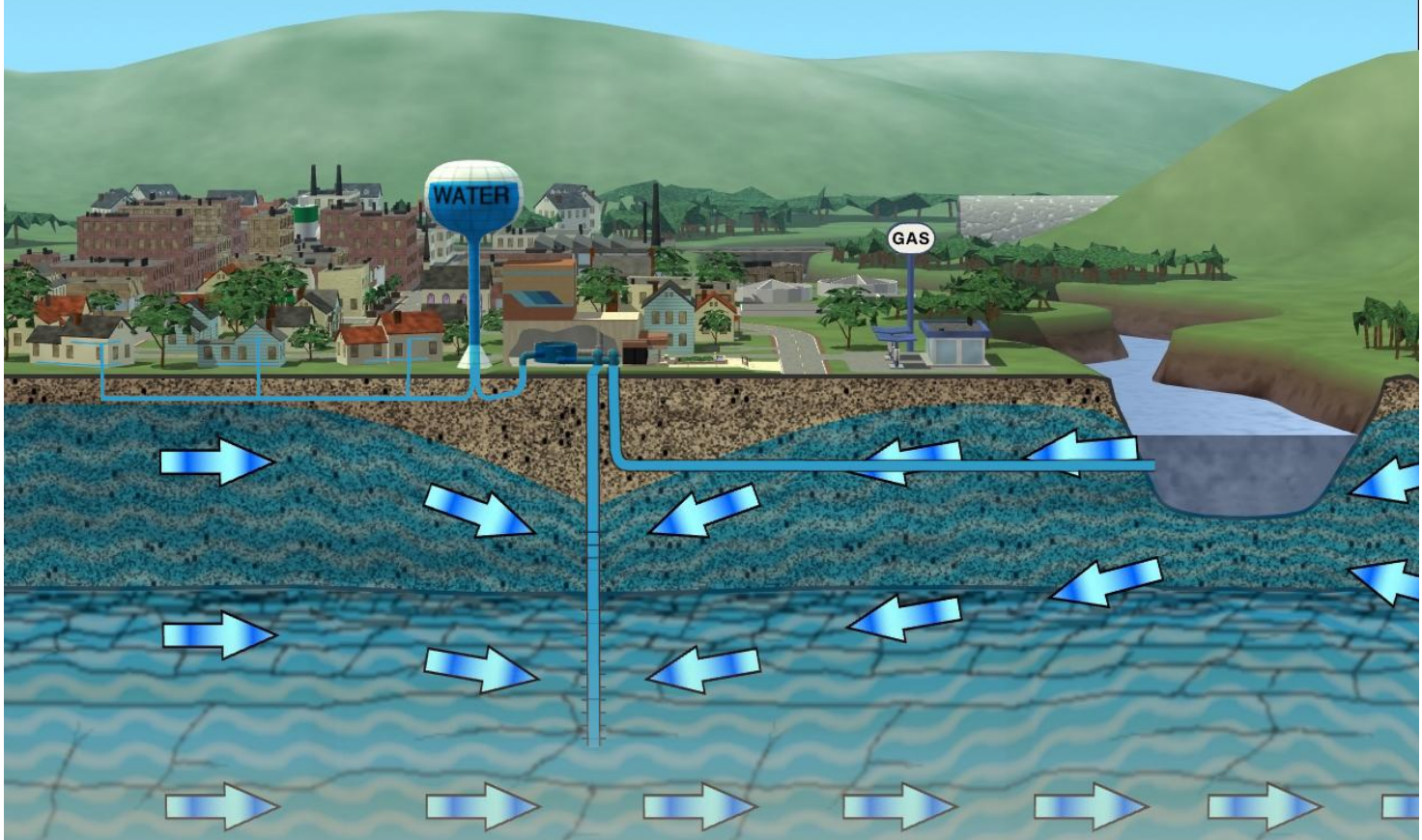
State of Ohio

Source Water Assessment and Protection Program



MAY 1999

The Ohio Environmental Protection Agency

Division of Drinking and Ground Waters

Division of Surface Water

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The attachments were developed for U.S. EPA for review purposes and are not part of the State Source Water Assessment and Protection Program. They are available on Ohio EPA's web page and by request.

CHAPTER ONE
Ohio Source Water Assessment and Protection Program Introduction and Program Summary

1.0 INTRODUCTION

Ohio's Source Water Assessment and Protection (SWAP) Program is an innovative program to protect Ohio's streams, rivers, lakes, reservoirs, and ground waters used for public drinking water from future contamination. Building on existing environmental assessment and protection programs, the SWAP Program will identify drinking water protection areas and provide information on how to reduce the potential for contaminating the waters within those areas. By focusing assessment and protection efforts on source waters, the Ohio EPA hopes to ensure the long term availability of an abundant supply of safe drinking water for existing and future citizens of Ohio.

1.0.1 The Safe Drinking Water Act

Since 1974 the federal Safe Drinking Water Act has set minimum standards on the construction and operation of public water systems, as well as on the quality of water they provide. In 1986 Congress amended the Safe Drinking Water Act to emphasize the protection of the water bodies being used to supply these systems. The amendments require every state to develop a wellhead protection program. The *Ohio Wellhead Protection Program* (Ohio EPA, 1992) was approved by the United States Environmental Protection Agency (U.S. EPA) in May 1992. The Wellhead Protection (WHP) Program was designed to protect public drinking water supplies using ground water by determining the area providing water to a well, inventorying potential contaminant sources within that area, and then developing strategies to protect the ground water from those potential contaminant sources. This federal requirement was driven by a growing recognition that relying on treatment alone is not always effective in protecting public health. In Ohio, approximately 150 public water systems have already initiated assessment and protection activities through Ohio's Wellhead Protection Program.

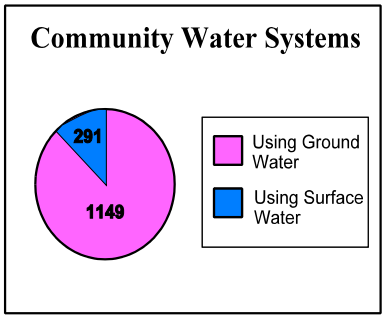
The 1996 amendments to the Safe Drinking Water Act expanded the concept of source water protection developed through the WHP Program to all public water systems, including those based on rivers, lakes and reservoirs. The 1996 amendments added Section 1453 which requires every state to develop and submit a SWAP program to the U.S. EPA and to complete a source water assessment of every public water system. Specifically, the amendments require three steps to be taken for each public water system:

- **Delineate** the area to be protected (the SWAP area), based on the area that supplies water to the well or surface water intake;
- **Inventory** potential significant contaminant sources within the SWAP area; and
- **Determine the susceptibility** of each public water supply to contamination, based on information developed in the first two steps.

