Drinking Water Source Protection Report for the

City of Springfield Public Water System

The City of Springfield is a community public water system that voluntarily completed their drinking water source assessment under the Wellhead Protection Program. The Susceptibility Analysis was completed by Ohio EPA.

Susceptibility Analysis for the City of Springfield (completed by Ohio EPA, 2003)

Springfield, Ohio Wellhead Protection Demonstration Project (completed by the Ohio EPA, 1990)
Susceptibility Analysis for the City of Springfield

**Wellfield Description:** The city of Springfield’s wellfield is located in Clark County, Ohio adjacent to the Mad River and serves approximately 70,487 people. The wellfield consists of twelve water wells which produce an average of approximately fifteen million gallons per day. The wells are 30 inches in diameter and have screened intervals between 55 and 115 feet deep.

**Hydrogeologic Setting:** The Mad River Buried Valley Aquifer is the source of water for the city’s wellfield. The aquifer consists of thick glacial deposits of sand and gravel. The aquifer at Springfield is unconfined, thus no natural barrier exists between the ground surface and the aquifer to prevent contaminants from entering the aquifer. Soils in the wellfield are mapped as Westland silty clay loams which have developed in the terraces adjacent to the Mad River. Infiltration of precipitation through these soils and the Mad River provide recharge to the aquifer.

**Aquifer Water Quality:** The city of Springfield is required to sample its treated water for total coliform, nitrates, volatile organic compounds, copper, and lead. The available water quality data indicates that low levels of trihalomethanes have been detected in the treated water as a result of chlorination of the ground water. Nitrate concentrations are normally less than 2 mg/l which is considered to be very low for this type of an aquifer.

**Potential Contaminant Sources:** The land use in the wellhead protection area includes commercial, residential and agricultural activities. The city has identified potential sources of contamination related to these facilities within the five-year time of travel. The details of the potential sources are specified in the city’s potential contaminant source inventory.

**Source Water Assessment and Protection Activities:** The wellfield is located above a buried valley aquifer which provides limited natural protection from contaminants infiltrating into the aquifer. Because of this setting, the aquifer that supplies drinking water to the city of Springfield is considered to be susceptible to contamination. The city has developed a comprehensive wellhead protection program to manage potential sources of contamination in the protection area to minimize any impacts to the aquifer.
SPRINGFIELD, OHIO
WELLHEAD PROTECTION
DEMONSTRATION PROJECT

OHIO ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF GROUND WATER

OhioEPA

SEPTEMBER 1990
(Revised August 1991)
SPRINGFIELD, OHIO
WELLHEAD PROTECTION DEMONSTRATION PROJECT

OHIO ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF GROUND WATER
1800 WATERMARK DRIVE
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SEPTEMBER 1990
(Revised August 1991)
The Safe Drinking Water Act Amendments of 1986 (SDWA), mandate that each state develop a wellhead protection program to protect public water supplies which utilize a ground water source. Guidelines were prepared by the United States Environmental Protection Agency (USEPA) recognizing that each state would tailor a program to suit its own needs. The requirements for wellhead protection programs are listed below.

Safe Drinking Water Act of 1986, Title II, Section 203, Subsection 1428 states that each state shall by July 1, 1989:

1. specify the duties of state agencies, local government entities and local public water supply systems.

2. determine WHPAs by the best available method utilizing best available hydrogeologic information.

3. identify within each WHPA potential anthropogenic sources of contaminants.

4. specify management approaches to program development, WHPA delineation and implementation.

5. include, for each WHPA, contingency plans for an alternate source of drinking water.

6. apply WHPA delineation techniques to all new public water supply wells.

7. for states with more than 2,500 active wells practicing annular injection of oil field brines, certify that a state brine control program exists and is enforced.

Each state shall by July 1991:

1. make every reasonable effort to implement the Wellhead Protection Program (WHPP).

2. submit a biennial report on the status of the state's WHPP.

The Ohio Environmental Protection Agency has been designated by the Governor as the lead agency for carrying out the mandates outlined in the Safe Drinking Water Act. The Division of Ground Water has the major responsibility for wellhead protection within Ohio EPA and has been active in both technical program research and policy development.

The Division of Ground Water, in cooperation with the City of Springfield, initiated a wellhead protection demonstration project in early 1989. The purpose of this project was to evaluate the technical aspects and policies involved in implementing wellhead protection in Ohio by developing a comprehensive wellhead protection plan to guard against contamination of Springfield's municipal wellfield.

This study includes three stages:

1. Delineation of the wellhead protection area (WHPA).

2. Inventory of potential pollutants within the WHPA.

3. Recommendations for development of a wellfield management plan.
ACKNOWLEDGEMENTS

The Division of Ground Water would like to acknowledge and thank all the individuals who contributed to the successful completion of this demonstration project. This includes the many State and local officials who provided invaluable information as well as the many property and business owners and managers that took time out of their busy schedules to meet with Division staff during the delineation and pollution source inventory phases of this project. A special thanks is extended to the City of Springfield Council Members, the Clark County Commissioners, Alvin Wansing, City of Springfield Utilities Director, Robert Chaffin, Water Plant Superintendent and Jeff Johnson, Assistant County Administrator, whose support made this project possible.

Carl A. Wilhelm, Chief
Division of Ground Water
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SECTION 1

GROUND WATER USE AND PROTECTION

In Ohio, approximately 1,200 community public water systems rely on ground water for all or a large portion of their water supply. Combined, these systems meet the daily water needs of over twenty-five percent of the State’s population. Over eight thousand non-community public water systems serving businesses, schools, parks, camps, etc., also rely on ground water for their water needs. As Ohio’s urban areas expand, the number of homes, businesses and industries served by public water systems will increase as well. Ohio’s Wellhead Protection Program, by specifying even more protection to ground water resources that supply public water wells, helps to ensure the present and future availability of safe, clean water for the users of these systems.

Although ground water has long been perceived as a source of pure water, it is now recognized that it is a very sensitive resource susceptible to contamination from many sources. Since ground water generally moves very slowly, contamination may be present for long periods before being detected. Just as in most of the midwest, Ohio has a very diverse economy generating a wide range of potential ground water contaminants. For example, modern agricultural practices involve the handling and application of large amounts and a wide range of fertilizers and pesticides. Additionally, Ohio’s industries, commercial establishments and residences generate significant quantities of solid and liquid wastes which often are applied, stored and disposed on the land. In parts of Ohio, oil, gas and coal production have resulted in local degradation of the quality of both surface and ground waters. Other sources of potential contamination include such facilities as underground storage tanks, septic tanks, plus miscellaneous leaks and spills.

Traditionally, ground water protection has been approached through remediation and redesign (or elimination) of the polluting source after ground water contamination has occurred. Unfortunately, the first indication of ground water contamination often has been through analysis of finished drinking water and a source is not identified easily. Ground water contamination already has caused several public water supply systems to implement costly remediation programs to prevent uptake of contaminants or to provide extensive treatment prior to distribution.

According to a five year study by Ohio EPA, traces of organic contaminants have been found in twelve percent of Ohio’s community water systems utilizing ground water. However, concentrations of these chemicals exceeded current health based standards in only one percent of the total systems in Ohio. Additional testing from March 1988 through January 1990 detected pesticides in approximately 3.6 percent of community systems using ground water in Ohio. None of these were near the health based maximum contaminant level.

Ohio EPA’s goal is to prevent degradation of ground water resources which might preclude present and future uses. Development of local wellhead protection plans is proving to be an effective and manageable step toward that goal.

