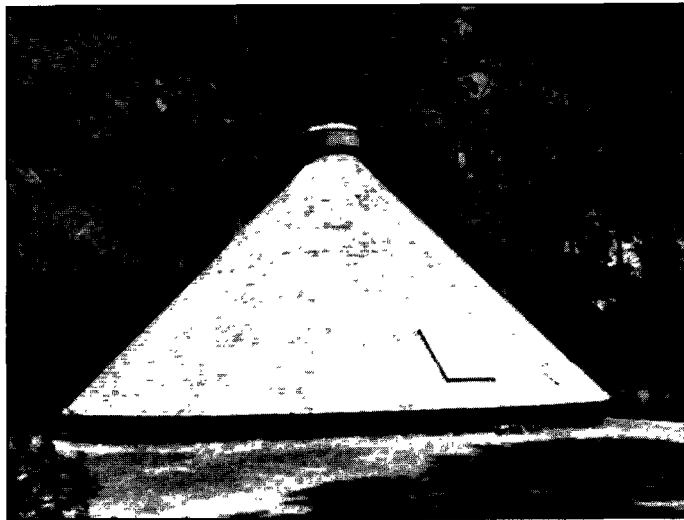


A growing number of States and municipalities in this country also are beginning to create such wellhead protection areas. To guard against the more persistent chemical threats, wellhead protection areas range anywhere from a distance of a few hundred feet to several miles from wells. The characteristics of the aquifers surrounding the wells, the extent of pumping and the vulnerability of the aquifer to surface contamination, and the degree of development and activity surrounding the well are the primary criteria by which most States, counties, or municipalities have delineated protection areas.

Management activities commonly employed within these protection areas include: regulation of land use through special ordinances and permits, prohibition of specified activities, and acquisition of land.

Massachusetts and Florida are among the States now using some of these management tools to protect public water supply wells. Beyond the obvious public health reasons, State-wide Wellhead Protection Programs make a lot of economic sense, as the earlier contamination examples illustrate.

*The Baddacock well in Groton, MA, one of the oldest public wells in New England, is being protected through a variety of land use management techniques.*





*Non-community wells such as those in campgrounds, for example, are also addressed by the Wellhead Protection Program.*

### **The Safe Drinking Water Act Amendments of 1986**

Provisions for wellhead protection were adopted as part of the reauthorization of the Safe Drinking Water Act, signed into law in June 1986. This legislation established a nationwide program to encourage States to develop systematic and comprehensive programs within their jurisdictions to protect public water supply wells and wellfields from con-

tamination from all anthropogenic sources.

The purpose of the Wellhead Protection Program is to prevent contamination of public water supplies. The primary goal is the prevention of problems as contrasted to correction of existing situations.

EPA's role in the Program is to provide leadership to States in efforts to preserve valuable groundwater supplies that currently, or may in the future, serve as sources of drinking water. This will be accomplished through program grants and technical guidance, not by imposing another layer of Federal regulation. The Federal government is not given any authority over water allocation, which is a State responsibility. Any Federal department or agency with jurisdiction over any potential source of contamination identified by a State under this Program is subject to the State's requirements.

State Wellhead Protection Programs developed under this Program are to address public water supply wells. There are

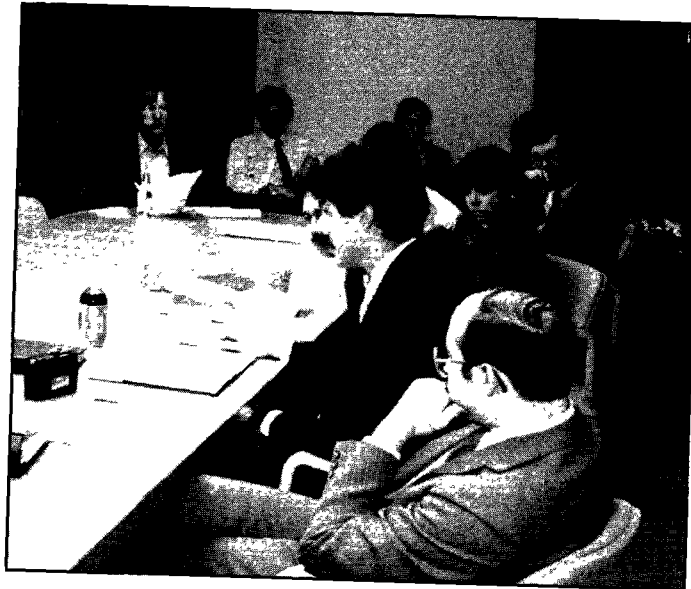
currently 187,000 public drinking water well systems, including 47,000 community and 140,000 non-community drinking water systems. These include

non-residential facilities, such as campgrounds and truck stops, and public water wells, which are those serving more than 25 persons.