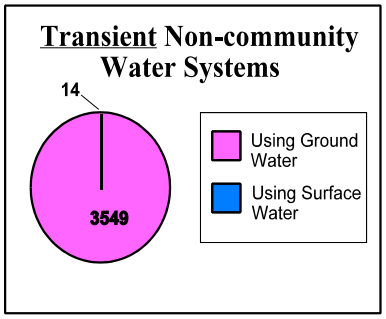
While Section 1453 of the Safe Drinking Water Act only requires states to complete assessments of public water systems, the 1996 amendments to the Safe Drinking Water Act also include a number of provisions for the *protection* of source waters. Section 1453(1) of the Safe Drinking Water Act states that source water assessments are "... for the protection and benefit of the public water system...". U.S. EPA has interpreted this to mean that source water assessments are intended to serve as the basis for protection programs. Guidance from U.S. EPA on state SWAP programs requires states to commit to active protection programs and to describe the linkages between source water assessments and ongoing or future protection efforts. Section 1.4.4 describes other provisions for source water protection activities included in the Safe Drinking Water Act.

1.1 PUBLIC WATER SYSTEMS IN OHIO

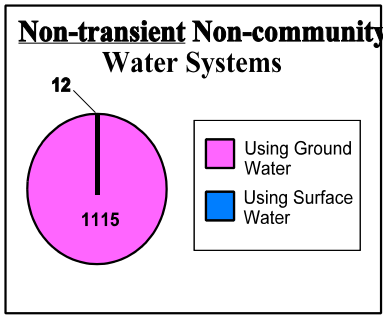
Approximately 90% of Ohio's population is served by community public water systems. In addition, approximately 4,600 businesses, schools, churches and camp grounds have their own water supplies being used by the public. The vast majority of public water systems use ground water as their source of water. Only 317 systems provide water taken from rivers, lakes or reservoirs, but a number of them—such as those in Cincinnati, Columbus, Cleveland, and Toledo—serve large populations. While they comprise only about 5% of the total number of systems, public water supplies using surface water provide water to approximately 60% of Ohio's population. The various types and numbers of public water systems in Ohio are defined in Figure 1-1.



Community public water systems provide water to cities, villages, mobile home parks and residential centers such as nursing homes. To be classified as a community system, the public water system must have at least 15 service connections or provide water to at least 25 year round residents.



Transient Non-community public water systems provide water to at least 25 *different people* for at least 60 days of the year. These systems include places like campgrounds, roadside rests, gas stations, restaurants and churches.



Non-transient Non-community public water systems regularly serve at least 25 *of the same people* for at least six months of the year and include places like schools, businesses, and industries.

Figure 1-1. Ohio's Public Water Systems *(Based on July 1998 figures - Ohio EPA)*
Note: These figures include public water systems that purchase their water from other systems. Public water systems using purchased water will not be held responsible for SWAP activities; however, they should be interested and involved in the SWAP activities of the vendor public water system.

1.2 WHY PROTECT SOURCE WATER?

Safe drinking water is something we all value and most of us have learned to expect. However, it is not something we take for granted. Protecting drinking water is a top priority in Ohio. A 1995 statewide survey conducted for the Ohio EPA Comparative Risk Project (Ohio EPA, 1995) indicated that Ohioans rank drinking water quality as one of the top three environmental concerns facing Ohio. Another statewide survey conducted in 1998 for the Ohio Water Resources Council (Ohio Water Resources Council, 1998) indicated that 90% of Ohioans consider the quality of drinking water to be a "very important" water resource issue. This was the highest ranking of any water resource issue rated in the survey.

Overall, Ohio's public water suppliers have established an excellent record of providing safe drinking water. However, no one can guarantee that an accident won't happen, and a mishap can have serious consequences. In 1993, the City of Milwaukee's public water supply became contaminated with *cryptosporidium*, a parasite found in animal wastes. Nearly half of the 850,000 consumers were infected, 4,400 people were hospitalized, and at least 69 people died, making this the largest documented waterborne outbreak in United States history (Solo-Gabriele and Neumeister, 1996).

While this example is dramatic, large outbreaks of illness from contaminated drinking water are relatively uncommon in the United States today. More often it is the local economy that suffers from contaminated drinking waters. For example, a small village dependent on a single wellfield may be devastated by contamination. The costs of "cleaning up" ground water contaminated with solvents can be astronomical, and the effort usually requires many years. In the past 25 years, about a dozen communities in Ohio have discovered ground water contamination in their well fields that required them to undertake expensive clean-up operations. Several others have conducted costly investigations in an effort to understand why traces of contaminants are being detected in the water supply. In a few cases, the communities have chosen--or been ordered--to abandon the well field. Any community that has endured this kind of crisis will agree: an ounce of prevention is worth a pound of cure.

1.3 PROGRAM DEVELOPMENT PROCESS

Ohio EPA has expended substantial efforts to ensure public participation in developing Ohio's SWAP Program. This level of effort is based on the recognition that environmental programs reflecting the concerns and desires of the public are most likely to be successful. They are more likely to be accepted by those who are affected by them, and more likely to be fully implemented. Moreover, those individuals who participate in the planning process gain an in-depth understanding of the program, enabling them to promote the program effectively.

Ohio EPA initiated development of the Ohio SWAP Program in 1997. In April of that year, Ohio EPA co-sponsored a stakeholder meeting in Columbus, Ohio to assist U.S. EPA in developing the national SWAP guidance (U.S. EPA, 1997) and to initiate discussions on development of Ohio's SWAP Program. Over 200 people attended this workshop making it one

of the most well attended of these workshops sponsored by U.S. EPA across the country. The attendance also demonstrated the high level of interest in the SWAP Program in Ohio.

To formalize the public participation process, Ohio EPA convened a Technical Advisory Committee and several Public Advisory Groups, located throughout the state. The first Technical Advisory Committee meeting was held in December 1997, and monthly meetings were held thereafter. The various Public Advisory Groups were organized starting in January 1998. The Central Ohio group met monthly throughout the first half of 1998 and other regional groups met at various intervals. All of the advisory groups provided substantial input and were responsible for determining the overall approach as well as the details of the program presented in this document.