Wellhead protection planning can help Ohioans manage the risks associated with activities in or near their wellfields. In delineated wellhead protection areas, local governments and private owners can focus attention on increasing security of their water systems and those portions of aquifers which are yielding water directly to their wells.
SECTION 2

OHIO WELLHEAD PROTECTION PROGRAM

Ohio's Wellhead Protection Program has been under development for several years. Ohio EPA submitted a draft Wellhead Protection Program to the U.S. Environmental Protection Agency in June 1989. This program was developed utilizing the guidelines outlined in the Safe Drinking Water Act. A second draft was completed in January 1991 incorporating appropriate comments received from U.S. EPA and many concerned individuals and organizations in Ohio. Three public hearings and information workshops were conducted in February 1991 to obtain comments and answer questions on the Program. The Program was revised and officially submitted to U.S. EPA in August 1991.

The objective of wellhead protection in Ohio is to protect the health of people utilizing public drinking water by providing a focus zone around public wells or wellfields for the prevention, detection and remediation of ground water contamination. This objective is met through the delineation of wellhead protection areas, identification and management of potential pollution sources, ground water monitoring plans, contingency plans, public vigilance and public participation and education efforts.

The following discussion describes major components of wellhead protection as outlined in the Ohio Program:

WELLHEAD PROTECTION AREA DELINEATION

A key component of Ohio's Wellhead Protection Program is delineation of wellhead protection areas (WHPAs) which are defined as the surface and subsurface areas supplying water to public wells or wellfields through which contaminants are likely to move toward and reach such wells or wellfields.

Ohio's diverse geologic settings and wide ranging community needs and resources require a flexible approach to the delineation of wellhead protection areas (WHPAs). To be most effective, a WHPA must be delineated based on the hydrogeologic conditions that are unique to the given aquifer and wellfield. The different needs as well as different technical, financial and personnel resources of Ohio's public water supply systems also have dictated a flexible approach to the delineation of wellhead protection areas. A rigidly defined and complex methodology would prove unworkable for many small public water supplies.

Methods for the delineation of an appropriately-sized WHPA range from simple fixed shapes which may or may not have any basis in hydrogeologic investigations, to complex computer generated numerical models which incorporate a great deal of site-specific hydrogeologic data. Selection of the most appropriate method to use when delineating a wellhead protection area is made after consideration of the availability of geologic and hydrogeologic information; the nature of existing and potential pollution threats; and the availability of technical expertise and financial resources to acquire additional hydrogeologic data. As such, the delineation method varies for different situations.
IDENTIFICATION AND INVENTORY OF POTENTIAL POLLUTION SOURCES WITHIN THE WELLHEAD PROTECTION AREA

An essential element of wellhead protection planning is an assessment of all land use activities in and around delineated wellhead protection areas. The purpose of the land use inventory is to identify any past, present and proposed land use activities that may pose a threat to the well or wellfield. The comprehensive, detailed land use inventory is essential for development of an effective wellhead protection management strategy.

Several processes may be needed for conducting a pollution source inventory. These include conducting windshield surveys of the area, meeting with local and State officials, searching files and records, interviewing individual residents and/or inspecting sites.

The key to a successful and cost effective inventory is locating all existing sources of information. Generally, a large amount of information is available from a number of different State and local government agencies.

Maintaining an accurate and comprehensive inventory and assessment of potential pollution sources is an on-going effort that requires periodic updating and oversight. Local officials should establish routine mechanisms for updating inventory information for new activities and changes in the operational status of previously inventoried facilities.

WELLHEAD PROTECTION AREA MANAGEMENT

The need for wellhead protection is due to land use activities incompatible with ground water protection. While all those served by a water supply are likely to be in favor of protecting its quality, they may not be willing or able to change their land use location or practices. Following the delineation of a wellhead protection area, regulation of activities within the WHPA must be carried out primarily by local governmental authorities. Management options include: design and operating standards, purchase of property or development rights, zoning, source prohibitions, public education and ground water monitoring. Because communities face different ground water threats and problems, no single wellhead protection tool or combination of tools is prescribed as best for all communities.

Wellhead protection area management builds on information gathered during the delineation process and the pollution source inventory. Management options for controlling specific sources must consider the degree of risk posed by the source including proximity to the wellfield, hydrogeologic sensitivity and type of activity.

Development of the management element of the WHP plan should build on existing regulatory control programs at all levels of government. While managing contaminant threats and land uses within a designated WHPA is primarily the responsibility of the water system owner and local government(s), many activities fall under the regulatory authority of State, and in some instances, federal agencies. Coordinating all these pollution control activities is essential to ensure enforcement of the appropriate regulations, avoid duplication of effort and prevent conflicts.
SECTION 3

SPRINGFIELD WHP DEMONSTRATION PROJECT

SELECTION OF PROJECT SITE

Ohio Environmental Protection Agency initiated selection of a city to conduct a WHP demonstration project in early 1989. Criteria used to select the community included:

Ground water usage Selection was limited to community water systems serving a population more than 25,000 and/or pumping an average in excess of five (5) million gallons per day.

Availability of hydrogeologic and hydraulic information This information was needed to allow the determination of an accurate wellhead protection area without investing in costly exploration wells and aquifer tests.

Cooperation of local officials Initial contacts were made with local officials to determine anticipated levels of local support.

Based on these criteria, the Division of Ground Water began working with the City of Springfield early in 1989 as the first community demonstration project in Ohio.

FIGURE 1
DEMONSTRATION PROJECT LOCATION
PROJECT SITE DESCRIPTION

The City of Springfield is located in Clark County in West Central Ohio (Figure 1). The community water supply is located several miles northwest of the city along the eastern bank of the Mad River at Eagle City Road. In addition to serving Springfield’s population of approximately 74,000, the City provides water to many industries in Springfield as well as homes and industries in portions of German and Moorefield Townships in the northern part of Clark County.

Hydrogeologic Setting

A considerable amount of hydrogeologic and hydraulic information is available for Clark County in the wellfield area. One major source of information is Bulletin 22 of the Ohio Department of Natural Resources, *The Water Resources of Clark County, Ohio* (Norris, et al., 1952). This report was a cooperative effort of ODNR, Division of Water and the Water Resources Division of the United States Geological Survey. Much of the following discussion is taken directly from that report.

Located in the Ohio-Indiana Till Plains Physiographic Region, Clark County is covered by glacial drift deposited during the late Pleistocene Epoch. It is underlain by sedimentary rocks of Ordovician and Silurian age, consisting chiefly of limestone and dolomite in the upland areas, and shale in the major valleys.

The best aquifers in Clark County are the sand and gravel glacial outwash valley deposits. Here, aquifer materials were deposited by meltwaters filling a deep bedrock valley which had been carved in part by the ancestral Teays River and in part by the meltwater of a glacial advance across Ohio. The thickest and most permeable of these deposits are in the Mad River Valley above and below Springfield.

The Mad River aquifer is an unconfined buried-valley type aquifer with high transmissivity and excellent recharge characteristics. In the vicinity of Eagle City, where the City’s water supply wells are located, the Mad River crosses the axis of the buried valley and excellent groundwater recharge conditions prevail. The outwash materials are coarse and well sorted, and are probably more than 200 feet thick in places (Figures 2, 3 & 4). Productivity traditionally has been excellent, even during periods of drought as experienced throughout Ohio during 1987-1988.

In the vicinity of the wellfield, the Mad River valley is approximately two miles wide. Only thin, well-drained soils overlie the aquifer throughout most of the wellfield area. These soils allow for significant recharge but offer only minimal protection for the aquifer. Uplands to the east and west are composed of non-stratified drift overlying bedrock. Drift thickness may be as great as 200 feet. The degree of hydraulic connection between the valley walls and the Mad River aquifer is limited.