*Siting and putting in new wells to replace contaminated wells can be a costly process.*

*Various levels of State and local government will be interacting in the development and implementation of Wellhead Protection Programs.*



### **The State Role In Wellhead Protection**

Historically, States have primary responsibility for ground-water management. EPA recognizes that they will fashion Wellhead Protection Programs that accommodate their own unique features and needs, since from State to State, and even within States, hydrogeology varies, sometimes dramatically, as do laws and administrative practices.

The Wellhead Protection Program was enacted to both enhance

State programs already underway, and to encourage other States to begin such protection programs by providing financial and technical assistance.

The statute specifies that all States will participate; however, the EPA has no authority to establish a Wellhead Protection Program if a State chooses to forgo action on its own. There are no EPA sanctions against States that do not participate.

Each State has the opportunity to design and implement a Wellhead Protection Program that meets broad Federal guidelines. States have a lot to gain as they go about the business of deciding how best to protect their ground water. They will benefit from the availability of a variety of technical assistance tools, and they will have additional funding to carry out the protective measures they decide are necessary.

### **Applying for a Wellhead Protection Program Grant**

What does applying for a grant involve? Basically, a State has to supply EPA with a blueprint of its Wellhead Protection Program. The Safe Drinking Water Act Amendments of 1986 set out the kinds of information that applicants must provide by requiring that six elements be addressed:

- Specify the duties of State and local agencies and public water systems in developing and implementing the Program

- Determine the extent of the wellhead protection area to be used
- Determine all potential anthropogenic sources of contaminants which may have an adverse effect on public health in the delineated wellhead areas
- Describe procedures to protect water supplies from such contaminants that are present within wellhead protection areas
- Include contingency plans for the provision of alternative drinking water supplies for each public water system in the event of well or wellfield contamination
- Require that all potential sources of contamination within the wellhead protection area of new public water supply wells be considered prior to construction.

*Calculation of the time it takes for contaminants to travel from the point where they enter the ground water to the wellhead is one method used to determine wellhead protection zones.*



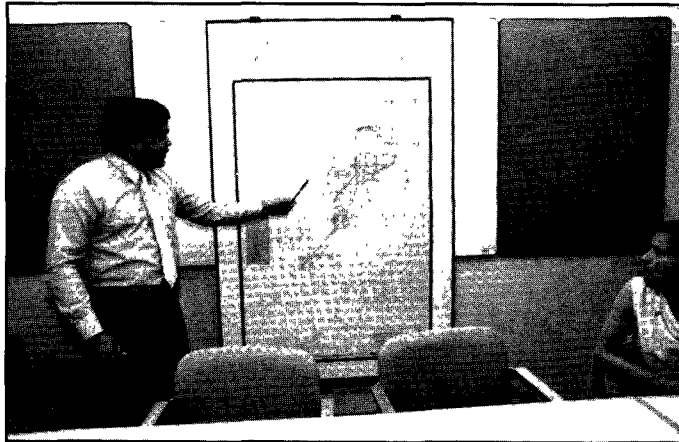
The Amendments further require an applicant State to demonstrate that public participation was solicited and carefully weighed in the process of formulating a Wellhead Protection Program.

As for choosing the way to create a Wellhead Protection Program that includes the above elements, that is left up to the individual State. However, the presumption is that, rather than starting from scratch, States will

build on Ground-Water Protection Strategies and existing programs and also look to those Federal programs with ground-water protection elements.

The EPA wants to ensure that States have a clear understanding of the intent of the statutory elements and will be offering specific guidance on how to establish a Wellhead Protection Program that will be eligible for Federal funding.

*Dade County is one of many communities that have established Wellhead Protection Programs.*



In fact, helping States to develop eligible programs is EPA's main goal as it administers the Wellhead Protection Program. As described later in this brochure, EPA will also publish a series of informational documents that include examples of programs and provide resource information to help States in developing their own programs.

### **Some Program Features**

Participants will need to designate a lead managing agency capable of carrying out requirements of the law and of coordinating communication and activities among the various entities that are

involved in public water administration and supply.

A very important program activity will be to determine the roles that State and local agencies, as well as public water suppliers, are to play in developing and carrying out the State Wellhead Protection Program. Again, the concept of a lead managing agency is introduced to ensure implementation through a coordinated and well managed program.

### **Getting Started**

When it comes to wellhead protection, participating States obviously will vary in their



needs and goals. Some will have sophisticated systems already in place; others may have few, if any, existing protection mechanisms.