In addition to convening the various Public Advisory Groups, Ohio EPA staff in the central and district offices have given presentations to numerous interest groups around the State. Ohio's SWAP Program development has also been publicized in several statewide news releases, articles in a variety of publications, and on the Agency's web page. The final draft of the SWAP Program document is being made available for public review and comment. Two public meetings are being conducted at each of Ohio EPA's five district offices to solicit public comment on the final draft. All of these efforts to involve the public in development of Ohio's SWAP Program are described in more detail in an attachment to this document, which is available upon request.

1.3.1 Ongoing Public Participation

Ohio EPA believes ongoing public participation is essential for effective implementation of the SWAP Program. A statewide Public Advisory Group will be formally established to provide ongoing guidance as Ohio EPA refines and implements the SWAP Program. Members of the Technical Advisory Committee and Public Advisory Groups will help in establishing membership and operational guidelines for this new group.

1.4 IMPLEMENTATION

1.4.1 Time Line

The Safe Drinking Water Act requires source water assessments to be completed within two years after U.S. EPA approves Ohio's SWAP Program. In accordance with the Safe Drinking Water Act and U.S. EPA guidance Ohio EPA can, and is, requesting an eighteen month extension of that deadline. While Ohio has developed an efficient and cost effective approach for completing assessments, it cannot complete meaningful assessment of over 6,100 public water systems within a two year time frame. This is due to the amount of time needed to actually complete assessments as well as funding and other resource constraints.

For example, much of the information needed to complete SWAP area delineations and susceptibility analyses is not currently available for all of Ohio. A major component of Ohio's SWAP Program is Resource Characterization, a data gathering exercise through which most of the information needed to delineate SWAP areas and determine sensitivity to contamination will be gathered. Key data sources include maps to be completed by the Ohio Department of Natural Resources. Some of these maps will not be completed until sometime in 2002. While initial

assessment activities will focus on areas where mapping and other resource characterization work has been completed, Ohio will not be able to complete assessments until after all mapping is completed.

Even if all the data needed to complete assessments were available, completing valid assessments of all public water systems in a two year time frame would be nearly impossible. There simply is not enough money or personnel to complete that much work in such a short amount of time. Even with the extension, it will be extremely difficult to accomplish this task; however, Ohio EPA is committed to completing assessments of all public water systems by May 2003.

Pilot projects for completing the source water assessment for selected groups of public water systems will be initiated to develop the procedures for completing SWAP assessments. Through out this pilot phase, procedures developed and the rationale for selecting particular approaches will be documented. By the end of 1999, procedures for completing the delineation, inventory and susceptibility analysis and criteria for decision point in the process will be included in the SWAP Process Manual. This manual will help to promote consistent Source Water Assessments across the state.

1.4.2 Responsibility for Completing Assessments

As outlined in Chapters 2 and 3, most source water assessments will be completed by Ohio EPA or its contractors, in cooperation with the public water systems and other interested parties. Both the Technical Advisory Committee and Public Advisory Groups felt that placing full responsibility for completing assessments with the public water systems would be overly burdensome on the owners of those systems. In addition, without state legislation requiring systems to complete assessments, Ohio EPA could not ensure that they would be completed by the statutory deadline. By completing or overseeing the majority of assessments, Ohio EPA will ensure a consistent approach to assessments and make the most efficient use of available resources.

The advisory groups also felt that participation of the public water system owners and operators was essential to their understanding the results of assessments and their willingness to implement protection strategies after assessments are completed. Therefore, public water suppliers will be actively consulted during assessments, particularly when identifying potential significant contaminant sources. Public water suppliers who wish to complete assessments on their own and submit them to Ohio EPA for review will be allowed to do so up to a specified time.

Ohio EPA does not have an adequate number of staff to complete assessments of all public water systems by May 2003. It is estimated that the equivalent of approximately 40 full-time staff per year would be required to complete assessments in four years. Hiring enough full-time permanent staff to complete these initial assessments is not a reasonable option. Therefore, Ohio EPA will work in cooperation with other state and federal agencies as well as other private and public organizations to complete assessments. The Ohio Department of Natural Resources and the United States Geological Survey (U.S. Geological Survey) will be major partners in completing resource characterization and delineation work. Other private and public organizations will be contracted as needed.

1.4.3 Resources to Complete Assessment and Protection Activities

Ohio EPA has estimated it will take over $12.5 million to complete source water assessments of all public water systems. The Agency currently spends approximately $500,000 per year in the WHP Program that will be redirected to SWAP activities. This leaves over $10 million of additional funding needs.

States are allowed to take a one-time set-aside of 10% of the Federal Fiscal Year 1997 capitalization grant for the Water Supply Revolving Loan Account Program to "... delineate and assess source water protection areas." Ohio has chosen to take this set-aside amounting to approximately $4.3 million. The Safe Drinking Water Act also allows states to take up to 10% additional set-aside from the annual capitalization grant to support ongoing WHP efforts. This would include the delineation of SWAP areas and contaminant source inventories for public water systems using ground water. Other funding options available to support assessment activities include the State Drinking Water Protection Fund and additional state general revenue funds. Decisions on what additional funding sources are most appropriate, including any additional set-asides from the Water Supply Revolving Loan Account Program, will be made in future years as assessments are being completed and after a more detailed and timely evaluation of funding needs. The Public Advisory Group that will be formed to assist Ohio EPA with SWAP Program implementation will assist in this evaluation.

1.4.4 Linkages to Source Water Protection and Funding Opportunities

The 1996 amendments to the Safe Drinking Water Act include a number of specific source water protection provisions. The most important of these, at least for public water systems using ground water, is the continuation of the Wellhead Protection Program under Section 1428, and new authority for states to support wellhead protection efforts through use of the State Revolving Fund set-asides (Section 1452(k)(1)(D)). Section 1428 requires States to adopt measures "...to protect wellhead areas (i.e. SWAP areas for public water systems using ground water) within their jurisdiction from contaminants which may have an adverse impact on the health of persons." Protection programs for these systems must include implementation of contaminant source control measures, education and training (Section 1428(a)(4)), and contingency plans (Section 1428(a)(5)).

Other opportunities to fund source water protection activities are provided in Section 1452(k)(1)(A) of the Act. This Section authorizes expenditures of the Water Supply Revolving Loan Account Program for loans to public water systems or communities to: 1) "...acquire land or conservation easements..., if the purpose of these acquisitions is to protect the source of water"; 2) " ...implement local, voluntary source water protection measures to protect source water areas"; and 3) to support the Source Water Petition Program authorized under Section 1454 of the Act.