Springfield’s Wellfield

Springfield’s wellfield was developed in the late 1950’s in response to the need for a reliable and safe water supply. Prior studies indicated that the location chosen would be capable of providing abundant supply by designing the wellfield to take advantage of induced infiltration from the nearby Mad River (Shafer and Walton, 1956). The present wellfield consists of ten 30 inch diameter wells, aligned in a north-south direction along the east bank of the river (Figure 5). The wells are located approximately 300 feet apart. Well depths range from 87-105 feet, with each screened over the lower 45 feet. Design capacity of the wellfield is forty (40) million gallons per day (mgd). When constructed in 1958, daily average demand was approximately fifteen (15) mgd with the expectation that demand would increase to thirty (30) mgd by 1990. This increase in demand has not yet occurred and peak day demand rarely exceeds twenty (20) mgd. Additional wells are planned for the area north of the existing wellfield between the Mad River and Moore Run due to declining specific capacity of the existing wells.
FIGURE 2

GEOLOGIC CROSS SECTIONS THROUGH SPRINGFIELD'S WELLFIELD

Source: Ground Water Levels in the vicinity of Eagle City, Report to the Ohio Water Commission, Ohio Dept. of Natural Resources, 1962.
FIGURE 3

BEDROCK SURFACE ELEVATIONS IN THE WELLFIELD AREA

Source: Ground Water Levels in the vicinity of Eagle City, Report to the Ohio Water Commission, Ohio Dept. of Natural Resources, 1963.
FIGURE 4
GROUND WATER RESOURCES OF CLARK COUNTY

EXPLANATION

EXCELLENT GROUND WATER AREAS
Valley-trough and interstream deposits of permeable sand and gravel, unsaturated, unconfined. Good to excellent yields from stream development.

GOOD GROUND WATER AREAS
Valley-trough and interstream deposits of permeable sand and gravel, unsaturated, unconfined, but not developed by the larger streams. These areas may be developed. Some wells yield more than 500 GPM.

GOOD TO FAIR GROUND WATER AREAS
Water supply generally obtained from sand and gravel deposits. Intersections in the valley trough are generally good. Wells yield less than 500 GPM. Generally, wells yield more than 50 GPM. Suitable for farm and limited municipal use.

FAIR GROUND WATER AREAS
Water supply generally obtained from sand and gravel deposits. Poor yield. Wells yield less than 50 GPM. Suitable for domestic supplies.

POOR GROUND WATER AREAS
Unweatherable clays, till, overlying the water. Well yields generally less than 25 GPM. Suitable for limited use.

POOR TO VERY POOR GROUND WATER AREAS
Unweatherable clays, till, overlying the water. Wells yield less than 25 GPM. Suitable for limited use.

Source: The Water Resources of Clark County, Ohio, Ohio Department of Natural Resources, 1952
FIGURE 5

WELLFIELD LOCATION
WELLHEAD PROTECTION AREA
DELINEATION

A wellhead protection area is defined as the surface and subsurface area surrounding a well or wellfield that contributes water to a wellfield and through which contaminants are reasonably likely to move toward and reach such a well or wellfield.

The delineation of a wellhead protection area is based on the selection of criteria that describe the physical processes of ground water flow and contaminant transport. Delineation criteria to be used in Ohio can be cataloged into three basic types.

Distance--delineation of a wellhead protection area using a radius or other dimension measured from the well or wellfield;

Time of travel (TOT)--the advective travel time for contaminants to flow through an aquifer and reach the well or wellfield;

Flow boundaries--ground water divides and/or other physical and hydrogeologic features that control ground water flow to the well or wellfield.

Wellhead protection delineation criteria thresholds are the numeric values selected for each wellhead protection area criterion used in a delineation (e.g., a TOT of 5 years). Multiple protection zones may be defined around a water supply well or wellfield by using different thresholds for the same criterion (e.g., one year and five year TOT). The purpose of multiple protection zones is to establish areas for differential management strategies based on proximity to the wellfield.

Methods for delineating wellhead protection areas can range from the simple calculated fixed radius method to resource and data intensive numerical computer modeling methods. While the latter method may be the most accurate, the amount of hydrogeologic information needed to develop such a model may delay or even prohibit the timely development of a WHP Plan.

In the case of Springfield, a substantial ground water data base was available, as were Ohio EPA resources for the support of a scientifically-based delineation process. In an attempt to develop a realistic pilot demonstration project representative of what other Ohio communities may undertake, a semi-analytical delineation method combining both analytical flow equations and numerical modeling techniques was employed.

Ground water flow in the Mad River aquifer in the vicinity of the Springfield wellfield was modeled using a semi-analytical model developed under contract to Ohio EPA by The Ohio State University. This model, known as CAPZONE, calculates drawdown in a stressed aquifer and can superimpose these calculated drawdowns on a regional background potentiometric surface to simulate pumping conditions. The results of CAPZONE are imported into the numerical computer model, GWPATH, to delineate time-of-travel bounded capture zones or to define flow paths to individual production wells (Roadcap and Bair, 1990; Springer and Bair, 1990).

With the substitution of the appropriate mathematical relationships into the CAPZONE code, the model can be applied to simulate aquifer response in different hydrogeologic settings. Drawdown in the aquifer is calculated at the intersection nodes of a gridded model which approximates aquifer dimensions and boundaries. Image well theory is utilized to compensate for variations in aquifer dimensions and aquifer boundary conditions such as streams or valley walls.

In modeling a WHPA for the Springfield Eagle City Wellfield, an area of the aquifer was gridded (Figure 6) and centered roughly on the wellfield. Requirements of the CAPZONE model are for a rectangular grid. Grid spacing was 400 feet on both the X and Y coordinates with overall dimensions of 9600 by 16000 feet.
Although aquifer theories have been developed for idealized, homogeneous, infinite aquifers, these do not exist in nature. Rather, aquifers have distinct boundaries and varied aquifer characteristics. In the case of Springfield, the buried-valley aquifer has highly varied materials, a varied thickness and boundary conditions which differ at the valley walls, up and down the valley and along the Mad River.

In order to apply CAPZONE to model the response of the aquifer to pumping stress, a number of simplifying assumptions have been made. Based on studies conducted on the wellfield in 1956 by Schaefer and Walton, the aquifer transmissivity was established at 300,000 gpd/ft, hydraulic conductivity was 400 ft/day and aquifer porosity was assumed to be twenty percent. The thickness of the aquifer, which varies from over 200 feet in the center of the valley to less than fifty feet near the valley walls was averaged to be 100 feet. Flow from the valley walls into the aquifer is believed to be negligible and the east and west boundaries of the model were set to approximate the valley walls.

Because the Mad River contributes such a large amount of water through induced infiltration (estimated at 60%) (Norris & Eagon, 1970), its effects on the water table had to be accounted for. The effects of hydrogeologic boundary conditions were modeled using image well theory. This theory is based on the principle of superposition and allows one to compensate for the increased drawdown at impermeable aquifer boundaries, or for the decreased drawdown which results from recharge boundaries such as the Mad River.

Background water levels for the gridded area were those inferred by Kaser in 1962. This water table was based on a supposed pre-pumping level with water moving down the valley gradient with a discharge line at the Mad River (Figure 7). These data were digitized for the gridded area and served as background head information for input into the CAPZONE model. CAPZONE was run using the aquifer properties explained above. Drawdowns were calculated by the model at nodes spaced 400 feet apart during a simulated stress period of 270 days. This period represents the typical annual period of no natural recharge, as determined from regional water level data.

Calculated drawdowns were superimposed upon the regional background water levels at each grid intersection node, to calculate a potentiometric surface for the area of the pumped wells. This surface was compared to that measured in the field at the end of the period of reduced aquifer recharge (Figures 8 & 9). Although some differences may be seen, there is general agreement between the two maps and the CAPZONE generated potentiometric surface is accepted as representing that measured in the field reasonably well.