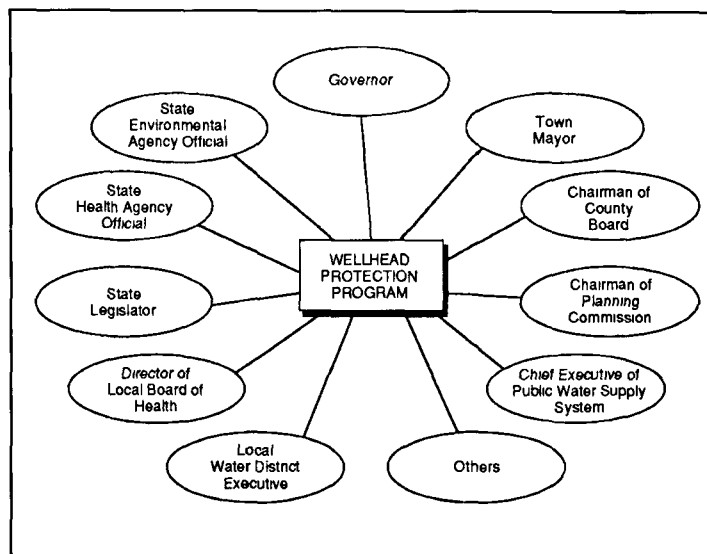
Whether the goal is to upgrade current programs, or just get started, every State has to begin by looking at the same things: the hydrogeology of the State as well as the existing legal and institutional apparatus. The latter is especially important to examine in order to get a head start in the planning process. For example, new laws may be needed to control sources of contamination not previously regulated. What are the steps neces-

sary to get such laws enacted and implemented and how long will it take?

Here is a list of questions that you might want to consider as you begin to develop a Wellhead Protection Program in your State:

- What is the seriousness and distribution of preventable well contamination problems in the State? Does a significant need exist for a State-wide effort to control such contamination?
- What organizational and legal authorities

*The roles of the various participants, on all levels, is a very important component of the Wellhead Protection Program*



already exist and are they sufficient to implement the type and level of wellhead protection desired on State and local levels?

- What is known about the hydrogeology of areas where public water supply wells are located?
- What jurisdictional units would be responsible for, or affected by, a WHP Program? State Departments of Environmental Quality or Public Health? What about substate units, such as special purpose districts, or public and private water companies? Are there local jurisdictional units and interested parties, such as Federal agencies with public water supply jurisdiction, to consider? How do we get these groups involved?
- What ground-water protection and resource management activities are already in place at the State and local levels? Could they be incorporated into

a WHP Program? Are there Federal and State programs with ground-water protection components that could be built on and enhanced?

- What kind of administrative structure is appropriate? Is there an existing agency that can manage the overall program, ensuring communication among those involved in program development? Or is a new umbrella agency needed? What capabilities should the managing agency have?
- What technical skills are needed for defining wellhead protection areas, taking stock of sources, and analyzing source risks?
- What resources are available (technical, managerial, and financial) to carry out the program? How can any gaps be closed? Is there information on existing inventories and risk assessment to use and thus avoid duplication?

Clearly, many factors have to be considered even before the process of identifying sources and developing management strategies can begin. Recognizing the extent of the commitment in time and resources that States will need to earmark for this program, EPA sought ideas from a broad spectrum of individuals and organizations in the development of program policy and guidance.

EPA consulted Federal, State, and local agencies; environmental groups; and experts in business, industry, and academia. State and local representatives, who have sat on technical committees and attended workshops, have helped pinpoint ways that EPA can streamline the program.

To help States plan programs eligible for Federal funding, EPA is preparing a series of documents, including a program guide and application package that spells out exactly what a State needs to include in a WHP Program submission for funding. Due out in June 1987, this package also will contain deadlines and funding information.

Targeted for publication at the same time, "Guide-

lines for Delineation of Wellhead Protection Areas" will outline various approaches that States can use to define protection areas around wellheads. The document specifically discusses various criteria mentioned by the statute that may be used to define wellhead protection areas. These include: distance, drawdown, time-of-travel, physical boundaries, and assimilative capacity approaches. The document also discusses a variety of technical methods to delineate these areas, ranging from simple "cookie-cutter" techniques to the use of sophisticated computer models.

Beginning in the summer and in the fall, EPA will issue several other technical assistance documents. The first of these will illustrate a variety of ways to put together a State Wellhead Protection Program. Other documents in the series will be similar to the one already issued on management of septic systems and will deal with specific topics pertinent to wellhead protection.

**Grant  
Process  
Schedule**

**Federal Funding**

Funding for Federal support of State WHP Programs is authorized for each of the Federal fiscal years 1987-1991. Subject to Congressional appropriation, funds have been requested in the President's Budget for FY 1988.