The 1996 amendments to the Safe Drinking Water Act also create several linkages among different parts of the law to promote source water protection activities. Linkages are established between the source water provisions and those for Capacity Development (Section 1420), Chemical Monitoring Waivers (Section 1418), and Underground Injection Control Class V Wells (Section 1421). Overall, the 1996 amendments create powerful incentives for states and public water systems to fully implement source water protection provisions.

The Clean Water Act also provides incentives and funding for source water protection activities. For example, funds available through Ohio EPA's Water Pollution Control Loan Fund can be used to support source water protection activities for both ground water and surface water. Section 319(h) of the Clean Water Act authorizes funds to support nonpoint source water quality issues. Ohio has provided additional priority to fund projects addressing waters being used by public water systems.

1.4.5 Relationship to the Ohio Wellhead Protection Program

The Ohio Wellhead Protection Program provides the core of Ohio's SWAP efforts and will be renamed and incorporated directly into the Ohio SWAP Program. While this change may initially be confusing, especially for those public water systems actively implementing wellhead protection plans, Ohio EPA believes this change is necessary to eliminate the perception that these are two separate programs and to bring surface water supplies under the same umbrella. In the long run, merging these two programs into one will make it much easier to effectively communicate with the public and other stakeholders about source water assessment and protection efforts being conducted for Ohio's public water systems. Guidance, fact sheets and other documents developed for the Wellhead Protection Program will be modified and updated as necessary.

If a public water system has an endorsed delineation and inventory under Ohio's Wellhead Protection Program, the delineation and inventory will also be acceptable (endorsed) under the SWAP program. In addition, most public water systems with endorsed inventories have evaluated the susceptibility of their source waters when prioritizing their potential contaminant sources. Ohio EPA will evaluate these public water systems on a system by system basis to determine if any additional susceptibility analysis information needs to be collected. In many cases, especially for systems with completely endorsed wellhead protection plans, additional susceptibility work will not be necessary. Ohio EPA will complete a susceptibility analysis for those systems that have not adequately evaluated the susceptibility of their source waters.

1.4.6 Tracking and Reporting Program Implementation

Progress on Ohio's SWAP Program will be reported to U.S. EPA through the self assessment completed annually in compliance with the Performance Partnership Agreement between Ohio EPA and U.S. EPA. It will also be reported in the Biennial Progress Report required under the WHP provisions of the Safe Drinking Water Act and the annual reporting requirements for the Drinking Water State Revolving Fund Capitalization Grant.

The Division of Drinking and Ground Waters currently has a computer program to track Ohio's WHP Program and development of local WHP plans. This system will be modified (or a similar system will be developed) to track completion of source water assessments and development of source water protection plans or strategies. This information will be made available on the Agency's Internet web page as time and resources allow.

1.5 SUMMARY OF OHIO'S SWAP PROGRAM

The following chapters outline how the State of Ohio will conduct source water assessments for all of its over 6,100 public water systems. The general structure is as follows:

Chapter Two describes the procedures for assessing public water supplies derived from ground water systems. Readers familiar with Ohio's WHP Program will note that the procedures used to assess ground water are nearly identical to the Ohio WHP Program's delineation and inventory steps.

Chapter Three describes the procedures for assessing public water supplies using a surface water source. While there are fewer SWAP areas to be assessed for surface water-based systems, the assessment process is much more complex. The area contributing water to a stream segment may be an entire watershed, which may comprise an area of several hundreds of square miles. In such cases, it is unrealistic to propose detailed inventories of the entire SWAP area. It is even less realistic to expect that public water suppliers will have the resources or ability to propose protective strategies for areas many miles from their own communities.

All these problems are compounded for (1) public water systems using the Ohio River, whose watershed covers portions of several states, and (2) for public water systems using Lake Erie, whose watershed extends into Canada. Because of the special inter-jurisdictional problems associated with the Ohio River and Lake Erie SWAP assessments, the procedures for these have been developed separately by interstate associations, and they are described separately in this document. Sections 3.1 to 3.4 address inland systems in detail, Section 3.5 summarizes SWAP procedures for systems on the Ohio River, and Section 3.6 summarizes SWAP procedures for systems on Lake Erie.

Chapter Four describes how Ohio EPA will disseminate the assessment information to the public water systems. It also describes how this information will be provided to the public. The degree to which the public supports and complies with drinking water protection strategies will be directly related to how well people understand the importance of protecting the drinking water supply. Their ability to participate in developing appropriate protection strategies will be enhanced by detailed information about the SWAP area and the susceptibility of the public water system to contamination.

Chapter Five describes how Ohio will utilize the additional information generated through source water assessments to direct on-going protection activities. Ohio's basic approach will be to integrate source water protection into on-going activities occurring at the local, state and federal levels. As indicated in U.S. EPA's guidance, a SWAP Program is "...more than a programmatic end in itself." A SWAP Program should serve as "the lens" by which states look at their priorities in other programs, and focus on drinking water as a central element in overall water quality management.

CHAPTER TWO
Ground Water Systems
Source Water Assessment and Protection Approach and Implementation

2.0 INTRODUCTION

Completing cost effective, yet scientifically valid source water assessments of nearly 5,800 public water systems using ground water within a four-year time frame requires adopting a systematic and semi-automated approach. Figure 2-1 summarizes that approach for Ohio. The sequence of activities includes:

1. Regional/aquifer-wide Resource Characterization;
2. Delineation of SWAP area;
3. Inventory of potential significant contaminant sources;
4. Susceptibility Analysis - leading to source water protection activities.

This Chapter starts with a programmatic overview of these activities followed by more detailed explanation in subsequent sections.