Water levels calculated in CAPZONE then were transferred to the ground water flow model GWPATH (Shaffer, 1987). The GWPATH model calculates pathlines and the velocity of ground water flow at any point within the gridded model boundaries. By calculating a set of reverse-tracked particles around the wellfield, a time-of-travel bounded wellhead protection area can be defined.

Figure 10 shows the one and five year time-of-travel (TOT) boundaries calculated for Springfield's wellfield using GWPATH. In this figure, the east side of the delineated area is not closed as the model boundary was set to approximate the valley wall. Without detailed hydrogeologic studies it is impossible to determine the exact contacts between the porous glacial outwash deposits, the dolomite bedrock surface and the overlying glacial tills. Without this detailed information, and the use of a complex numerical model, this boundary could not be estimated accurately.

In order to close the delineation area to the east, Division staff utilized the topographic high located within one mile from the model boundary (Figure 11). This represents those areas contributing the largest amount of surface runoff to the one and five year TOT boundaries. Ohio EPA believes that runoff from these areas has the potential to affect ground water reaching the wellfield due to the shallow depth to ground water in the valley and the amount of induced infiltration of surface waters.
FIGURE 7

ASSUMED MINIMUM STATIC GROUND WATER LEVEL IN THE EAGLE CITY AREA
BASED ON STREAM BOTTOM ELEVATIONS

Source:  Ground Water Levels in the vicinity of Eagle City, Report to the Ohio Water Commission,
Ohio Dept. of Natural Resources, 1962.
FIGURE 8

WATER LEVEL ELEVATIONS IN THE EAGLE CITY AREA ON FEBRUARY 27, 1961

FIGURE 9

DRAWDOWN ELEVATIONS CALCULATED BY CAPZONE
FIGURE 10

GWPATH – ONE AND FIVE YEAR TIME-OF-TRAVEL DETERMINATIONS
FIGURE 11

SPRINGFIELD OHIO
ONE AND FIVE YEAR TIME-OF-TRAVEL WELLHEAD PROTECTION AREAS
**WHPA Delineation Criteria**

**Conclusions From Study**

For community water supplies utilizing surficial outwash or other unconfined aquifers, TOT in combination with a flow boundary criterion is the preferred criterion for delineation. A TOT wellhead protection area is defined as the area surrounding a well or wellfield that contributes flow to the well(s) within a specified period of time. Ohio EPA recommends public water surveyors use a threshold of five years. A five year TOT WHPA represents the area surrounding the well or wellfield that will contribute ground water flow to the well(s) within five years. The five year TOT fulfills Ohio’s Wellhead Protection Program objective by allowing a surveyor time to respond to ground water contamination reaching the WHPA. Past experience has shown that five years should provide adequate time to design an interceptor well system, add treatment to the water system, or even develop an alternate water source.

Ohio EPA also recommends delineating an inner management zone with a one year TOT. Due to the proximity to the well or wellfield (i.e. shorter travel time and therefore shorter response time) this zone requires more stringent management controls than the one to five year zone. Management options may include: limit on certain types of activities, more stringer design and operating standards, and/or strict monitoring of potential pollution sources.

In some instances a surveyor also may choose to have an additional management zone beyond the five year TOT (e.g. ten or more years). This is especially useful where the aquifer is extremely susceptible to contamination from surface or near surface activities. Such an area requires fewer controls than the one-to-five year TOT area. Management options for this outer area include reporting requirements for certain types of materials’ handling and use, promoting best management practices and implementing education programs.

For most public water supplies located in a confined aquifer setting, a distance criterion is the minimum acceptable criterion to delineate the wellhead protection area. The distance criterion may be used in combination with a flow boundary criterion and multiple zones for differential management may be designated.

For those systems utilizing a confined aquifer it also will be necessary to identify recharge areas. If a recharge area is not next to the wellhead protection area around the well or wellfield, a separate "satellite" wellhead protection area should be designated.

**WHPA Delineation Methods**

**Conclusions From Study**

Wellhead protection areas for public water supplies should be delineated using the most appropriate method and the best available hydrogeologic information. This delineation method will vary for different situations.

Selection of a method to be used to delineate a wellhead protection area for any public water supply will be made after consideration of available geologic and hydrologic information, a consideration of the nature of existing and potential pollution threats to the ground water of the area, and the financial resources of the water supplier. Effective implementation of WHP in Ohio for all public supplies will depend on a flexible program based on sound technical guidance.

Ohio EPA recommends that the majority of larger water supplies utilize semi-analytical methods, usually in combination with geologic mapping, to delineate a TOT wellhead protection area. Although semi-analytical models require simplifying assumptions about aquifer properties and dimensions (e.g., homogeneous, infinite aquifer), research in Ohio has shown they can provide a high level of precision in delineating TOT boundaries. When used in conjunction with image well theory, the effects of hydraulic boundary conditions such as
valley walls and induced river recharge can be accounted for. Semi-analytical models also can be adjusted to accommodate changing hydraulic conditions such as increased water usage or variations in recharge conditions. Ohio EPA recommends that communities use the maximum pumping rates when delineating WHPAs to account for future wellfield expansion. This also will produce a more conservatively-sized [larger] WHPA.

Cities with considerable hydrogeologic information, complex hydrogeologic settings or with numerous pollution threats can obtain a more accurate delineation of their wellhead protection area using a numerical flow model using computers to accommodate a significant degree of variation in aquifer material properties and aquifer dynamics. While such a properly executed and evaluated model can provide the best delineation of the zone of contribution to a well or wellfield, it also will be the most complex and expensive approach.

For many of the smaller public water supplies in Ohio, certain types of hydrogeologic information (i.e. hydraulic conductivity and ground water flow direction and velocity) are not readily available and the cost of acquiring them may be prohibitive. In such situations, a simple analytical model or a calculated fixed-radius method, in combination with basic hydrogeologic mapping may be used. By making reasoned estimates of aquifer properties and maximizing pumping rates, these methods provide a conservatively-sized wellhead protection area to allow for adequate protection of the wellhead or wellfield.

Protection of public water supplies for the future requires ongoing vigilance and continued evaluation of both the ground water resource and potential pollution sources. As the needs of Springfield change through growth and development, it will be necessary to review the WHPA periodically. Refinement of the delineation of the WHPA may have to be done, including a reassessment of the method used. It is conceivable that a community may choose to upgrade its protection area delineation through a more sophisticated method, and/or the incorporation of more accurate and complete data.

Ohio EPA continues to refine the delineation process as wellhead protection is implemented in the State. The Division of Ground Water has contracted with The Ohio State University to prepare a user's guide for local, State and federal officials, local water system surveyors and others to learn how WHP areas can be delineated using CAPZONE coupled with GWPATH and/or other semi-analytical models.

**POLLUTION SOURCE INVENTORY**

**Inventory Process**

After delineating the wellhead protection area the next phase of a wellhead protection program is an assessment of all land uses in and around the delineated area.

The purpose of the land use inventory is to identify any past, present or proposed land uses that may pose a threat to existing or potential public drinking water supply wells. The land use inventory is essential for development of an effective wellhead protection and management plan.