The first two years of funding are to be directed toward program development. Once a State program is approved, the State may then apply for funds to implement its program. EPA cannot fund program development after June 1989.

Funds will be allocated on a matching basis with EPA matching State funds at 90 percent for FY 1988, the maximum allowable level, with a 10 percent Federal matching level decrease during each of the subsequent program funding years, e.g., 80 percent for FY 1989. Assistance funds are for a one-year budget period and must be applied for annually.

During the development phase, States will design a State WHP Program that specifically describes their Program and formally designates a managing agency to

- June 19, 1987
  - Applicants' Guidance and Application Materials can be requested from EPA
- July 1987 - August 1987
  - Training available to State staff by EPA concerning WHP Program and process for Assistance Application
- May 1987 - January 1988
  - Application Development discussion between State staff and Regional Office staff
- January 1988
  - Financial Assistance Application received from States by Regions
  - States needing more time would submit a letter of intent to the Regions by this date if they cannot provide an application
- January 1988 - May 1988
  - Funding arrangements completed

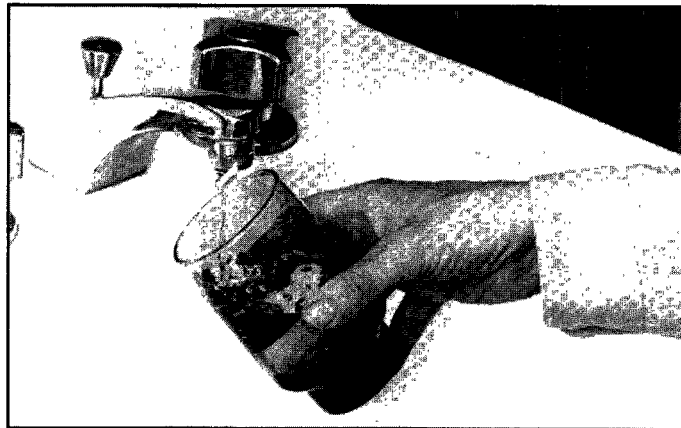
direct the Program. Many States will probably have a number of agencies, both at the State and local level, which will have responsibility for the various Wellhead Protection Program activities. The managing agency will have the responsibility of ensuring that these activities are implemented.

## Summary

Wellhead protection is a management process that acknowledges the link between activities that take place in wellhead areas and the quality of the ground-water supply for those wells. It calls for cooperation among the many groups that have a say in the activities that affect wellhead protection areas.

For some States, the process already has begun. For them, Federal funding and technical assistance means a chance to create a more comprehensive ground-water protection program than they now have. For States which are just beginning, here is an opportunity to build a solid program from the start.

Whatever ground-water protection phase a State may be in, the Wellhead Protection Program is an opportunity to focus on the needs and goals of each individual State and help it meet its water supply protection goals. For all of those involved, there is one underlying goal, namely to help provide quality drinking water for generations to come.



## EPA Regional Ground-Water Representatives

### Region I

Bert Mendoza  
Water Management Division  
Boston, MA 02203  
(TS) 8-835-3600  
(COMM) 617-565-3600

### Region II

John S. Malleck  
Water Management Division  
New York, NY 10278  
(TS) 8-264-5635  
(COMM) 212-264-5635

### Region III

Thomas Merski  
Water Management Division  
Philadelphia, PA 19107  
(TS) 8-597-2786  
(COMM) 215-597-2786

### Region IV

James S. Kutzman  
Ground-Water Protection Branch  
Atlanta, GA 30365  
(FTS) 8-257-3866  
(COMM) 404-347-3866

### Region V

Jerri-Anne Garl  
Water Division  
Chicago, IL 60604  
(FTS) 8-886-1490  
(COMM) 312-353-1490

### Region VI

Don Draper  
Water Management Division  
Dallas, TX 75202-2733  
(FTS) 8-255-6446  
(COMM) 214-655-6446

### Region VII

Timothy L. Amsden  
Office of Ground-Water Protection  
Kansas City, KS 66101  
(FTS) 8-757-2815  
(COMM) 913-236-2815

### Region VIII

Richard Long  
Water Management Division  
Denver, CO 80202-2405  
(FTS) 8-564-1543  
(COMM) 303-293-1543

### Region IX

Patricia Eklund  
Water Management Division  
San Francisco, CA 94105  
(FTS) 8-454-0831  
(COMM) 415-974-0831

### Region X

William A. Mullen  
Water Management Division  
Seattle, WA 98101  
(FTS) 8-399-1216  
(COMM) 206-442-1216