2.0.1 Overview

Resource Characterization. The first phase of the assessment for public water systems using ground water is Resource Characterization. The purpose of Resource Characterization is to compile and evaluate existing information on Ohio's geology, ground water resources, and public water systems to facilitate a cost effective and systematic approach for delineating SWAP areas and determining the aquifer's intrinsic sensitivity to contamination. Information to be collected includes values for aquifer porosity, hydraulic conductivity, and ground water levels, as well as site specific information on public water systems such as well depth, well integrity, length of open or screened interval, water quality, and pumping rates. This information is currently distributed among various organizations and institutions across Ohio, and completing assessments of public water systems without this phase would require collecting applicable data from each of these

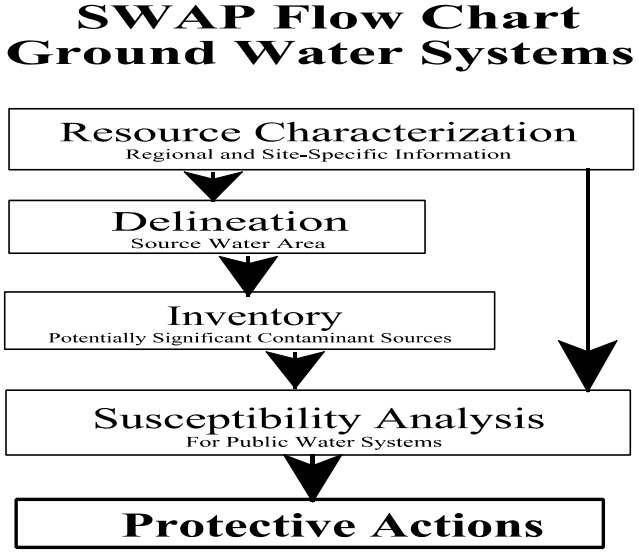


Figure 2-1. Source Water Assessment Process for Ground Waters

various sources on a site-by-site basis.

Delineation. Delineating the SWAP area is the second phase of assessments for ground water systems. The SWAP area for public water systems using ground water will be based on a five year time-of-travel criterion. In other words, the boundary will enclose the area that will provide water to the well in five years or less. An inner management zone representing approximately a one (or two) year time-of-travel area will also be delineated. A final determination of the time-of-travel will be based on the pathogen viability determination being completed by U.S. EPA. The majority of SWAP area delineations will be completed by staff from the Ohio Environmental Protection Agency (Ohio EPA) Division of Drinking and Ground Waters. However, in some instances delineations will be completed by other public or private organizations. The methods used to delineate SWAP areas will be determined on an aquifer by aquifer basis using information gathered during the Resource Characterization phase. This will help ensure a more consistent application of delineation methods to a given hydrogeologic setting using the best available information. Regional source water delineations will be completed for the shallow karst aquifers in Ohio.

Inventory. Public water systems will assist in completing the inventory of potential significant contaminant sources within their SWAP area. Participation of the public water suppliers is essential to their understanding the results of assessments and their willingness to implement protection strategies. Inventory checklist forms have been developed to help identify potential significant contaminant sources. These inventory forms will be sent to public water suppliers with a map of their delineated source water protection area. A list and map of potential significant contaminant sources identified by Ohio EPA in statewide databases will also be provided. Ohio EPA, or other SWAP support staff will meet with the public water system staff on site to field check and/or assist them in completing their inventory.

Susceptibility Analysis. The final phase of a source water assessment is the Susceptibility Analysis. Ohio has defined "susceptibility" as *the likelihood for the source water(s) of a public water systems to be contaminated at a concentration that would pose a concern*. The purpose of the analysis is *to provide a pointer to what actions a public water system should take to further define and reduce susceptibility.*

2.1 RESOURCE CHARACTERIZATION

The purpose of the Resource Characterization is to compile and evaluate existing information on Ohio's geology, ground water resources, and public water systems to facilitate a cost effective and systematic approach for delineating SWAP areas and for determining aquifer sensitivity to contamination. Inaccessibility of these data is viewed as one of the greatest barriers to completing efficient assessments of public water systems using ground water. While a great deal of work has been completed to characterize ground water resources and geology, these data are currently distributed among various organizations and institutions across Ohio. Completing assessments of public water systems without this effort would require collecting applicable data from each of these sources on a site-by-site basis.

The major focus of the Resource Characterization is the collection of existing regional and site-specific hydrogeologic data. While this information is maintained by a large number of local,

state and federal agencies, universities, consultants, and others, the Ohio EPA, Ohio Department of Natural Resources, and the United States Geological Survey (U.S. Geological Survey) are the three largest repositories of this information on a statewide basis. Initial efforts to compile data will be completed by these three agencies. Additional sources of information collected and maintained by other public and private organizations may be compiled as time and resources allow.

Table 2-1. Hydrogeologic Parameters

- Values of porosity;
- Values for permeability;
- Values for vertical hydraulic conductivity;
- Values for horizontal hydraulic conductivity;
- Values for transmissivity;
- Values for specific yield;
- Depth to ground water;
- Aquifer thickness;
- Ground Water Pollution Protection index (DRASTIC)

Information to be collected as part of the Resource Characterization can be separated into two key categories: one for hydrogeologic parameters and another for well information. Key hydrogeologic and well parameters to be collected are listed in Tables 2-1 and 2-2 respectively.

The information collected during the Resource Characterization will be compiled in a centralized database with geographic links. Selecting hydrologic data sets from this database will help ensure the best available information is used to delineate SWAP areas and allow the automation of assessment activities. For example, values for parameters needed to delineate SWAP areas will be compiled and maintained in a geographic information system.

One of the challenges of the Resource Characterization process is combining information located in many different sources and formats, including paper files, unpublished reports, scientific papers/journal articles, electronic databases, and maps. To make this process easier, a standard set of attributes, including bibliographic data, will be collected for each parameter and data source. Table 2-3 lists the types of attributes that will be collected.

While the Resource Characterization phase will consist primarily of researching, compiling and evaluating *existing* data, some new data will be collected. For example, the delineation of SWAP areas requires accurate locations of public water system wells and intakes. Ohio EPA staff have been collecting accurate locations of public water systems using global positioning systems since early 1997.

Table 2-2. Well Parameters

- Public water system identification number
- Ohio Department of Natural Resources well log number (if available)
- Total depth of well
- Casing length
- Static water level and date measured
- Pumping rate
- Well diameter
- Length of screen or open interval
- Aquifer type (confined, unconfined, leaky)
- Aquifer lithology
- Latitude
- Longitude
- Wellhead elevation
- Address
- Date drilled
- Pump test rate
- Pump test duration
- Well integrity
- Water quality data

Table 2-3. Key Parameter Attributes

- Data type (regional vs. point data)
- Data value range
- Units
- Confidence
- Point data latitude
- Point data longitude
- Measuring point (for Z-coordinate)
- Point data address
- County
- Township
- Topographic quadrangle map name
- Data location (Ohio Department of Natural Resources, U.S. Geological Survey, Ohio EPA)
- Name of map coverage
- Scale of map
- Citation reference
- Name of database
- Format of database
- Name, location of paper files

Efforts to collect this information will be augmented as part of the Resource Characterization. Because of the time necessary to accurately locate the wells, this task may be outsourced to a contractor that specializes in global positioning system equipment. Another example of new data that may be collected is tritium. Selected public water wells could be sampled for tritium to determine if the production aquifer is confined (refer to Section 2.4.2 for more details on tritium sampling and results).