The Division of Ground Water spent a great deal of time locating, surveying and evaluating the potential pollution sources in and around Springfield's wellhead protection area. Components of the inventory included a windshield survey of the area, meetings with local officials, file and record searches, personal interviews and site inspections of each facility in and around the wellhead protection area. An initial inventory of the area was conducted by a windshield survey of all roads. Detailed field notes identified existing facilities and other land use activities including business and residential areas, agricultural activities and major transportation routes. These activities were located on USGS 7 1/2 minute topographic maps.
# TABLE 1

## MAJOR INDUSTRIAL/COMMERCIAL POTENTIAL POLLUTION SOURCES

<table>
<thead>
<tr>
<th>MAP #</th>
<th>FACILITY NAME AND ADDRESS</th>
<th>APPROX. DISTANCE TO WELLFIELD</th>
<th>TYPE OF ACTIVITY</th>
<th>POLLUTION THREATS/COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Jack Bowshier Buick</td>
<td>6,500 Ft.</td>
<td>Auto dealer and maintenance</td>
<td>2-USTs (gasoline, waste oil); chemical use/storage (cleaning solvents, rust inhibitors, paint, thinners, lacquers, oil &amp; misc. fluids); floor drains go to septic tank (leaching field; 1985 fire destroyed original building, private well)</td>
</tr>
<tr>
<td></td>
<td>4815 Urbana Road</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Springfield, OH 45501</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>John Slattery 399-9700</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2.</td>
<td>Jerry Tacket</td>
<td>3,600 Ft.</td>
<td>Auto dealer and maintenance</td>
<td>2-USTs (unleaded gasoline &amp; diesel); wastewaters directed to on-lot aeration unit and sand filter (not in use at time of visit); then discharged to Kenton Creek; car wash on back of building; several 55 gal. drums (paint waste, lacquer thinner) stored on south side of building; owner/operating unwilling to meet with Ohio EPA staff.</td>
</tr>
<tr>
<td></td>
<td>4655 Urbana Road</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Springfield, OH 45501</td>
<td></td>
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<tr>
<td></td>
<td>390-2300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Trenor Motor</td>
<td>6,000 Ft.</td>
<td>Auto dealer and maintenance</td>
<td>No information available.</td>
</tr>
<tr>
<td></td>
<td>4701 Urbana Road</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Springfield, OH 45501</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>399-9901</td>
<td></td>
<td></td>
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<tr>
<td>4.</td>
<td>Trueline Tool &amp; Mach.</td>
<td>3,800 Ft.</td>
<td>Manufacturer of specialty machines used in assembly processes</td>
<td>Built in 1967, formerly Recknagel Machine Products; water based cutting fluids, 2 floor drains, discharge from floor drains and restrooms go to a septic system in front of building and they are connected to city water; approx. twenty barrels of cooling oils and water based coolants stored on outside dock; spent solvents picked up by waste hauler; solid waste scrap area - picked up by different buyers.</td>
</tr>
<tr>
<td></td>
<td>200 Eagle City Road</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Springfield, OH 45502</td>
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<tr>
<td></td>
<td>Rick Darr, 399-8202</td>
<td></td>
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</tr>
<tr>
<td>5.</td>
<td>Macray Company</td>
<td>2100 Ft.</td>
<td>Road and Sign Painting</td>
<td>Use approx. 8,000 gallons of paints/year (mostly in summer); xylene used to clean equipment and then reused as a thinner; 500 gal. above ground tank for gasoline.</td>
</tr>
<tr>
<td></td>
<td>Eagle City Road</td>
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<td></td>
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<tr>
<td></td>
<td>Springfield, OH</td>
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<tr>
<td></td>
<td>Carl Yiagst, P.E.</td>
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</tr>
</tbody>
</table>
# TABLE 1
MAJOR INDUSTRIAL/COMMERCIAL POTENTIAL POLLUTION SOURCES

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<thead>
<tr>
<th>MAP #</th>
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<th>TYPE OF ACTIVITY</th>
<th>POLLUTION THREATS/COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>Woodrow Mfr. Co. 4300 River Road Springfield, OH 45501 Pat MacAfee, 399-9333</td>
<td>4,000 Ft.</td>
<td>Product identification using metal etching, silk screening &amp; printing.</td>
<td>Etches Al &amp; Stainless Stell using ferric chloride (HF) &amp; hydrochloric acid (HCL); spent acid &amp; rinse water are neutralized with caustic soda and flocculents and discharged to leach field (&lt;1000 gpd); original disposal into a Class V well; separate leach field for sewage disposal; waste acids are stored in barrels and hauled away; chemicals stored in locked garage with spill containment; two on-site production wells sampled twice a year by Ohio EPA; more monitoring wells proposed; several years ago vandals poured out eight drums of Xylene (approx. 80 cu. yds. of soil and subsoil were removed).</td>
</tr>
<tr>
<td>7.</td>
<td>Carich Ford Tractor 5375 Urbana Road Springfield OH 45501 399-0330</td>
<td>10,000 Ft.</td>
<td>Tractor sales and repair</td>
<td>2 UST's (diesel, gasoline); misc. fluids including fuels, oils, antifreeze hydraulic, and solvents used in general tractor and engine repair; stream cleaning; Ohio EPA staff located oil and water filled pit in rear of building during inspection/machine testing facility</td>
</tr>
<tr>
<td>8.</td>
<td>Sprout-Bauer 3200 Upper Valley Pike Springfield, OH 45501 Marvin Ferrazza</td>
<td>5,000 Ft.</td>
<td>Pulp processing and</td>
<td>Liquid pulp waste from paper making equipment discharged through spray irrigation; 1-UST for gasoline to be removed; 3-above ground tanks for fuels; dichloro-methane used in analytical lab; store small quantities of hydraulic oils and fuel oil; one upgradient and one dowgradient monitoring well (last sampled in 1986), no indication of contamination other than slightly elevated sodium levels; 2 production wells pump between 50 and 150,000 gallons/day.</td>
</tr>
<tr>
<td>9.</td>
<td>Rittal Corp. 3100 Upper Valley Road Springfield OH Bud Rehl</td>
<td>5,400 Ft.</td>
<td>Manufacturer of electrical enclosures</td>
<td>Began manufacturing operations in August 1991; use alkaline cleaner, zinc phosphate nonchromium rinse, anionic coagulant and misc. solvents; wastewater pretreated and discharged to city sewer; good waste management practices; all above ground storage in concrete basins; spill retention barriers.</td>
</tr>
<tr>
<td>10.</td>
<td>SPECO Corp. 2941 Baker Road Springfield, OH 45505 Harry Hartsh, 390-3000</td>
<td>3,500 Ft.</td>
<td>Manufacturer of helicopter transmissions</td>
<td>2-UST's for methyl ethyl ketone waste and Stoddard Solvent; large number of hazardous and non-hazardous materials stored and used on-site. Use city water; several monitoring wells were installed when the company initiated closure of a hazardous waste drum storage area and UST's in 1990, ground water monitoring has indicated contamination especially in the former drum storage area, additional wells are being installed to determine the rate and extent of ground water contamination.</td>
</tr>
<tr>
<td>MAP #</td>
<td>FACILITY NAME AND ADDRESS</td>
<td>APPROX. DISTANCE TO WELLFIELD</td>
<td>TYPE OF ACTIVITY</td>
<td>POLLUTION THREATS/COMMENTS</td>
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<tr>
<td>11.</td>
<td>Navistar International</td>
<td>14,000 Ft.</td>
<td>Truck assembly</td>
<td>Largest truck assembly plant in nation; use and store large number of hazardous materials; scrap paint and solvent make up majority of primary waste stream; waste water goes to on-site treatment plant, discharged to two lagoons and eventually to Moore's Run; large underground storage tank farm for product and waste (including fuels, antifreeze, oils, paints &amp; solvents) storage; ground water sampling has indicated substantial ground water contamination; the company has initiated corrective actions at the site.</td>
</tr>
<tr>
<td></td>
<td>6125 Urbana Road</td>
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<tr>
<td></td>
<td>Springfield, OH 45501</td>
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<td></td>
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<tr>
<td></td>
<td>James Nooks 399-4075</td>
<td></td>
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<tr>
<td>12.</td>
<td>Springfield Armature</td>
<td>9,500 Ft.</td>
<td>Remanufacture electric motors</td>
<td>Use solvents, resins, lubricating oils, antifreeze &amp; paints; waste is drummed and hauled away; hot water pressure washer drains into separate tank in floor and hauled to treatment plant.</td>
</tr>
<tr>
<td></td>
<td>5330 Prosperity Drive</td>
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<tr>
<td></td>
<td>Springfield, OH</td>
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<tr>
<td></td>
<td>Tom Nuss</td>
<td></td>
<td></td>
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<tr>
<td>13.</td>
<td>Benz Metal Products</td>
<td>9,500 Ft.</td>
<td>Manufacturer of Truck sleepers &amp; accessories</td>
<td>Used solvents, glues; waste are contained and hauled.</td>
</tr>
<tr>
<td></td>
<td>5245 Prosperity Drive</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Springfield OH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kurt Gallmeyer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Fontaine Truck Modification</td>
<td>9,500 Ft.</td>
<td>Truck customization</td>
<td>Use and store solvents, lubricants, antifreeze, minor spray painting</td>
</tr>
<tr>
<td></td>
<td>5325 Prosperity Drive</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Springfield OH</td>
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<tr>
<td></td>
<td>Steve Kraus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Draw - Foam</td>
<td>9,500 Ft.</td>
<td></td>
<td>No information.</td>
</tr>
<tr>
<td></td>
<td>3240 Prosperity Drive</td>
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<tr>
<td></td>
<td>Springfield, OH 45501</td>
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<tr>
<td></td>
<td>5225 Prosperity Drive</td>
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<tr>
<td></td>
<td>Springfield OH 45501</td>
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</tbody>
</table>
Another major concern within the one and five year TOT zones are the major transportation routes and the potential for spills resulting from accidents. U.S. Route 80 has a high volume of commercial traffic and a major interchange is located, at least in part, within the one year TOT. Eagle City Road runs directly through the middle of the wellfield and plans are currently in place to replace the bridge across the Mad River between wells number 5 and 6. Conrail railroad tracks run north and south along the east edge of the Mad River valley AND Grand Trunk Railroad runs along the west edge. Both tracks are active. The east tracks run within the one and five year TOT zones.