The Resource Characterization work will also involve manipulating and interpreting existing data to generate new information on ground water resources. For example, with careful selection and using best professional judgement, water level data collected from well logs maintained by the Ohio Department of Natural Resources may be used to generate regional potentiometric maps of ground water elevations. The ground water flow direction and gradient derived from these data can then be used in the delineation of SWAP areas.

Information collected and generated during the Resource Characterization will not only serve as the foundation for completing source water assessments in Ohio, but will have other long-term benefits. Ohio EPA, public water suppliers, and others will have access to these data to further refine and update their source water assessments and to complete assessments for new public water systems. Access to these core data will be essential when developing or implementing protection activities. Both the public and private sectors will also be able to access and use these data as a starting point for other types of hydrogeologic investigations at all scales. Data gaps identified during the Resource Characterization can be used to focus future data collection efforts.

The data collection process will be initiated immediately and is expected to continue throughout much of the assessment period. The intensity of data collection will be greatest during the first two years and decrease as the SWAP Program progresses, although it is anticipated that some level of data collection will continue throughout much of the assessment period. Completion of the Resource Characterization efforts on a geographic basis will allow assessment activities to be initiated as areas of the State are completed.

2.1.1 Primary Data Sources

Table 2-4 lists the primary data sources Ohio EPA will use in conducting source water assessments. The Ohio Department of Natural Resources aquifer maps will serve as the basis for compiling resource information and will be critical in delineating SWAP areas. These aquifer maps will be produced as geographical information system products on the 1:100,000 Ohio

topographic quadrangles. The geology is originally compiled at a scale of 1:24,000. The glacial aquifer maps have five attributes attached to the area polygons: local aquifer name; yield; thickness; lithology, and hydrogeologic setting. Lithology and hydrogeologic setting will be especially helpful in determining appropriate delineation methods. The bedrock aquifer maps utilize the Division of Geologic Survey's bedrock maps. Each hydro-stratigraphic unit is represented as a map with attributes of yield and thickness. Some of these aquifer maps are completed and the current work plan has the entire state completed by March 2000. The Resource Characterization process will follow the completion of the aquifer maps.

Table 2-4. Primary Data Sources

Mapping Projects
- Ohio Department of Natural Resources' glacial aquifer and bedrock aquifer maps as digital geographic coverages (mapping base is 1:24,000);
- Ohio Department of Natural Resources' karst (1:500,000), glacial, and bedrock mapping projects;
- Ohio Department of Natural Resources' ground water pollution potential maps (based on DRASTIC).

Localized Ground Water Studies
- The U.S. Geological Survey Lake St. Clair-Lake Erie National Water Quality Assessment Program;
- The U.S. Geological Survey Great Miami National Water Quality Assessment Program;
- The U.S. Geological Survey Regional Aquifer-System Analysis Program;
- Other special studies on stratigraphic units.

Other Data Sources
- Ohio Department of Natural Resources well logs;
- Ohio EPA, U.S. Geological Survey, and other water quality data bases;
- Ohio EPA public water system inventory data

The ground water pollution potential maps, also prepared by the Ohio Department of Natural Resources, are particularly important for evaluating the sensitivity of hydrogeologic settings. These maps are based on the DRASTIC system developed by the National Water Well Association for the U.S. EPA (Aller et al., 1987). The hydrogeologic characteristics used in DRASTIC to characterize aquifer sensitivity are: **D**epth to ground water, net **R**echarge to the aquifer, **A**quifer media, **S**oil media, **T**opography, **I**mpact of the vadose zone media[1], and Hydraulic **C**onductivity of the aquifer. Unfortunately, as of mid 1998, ground water pollution potential maps had been completed for only 50 out of 88 counties in Ohio. Completing these maps for the remaining portion of the State would require a great deal more time and money than available to complete assessments. Therefore, Ohio EPA will contract with the Ohio Department of Natural Resources to complete *partial* DRASTIC analyses for these counties by December 2002. It is anticipated that the sensitivity analyses will be completed using only those parameters with the greatest impact on ground water sensitivity (depth to ground water, recharge, impact of the vadose zone media, and soil media). Ohio Department of Natural Resources staff will then use these data to make a relative pollution potential analysis. This analysis is not only critical for completing source water assessments, but will also aid the Department of Natural Resources in completing pollution potential maps for Ohio.

[1] *Impact of the vadose zone media* refers to the physical and chemical processes that can occur as a contaminant moves through the vadose zone above the aquifer. The *vadose zone* represents that area above the aquifer and below the soil horizon that is unsaturated. Under confined aquifer conditions, the vadose zone is referred to as the confining layer.

The Ohio Department of Natural Resources, Division of Geologic Survey, has several mapping projects that will provide geologic information for evaluating the hydrogeologic setting of public water systems. The karst mapping effort was designed to identify areas that include karst features that act as entry points for surface water to directly recharge ground water (Ohio Department of Natural Resources, in preparation). This digitized map will be useful for identifying karst areas for SWAP delineations. Current bedrock and surficial mapping efforts provide basic geologic information for SWAP assessments as well as contributing to the aquifer mapping effort.

Other significant data sources include: well logs maintained by the Ohio Department of Natural Resources, numerous regional and local studies completed by the U.S. Geological Survey, and the Ohio Department of Natural Resources, the public water system inventory files maintained by Ohio EPA, and the public water systems themselves.

2.2 DELINEATION OF SWAP AREAS

2.2.1 Background Information

Delineating a SWAP area for a public water system using ground water provides the area of focus for the other assessment and protection activities. Through delineation, the providers and consumers of public water learn where the water supplying the well(s) is coming from. Within this area, potential significant contaminant sources will be identified and protective activities will be implemented. Protective activities also may be undertaken outside the area, at the discretion of the supplier and/or concerned citizens, but the SWAP area should receive the highest priority and will be the area of focus for statewide protective activities.

The SWAP areas for ground water systems will be based on a five-year capture zone. In other words, the protection area will encompass the area that provides water to the well(s) in five years or less (Figure 2-2). This water may originate as rain that fell directly over the protection area, ground water seeping into the protection area from surface water bodies, and ground water from more distant portions of the aquifer.