The Woodrow Manufacturing Company which etches aluminum and stainless steel plates, is located within the five year TOT zone approximately 3,500 feet up-gradient of well number 10. Neutralized spent acid and rinse water were disposed in a Class V injection well until 1978 but now are discharged to a tile leaching field. Other firms located within the five year delineated WHPA are a TrueLine (tool and die firm) and Beech Manufacturing.

Due to the large amount of recharge to the aquifer from the Mad River, discharges to the River and its tributaries must be considered potential threats to the wellfield. Navistar Corporation, one of the nation's largest truck manufacturing plants and several smaller commercial facilities (outside the WHPA) discharge treated waste waters to Moore Run, a tributary of the Mad River.

Other potential threats to ground water within the WHPA include two underground petroleum pipelines and nearby residential subdivisions with individual on-lot sewage disposal systems.

**Inventory Process - Conclusions From Study**

Conducting the Springfield demonstration project has provided invaluable insight into the intricacies of collecting this information. From its studies, the Ohio EPA found that the inventory process need not be costly, but it may require considerable labor. The key to a successful and cost effective inventory is identification of existing sources of information. A large amount of data already exist and duplication of effort should be avoided.

Conducting individual site assessments may be time consuming but is believed to be a critical component of the land use inventory. It is important to get those businesses or individuals potentially affecting water quality involved at the earliest possible stage of a WHP planning program. If business owners feel that a regulatory program is being forced on them that will force them to change their current practices without understanding how their practices could affect the wellfield, and without having any input, they will fight it.

Ohio EPA staff found that while most people they talked with were aware of the wellfield, they had little idea that their activities and management practices could affect water quality of these wells. Personal interviews serve as a great educational tool by informing those in the area about their local wellfield, the ground water resources being utilized and the concept of wellhead protection. If business owners or individuals truly understand how their activities could impact the local water supply, they will be more willing to change them.

It is realized that in highly developed areas conducting on-site assessments of every facility may not be practical. In these instances potential pollution sources and land uses could be identified more easily using available information sources. These should be plotted on a map of the wellfield and surrounding area to aid in identifying those facilities in areas with the greatest risk to the water supply. The most appropriate scale is USGS, 24,000
to 1 (2-1/2 minute topo). Site assessments then can be conducted for those facilities that appear to present the largest threat based upon the type of activity, proximity to the wellfield, specific hydrogeologic setting and/or upgradient relationship to the wellheads.

Tables and maps of pollution sources also will be useful in combination with ground water flow maps to design an effective wellhead protection monitoring program. Information to be compiled must include: owner's name and address, longitude and latitude, distance from nearest production well, start-up of facility or practice, operating status, permit numbers, and identification of public agencies that maintain facility records on operations and design. Citations of any incidents, malfunctions or other operational and design deficiencies which could be of significance in assessing ground water pollution impacts should be reported to the extent known.

A study of historic land uses should be carried out for each WHPA. One way to achieve this is to make a comparative study of aerial photographs through time. Communities should make use of the memories of long-time residents to capture records of past land uses.

Inventory activities should be carried out concurrently with other field activities associated with the wellfield delineation process. In general, the initial pollution source inventory should require no more than a few months to complete except for unusually large or highly-developed wellfield areas, and depending upon available resources.

Maintaining an accurate and comprehensive inventory and assessment of potential pollution sources is an on-going effort which requires regular and continual updating and oversight. Available public records of established sites and facilities should be reviewed periodically to insure that information needed to support local decisions is accurate and represents current conditions. Once the local inventory methodology has been adopted and administrative mechanisms put in place, these activities for WHP planning should become a routine continuous process.

**WHPA MANAGEMENT STRATEGY**

The next and most important phase in establishing an effective wellhead protection program is developing and implementing a comprehensive and coordinated management strategy to control existing and potential sources of ground water contamination within the wellhead protection area. This includes both regulatory approaches such as zoning ordinances and building codes, and non-regulatory methods such as ground water monitoring, emergency planning and education programs.

Public water systems WHP Plans should include local management initiatives to prevent contamination from existing as well as future potential pollution sources, modified contingency plans which identify short term as well as long term alternate water sources in the event of contamination and the establishment of policies and procedures for protecting all existing and new water supplies.

The management component of Springfield's Wellhead Protection Plan will build on information gathered during the delineation process and the pollution source inventory. Management options for controlling specific contaminant sources must consider the degree of risk posed by the source including proximity to the wellfield, hydrogeologic sensitivity, and type of activity. Those facilities within the one year time-of-travel zone that pose a high risk to ground water because of chemical use, storage or disposal practices, will require more stringent controls than facilities located only in the five year time-of-travel zone and pose a lesser threat to ground water.
Development of the management element of the Plan also must build upon existing regulatory control programs at all levels of government. While managing contamination threats and land use within a designated WHP area is primarily the responsibility of the local government(s), many activities fall under the regulatory authority of State agencies, and in some instances, federal agencies. Coordinating pollution control activities between the various agencies is essential to insure enforcement of the appropriate regulations within Springfield's WHPA, avoid duplication of effort and prevent conflicts with existing regulations.

Pollution Source Controls - Summary

Table 2 outlines a list of management options prepared by the Division of Ground Water for controlling existing and potential threats to the Springfield WHP area. These recommendations include options for managing specific sources of contamination as well as overall management practices for the WHPA.

The following recommendations are based on information from the pollution source inventory, several meetings with officials from the City of Springfield and Clark County, guidance available from U.S. EPA, WHP management systems prepared by other communities, and a number of other reports including Potential Pollutant Source Guidelines For Ground Water Protection In The Miami Valley Region, prepared by the Miami Valley Regional Planning Commission in 1987. They are only recommended management options and do not necessarily address all of the activities and sources that can lead to ground water contamination within the WHPA, nor do they address issues of costs, multi-jurisdictional coordination or other implementation barriers. They are only a starting point. The Division of Ground Water continues to assist officials from the City of Springfield, Clark County and the appropriate Townships in developing a final management strategy that will help assure protection of the local water supply.
**TABLE 2**
**POLLUTION SOURCE CONTROL AND MANAGEMENT OPTIONS**
Springfield Wellhead Protection Demonstration Project
Ohio EPA Division of Ground Water

<table>
<thead>
<tr>
<th>Agriculture:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A * Require reporting of chemical use on a field by field basis within the one and five year TOI zones.</td>
</tr>
<tr>
<td>* Provide maps and/or post the boundaries of the TOI zones for farmers information.</td>
</tr>
<tr>
<td>* Establish ground water monitoring in key areas to evaluate potential effects of agricultural activities.</td>
</tr>
<tr>
<td>* Assist Soil and Water Conservation District personnel in educating farmers on the concepts of wellhead protection and in the latest management practices that maximize crop yield and minimize chemical application.</td>
</tr>
<tr>
<td>* Require back-siphoning prevention devices on wells used to mix agri-chemicals or fill dispensing equipment.</td>
</tr>
<tr>
<td>2. A * Require use of impermeable pads with collection dikes for cleaning dispensing equipment.</td>
</tr>
<tr>
<td>* Prohibit the storage and disposal through land application of animal waste, sewage sludge and septage within the one year TOI zone.</td>
</tr>
<tr>
<td>2. A * Limit the storage, transportation and mixing of substantial amounts of agriculture chemicals within the one year TOI zone.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transportation Routes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A * Post all roadways to indicate when entering the WHP zone and provide an emergency number to call in the event of an accident or spill.</td>
</tr>
<tr>
<td>2. A * Establish an emergency action plan to coordinate appropriate agencies in the event of a spill.</td>
</tr>
<tr>
<td>* Restrict or prohibit trucks carrying hazardous or other deleterious materials from using Eagle City Road.</td>
</tr>
<tr>
<td>* Reduce the speed limit for highways and railroads that run through or near the WHPA.</td>
</tr>
<tr>
<td>3. A * Monitor existing transportation routes for vehicles transporting hazardous materials and develop recommended alternative routes away from the WHPA.</td>
</tr>
<tr>
<td>4. A * Limit the application of road salt and other de-icing agents within the WHPA by utilizing street plowing as much as possible and mixing salt with other materials such as sand, fine gravel or cinders to reduce salt content.</td>
</tr>
<tr>
<td>* Maintain records of salt usage within the WHPA</td>
</tr>
<tr>
<td>* Conduct education programs to inform businesses, industry and the public about deicing methods and materials that minimize possible ground water impacts.</td>
</tr>
</tbody>
</table>
### TABLE 2
POLLUTION SOURCE CONTROL AND MANAGEMENT OPTIONS
Springfield Wellhead Protection Demonstration Project
Ohio EPA Division of Ground Water

**Underground Storage Tanks:**

- Coordinate with the Ohio Department of Commerce, Bureau of Underground Storage Tank Regulation (BUSTR) to insure compliance with all underground storage tank regulations.
- Require proper identification for all underground storage containers including size and stored material.
- Require regular inspection, testing and maintenance programs for all underground storage tanks and associated piping within the WHPA.
- Require that records of deliveries and consumption be reconciled daily against measured inventory to detect product loss.
- Require monitoring of the areas adjacent to tanks within the WHPA to detect any subsurface leaks. This may include electronic leak detection devices.
- Require perimeter containment structures to contain spills or overflows (1-YR TOT). This may include a sump and equipment for removing released product.
- Prohibit installation of any new underground storage tanks within the one year TOT.

Due to the shallow depth to ground water installation of new underground storage tanks should be prohibited from the five year TOT unless plans are submitted showing that the tank will meet all rules and regulations of the BUSTR program and meet all of the requirements for new and existing tanks.

- Require all tanks to be equipped with overfill protection.
- Require secondary containment systems that are capable of holding at least 110% of the storage vessel (1-Yr TOT).
- Require development and posting of emergency response procedures in event of a leak or spill.

**Transmission Lines:**

- Obtain copies of maps showing precise location of pipelines and require regular inventory reports of substances that pass through the WHPA.
- Establish emergency response procedures designed to prevent or minimize ground water contamination resulting from the release of product.
- Compile and maintain a list of pipeline operator emergency response telephone numbers.
- Perform routine periodic testing to determine if leakage is occurring within the WHPA.

**Sanitary Sewer Lines:**

- Cooperate with the Ohio EPA and other appropriate agencies to insure compliance with all existing pretreatment and discharge regulations.
- Maintain maps showing precise location of all sanitary sewers.
- Perform periodic testing and inspections for exfiltration.
| **TABLE 2** |
| **POLLUTION SOURCE CONTROL AND MANAGEMENT OPTIONS** |
| **Springfield Wellhead Protection Demonstration Project** |
| **Ohio EPA Division of Ground Water** |

**Automotive Dealers, Repair Shops and Misc. Manufacturing Firms:**

- Coordinate with Ohio EPA and other appropriate agencies to insure that all materials use, handling, storage, reporting and other safety regulations are enforced.
- Provide signs or posters, to be posted in work areas, that indicate that the entity is located within a designated wellhead protection area and promote cautionary measures.
- Promote regular educational programs for facility personnel to supply information and training relative to the WHPA and materials used on the premises including handling procedures and precautions.
- Require proper labeling of all hazardous materials and other deleterious materials present on the premises.
- Require materials safety data sheets be posted or otherwise readily accessible that present health and safety data, chemical properties and emergency response procedures for all potentially threatening materials.
- Require that records be kept of potentially threatening materials brought into the work areas by type, total amounts entered, total amounts used and require reconciliation with records of waste products leaving the work area.
- Require hazardous materials management plans addressing all aspects of the use, storage and handling of each material on the premises.
- Perform periodic inspections of the premises including all interior and exterior areas to insure that requirements are being met and that proper practices and precautions are being followed.
- Require regular inspection and maintenance programs for all pipes, drains, traps, vessels and other equipment used to store or transport hazardous or deleterious materials.
- Require emergency response plans specifying procedures and responsibilities in the event of an accidental spill or other unauthorized release of all potentially threatening materials present on the premises.
- Revise building codes to require additional ground water protection measures. This could include:

  - Prohibiting the discharge of floor drains, piping or other channels to on-lot disposal system;
  - Installation of floor drain collection systems to direct and contain all hazardous or deleterious materials released during normal operations or from accidents and spills;
  - Adequate building and site security methods and systems;
  - Perimeter containment systems capable of preventing hazardous materials from migrating off-site; mechanical protection against overfilling of tanks or other vessels used for any deleterious materials; and, secondary containment systems that are capable of holding at least 110% of containers used to store hazardous materials;
  - Require the use of containment methods in all transport and transfer areas to contain minor spills. This could include impervious pavement and curbs.