Since ground water moves very slowly through the subsurface, a five-year capture zone may be only a few acres to several square miles in size, depending largely on the pumping rate and the aquifer thickness. The shape of the capture zone also varies depending largely on flow boundaries (where present) and the gradient (slope) of the water table. Detailed information on how the hydrogeology of a site affects the size and shape of a capture zone can be found in Chapter 2 of Ohio EPA's wellhead protection area delineation guidance (Ohio EPA, interim 1994).

An "inner management zone" also will be calculated based on a two-year capture zone. Due to the proximity to the well(s), this zone may require more stringent protection measures than

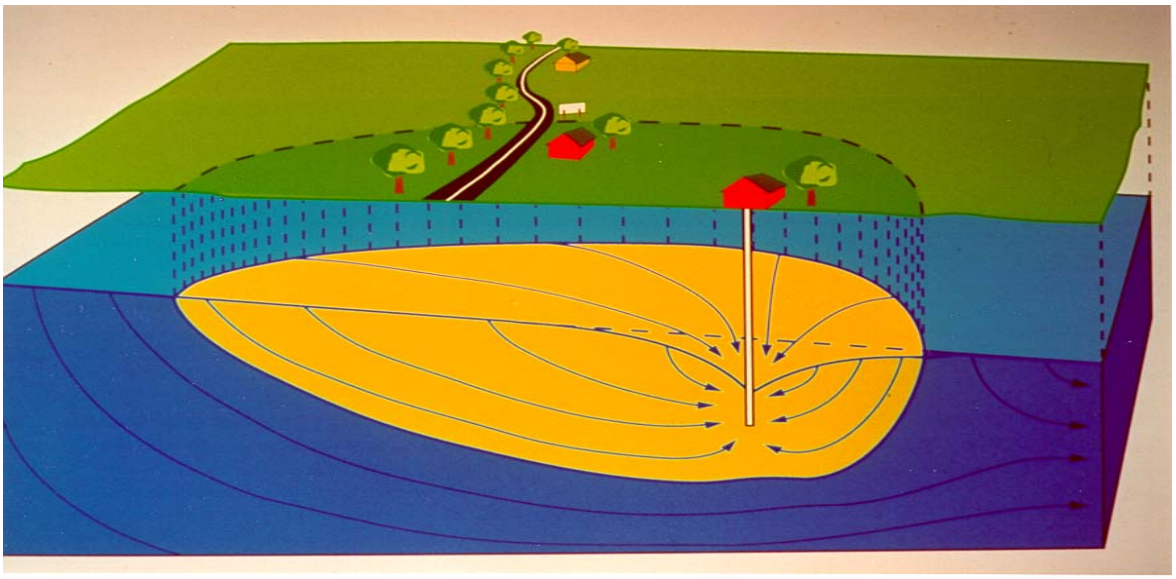


Figure 2-2. The Capture Zone of a Pumping Well, Shown in Three Dimensions

the five-year capture zone. This area will also provide a focus zone for identifying potential significant sources of pathogens such as *cryptosporidium* and *giardia*.

2.2.2 Types of Delineation Methods

Methods that will be used for delineating capture zones fall into three basic categories: volumetric equation methods, computer models (analytical and numerical), and hydrogeologic mapping. Each of these methods is described briefly below. For more detailed information, see Chapter 3 of Ohio EPA's wellhead protection area delineation guidance (Ohio EPA, interim 1994).

Volumetric Equation Method. This delineation method involves determining the *volume* of aquifer that provides water to a well over a five-year period of time. This volume can be calculated using a variation of the equation for the volume of a cylinder, as follows:

$$\underset{\text{(volume pumped in five years)}}{Q\,t} = \underset{\text{(volume of cylinder)}}{n\ \pi\ H\ r^2}$$

where Q = maximum anticipated pumping rate of well (in units of feet^3 per year)
t = time in years
H = open interval or length of well screen (feet)
n = aquifer porosity (unitless)
π = 3.1416 (unitless)
r = radius of circular SWAP area around the well (feet)

This equation then can be arranged to solve for the radius (r) of the cylinder:

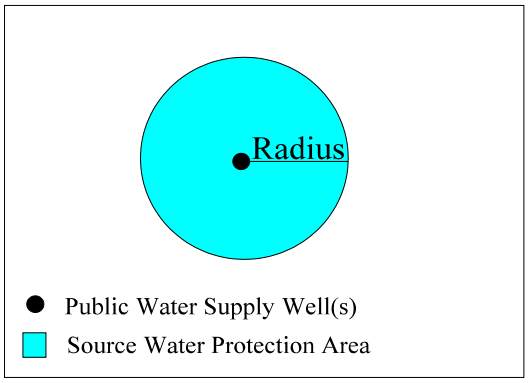
$$r = \sqrt{(Qt/n\pi H)}$$

The value obtained is the radius of a circular five-year time-of-travel area (illustrated in Figure 2-3 (a)). A circular SWAP area is often reasonable for wells located in aquifers (or portions of aquifers) that are relatively homogeneous and have a very low flow gradient, because in this setting the well will capture almost equal amounts of water from every direction. However, in areas with a steep flow gradient, more of the water captured by the well will be from the upgradient portion of the aquifer, and less from the downgradient portion. It would therefore be more correct to shift the SWAP area preferentially toward the upgradient side.

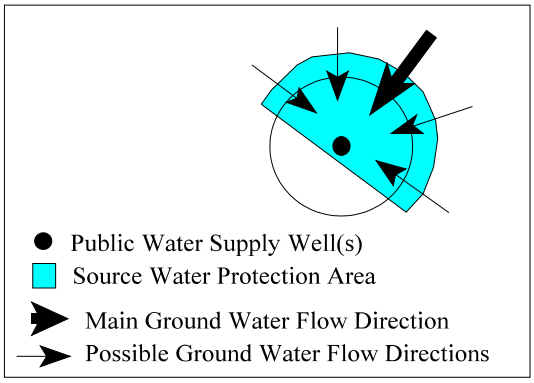
The volumetric equation can be used to calculate SWAP areas of simple shapes skewed toward the upgradient side. A semi-circular area could be drawn that would cover more of the upgradient area and flow directions ranging 180 degrees (Figure 2-3(b)). Similarly a wedge-shaped area (developed from a quarter-cylinder) could be calculated that would extend the SWAP area even further into the upgradient direction (Figure 2-3(c)). This area would cover flow directions within a 90-degree range. Thus, if the flow direction is known with greater certainty, this shape might be recommended. The simple volumetric equation for a half-cylinder is $Q = (\frac{1}{2} n\pi H r^2)/t$ and the equation for a quarter cylinder is $Q = (1/4\ n\pi H\ r^2)/t$.