- Establish routine ground water monitoring using on-site production wells and properly constructed monitoring wells hydraulically down gradient from potential contaminant sources.
TABLE 2
POLLUTION SOURCE CONTROL AND MANAGEMENT OPTIONS
Springfield Wellhead Protection Demonstration Project
Ohio EPA Division of Ground Water

Septic Tanks and Leach Systems:

- Extend the city's sanitary sewer to those residential subdevelopments and commercial establishments along Route 68 currently using on-lot disposal systems and require hook-up to centralized sanitary sewer wherever feasible.
- Provide home and business owners with information concerning the proper operation and maintenance of septic systems and the possible negative affects on ground water of using septic systems for the disposal of cleaners, degreasers, solvents and other deleterious household and industrial products.
- Prohibit the discharge of hazardous materials or other deleterious materials into any on-site septic systems.
- Require septic tanks to be pumped out and inspected on a routine basis and prior to transfer of property.
- Coordinate with State and Local Health Departments to assure that all siting and installation requirements are met within the five year TOT zone.
- Adopt siting, design, installation and inspection requirements that are more stringent than the state requirements for the one year TOT zone.
- Set permit-to-install fees at a level sufficient to support a rigorous inspection and enforcement program.
- Recommend that water softeners are not used in combination with septic systems.
- Require housing developments to maintain suitable densities of septic systems (e.g. 1/AC).

Domestic Chemical Waste:

- Develop and maintain public information/education programs that identify household chemicals and proper use, storage and handling methods.
- Require that household waste be separated from other wastes.
- Conduct special collection programs for hazardous household waste on a periodic basis.
- Develop holding stations where hazardous household wastes can be dropped and then properly disposed of.
- Develop and operate a used motor oil recycling network to collect waste through commercial and/or municipal garages.
TABLE 2
POLLUTION SOURCE CONTROL AND MANAGEMENT OPTIONS
Springfield Wellhead Protection Demonstration Project
Ohio EPA Division of Ground Water

Miscellaneous Recommendations:

* Install fencing to limit access to the wellfield, quarries and borrow pits surrounding the wellfield, to deter vandalism and unauthorized dumping.
* Coordinate with the Ohio EPA to restrict upstream discharges to the Mad River and its tributaries that could affect the quality of water recharging the aquifer.
* Perform routine water quality sampling of the Mad River immediately upstream of the wellfield.
* Maintain and enforce regulations prohibiting dumping or depositing materials in unauthorized locations.
* Coordinate with the local Health departments to insure that all abandoned wells are located and properly plugged.
* Plan and install a network of monitoring of monitoring wells to insure early detection and response to contaminants moving toward the wellfield.

Future Development:

* Require pre-development ground water monitoring at proposed sites to establish baseline conditions for water quality data.
* Conduct public hearings for all proposed development within the wellhead protection area at which detailed information is presented concerning the proposed development of a facility, its operation, procedures and process chemical usage, and plans for ensuring environmental and public safety.
* Coordinate with County and Townships to change current industrial zoning within the one year TOT zoning and to assure appropriate zoning for the future.
* Initiate program to purchase property or development rights surrounding the wellfield to control any future development.
Pollution Source Controls - Conclusions From Study

The options available to communities for controlling potential sources of pollution within wellhead protection areas depends on the nature of current land uses and the types of potential pollution sources identified. Because communities face different ground water threats and problems, no single wellhead protection tool or combination of tools can be prescribed as best for all communities. The Ohio EPA has, however, identified several key elements for developing and implementing an effective wellhead protection program at the local level.

The need to coordinate the many branches and levels of government with responsibilities and capabilities for protecting ground water resources cannot be overemphasized. Local officials need to educate themselves on the complex legal and institutional framework under which Ohio provides ground water protection. By knowing what rules and regulations apply to potential pollution sources within their WHP areas and what agencies are responsible for implementing them, local officials can determine what activities within the WHPA are unregulated and develop and implement their own control mechanisms. They also can determine what potential pollution sources already are regulated; work cooperatively with the responsible agency or agencies to insure compliance; and, if a violation is noted, insure that enforcement actions are taken. By utilizing the regulatory and institutional framework already in place, communities can make the most efficient use of available resources.

Many of the WHP areas to be delineated in Ohio will be, at least in part, in areas outside the jurisdiction of the water supply owner. Land use may be controlled by other communities, counties, townships, and possibly State or federal agencies. Cooperation from these other authorities will be essential for a public water supply to implement its WHP program. Officials from these jurisdictions should be involved in program development at the earliest stage possible. As an example, legislation introduced to Ohio’s General Assembly in 1990, would allow owners of a water supply whose WHPA is located within other jurisdictions, to petition the Director of Ohio EPA to establish a council consisting of representatives from each jurisdiction to develop the WHP program. The Ohio EPA currently is preparing a guidance document with some options to help resolve multi-jurisdictional problems in wellhead protection areas in Ohio.

Education, training and public involvement programs are essential components of a successful wellhead protection program. Individuals living and working in the wellhead protection area should be given a sense of "ownership" in the wellfield and the wellhead protection program. Open communication often promotes public trust and confidence and ultimately the development of a WHP plan which not only protects the water source but also reflects the needs and desires of involved parties.

Most people living or working in a designated wellhead protection area have little understanding that their activities could impact the quality of the local water supply. Unless efforts are made to inform them, they may not even realize they are located in a WHPA. Even if people realize they are located in or near a WHPA and that their activities can effect ground water quality, they may not know how or to what to change their practices to avoid such impacts.

The Ohio EPA has made several recommendations for educational or training programs for Springfield’s wellhead protection program. These range from relatively simple and inexpensive methods such as posting signs designating the boundaries of WHP zones on roads and highways and placing posters in working places informing people they are located in a wellhead protection area, to more complex and expensive training programs on proper materials use, handling and
storage. Public education efforts and public involvement in decision-making can be accomplished through technical advisory groups, public hearings, meetings, seminars, newsletters, brochures and public service announcements.

Another key component of an effective Springfield Wellhead Protection Plan is a network of ground water monitoring wells to insure early detection and remediation of any contaminants moving toward the wellfield. First local officials should insure that entities required to conduct ground water monitoring under other regulatory programs are in fact doing so and that this information is reported to the water supply owner. They then should develop a ground water monitoring program that is based on the hydrogeologic information gathered during the delineation process and significant threats identified during the pollution source inventory. This plan should utilize existing wells whenever possible to limit the costs of monitoring well installation. Any new monitoring wells should be placed between significant sources of ground water contamination and the wellfield. All wells should be located and constructed in a manner that assures early detection of contaminants. Wells should be sampled and analyzed for parameters indicative of the pollution source(s) being monitored at least annually and preferably semi-annually.
SECTION 4

DEMONSTRATION PROJECT -- CONCLUSIONS

The Springfield Wellhead Protection Demonstration Project has provided invaluable experience to Ohio EPA Division of Ground Water staff on the intricacies of developing a local wellhead protection program. Division staff have gained practical knowledge on alternative methods of delineating wellhead protection areas, conducting a pollution source inventory and developing mechanisms for controlling potential sources of pollution. This practical experience has enhanced the Division's ability to develop guidance and provide technical assistance to local officials as they develop their own wellhead protection programs.

Through the demonstration project it has become apparent that the pollution source inventory and development of a sound management system are the key components to developing an effective wellhead protection plan. While defining accurate WHPAs based upon sound hydrogeologic information is important, communities can spend too much time and effort trying to fine-tune the precise location of the WHPA boundaries. These boundaries are not fixed and should fluctuate with changes in pumping or as more detailed information becomes available. The pollution source inventory should be conducted for the areas in and around the delineated area and mechanism for managing those activities on the perimeter included in the management component of the plan. Mechanisms for redefining the WHPA boundaries as conditions change or as more detailed information becomes available should be included in the management system.

Local officials have to spend a significant amount of time educating themselves on the intricacies of developing a wellhead protection plan. This includes understanding delineation methods as well as trying to understand the extremely complex legal and institutional framework under which Ohio provides ground water protection. This learning process emphasizes the need for Ohio EPA to develop appropriate guidance materials and to provide technical assistance to local officials as they develop their own wellhead protection programs.
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