Deciding exactly where to place a semi-circular or wedge-shaped SWAP area in relation to the well is more difficult. For example, if it seems reasonably certain that the general flow direction in an area is due south, the delineator will orient the semi-circle or wedge to extend north from the well. However, the well is still drawing *some* water from the downgradient side, and how much it is drawing depends primarily on the flow gradient. If the gradient is nearly flat, the capture area will resemble a circle (rather than the proposed semi-circle or wedge). If the gradient is steep, the capture area will resemble a long narrow parabola extending north from the well, and almost none of the area south of the well will contribute water to it. Unfortunately, flow gradient values are difficult to obtain, requiring nearly simultaneous measurement of water levels in at least three local wells. In many cases, if a delineator is using a volumetric equation to delineate a SWAP area, it is *because* he or she does not have reliable information on the gradient.

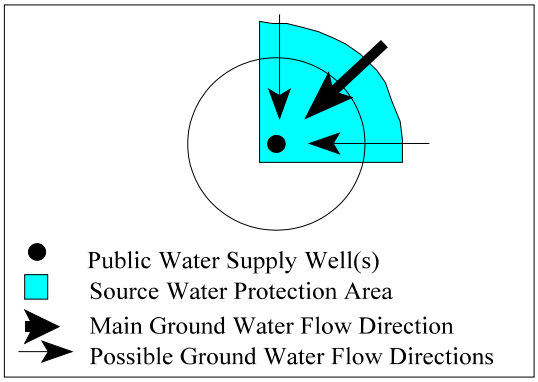
Precise guidance on how to use and position semi-circles or wedge-shaped SWAP areas will be determined during the pilot phase (May through December 1999) and will be documented in a SWAP Process Manual, which should be fully drafted by December 1999. This Manual will guide Ohio EPA District staff as they complete assessments throughout the state from approximately January 2000 to May 2003.



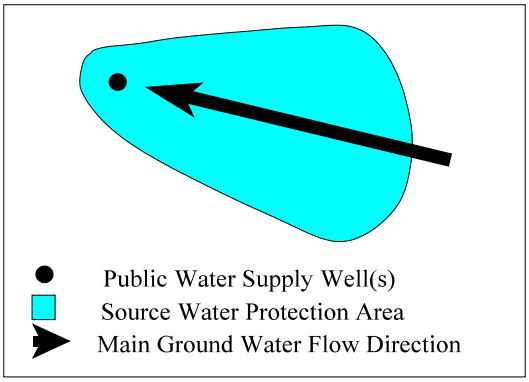
(A) Volumetric Equation: Circular Area



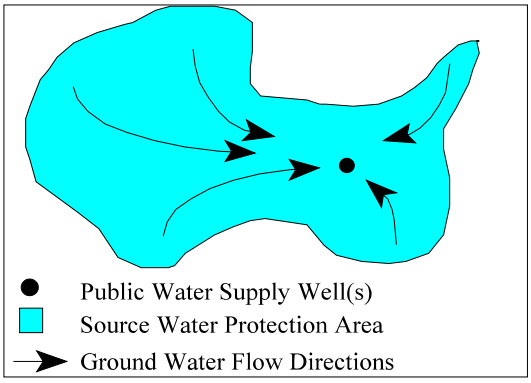
(B) Volumetric Equation: Semi-Circular Area



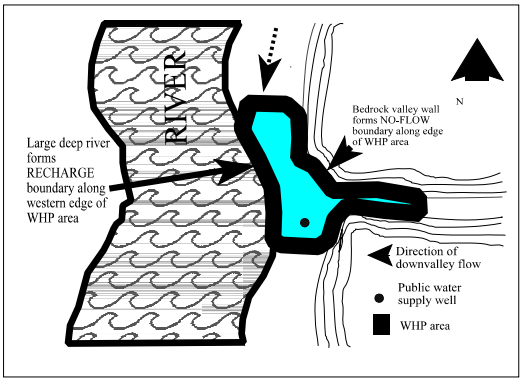
(C) Volumetric Equation: Wedge-Shaped Area



(D) Simple Computer Model Delineation



(E) Delineation Using Numerical Model



(F) Delineation Using Flow Boundaries

Figure 2-3. Methods of Delineating SWAP Areas for Ground Water Systems

Advantages and Disadvantages of Volumetric Equation. There are two main advantages of this kind of delineation. First, it requires minimal data (volume of water pumped, length of screened interval or open borehole, and aquifer porosity). In many cases the information needed to use a more complex delineation method is not available and it would be too costly to obtain it. This is especially true for the thousands of transient public water systems. Secondly, a semi-automated

process can be used to increase the efficiency of delineations. The equations can be programmed into a geographic information system so that the input data for each of multiple wells in an area could be entered and solved simultaneously, and the boundaries could be drawn on a base map. For these reasons, this kind of delineation would be useful for efficiently delineating the transient systems--which represent two-thirds of Ohio's public water systems. These systems typically pump small amounts of water, and may have little to no information about the well or the aquifer.

The main disadvantage of a volumetric delineation is that it is based on very little data, and the accuracy is therefore suspect.

Computer Models. There are many types of computer flow models that can be used to delineate SWAP areas. Analytical and semi-analytical models solve ground water flow equations through simple, calculus-based mathematics, generating an approximate mathematical solution for the unknown variable--typically the hydraulic head at a given location. These models require simplifying the ground water equation by assuming the aquifer is homogeneous and isotropic and flow is strictly one- or two-dimensional. The resulting capture zone typically is a simple shape ranging from a circle to a parabola that opens to the upgradient side (Figure 2-3(d)).

Numerical models use approximating techniques that change the basic ground water flow equation to a form that can be quickly solved by a computer. This allows the flow equation to be defined at hundreds of locations (called "nodes") in the aquifer. The set of transformed equations generated at each node then can be solved using a combination of matrix and iterative solution techniques, to obtain values for hydraulic heads at each node. A particle-tracking routine calculates the velocity and direction of flow to the wells based on these hydraulic head values, and then calculates the location of the SWAP area boundary.

Advantages and Disadvantages of Computer Models. Analytical computer models use more site-specific information than the volumetric equation, and are therefore assumed to be more accurate. They typically can model recharge from precipitation, multiple pumping centers, and simple boundaries. They are also relatively easy to program, and require fewer data than numerical models. However, they are less flexible than numerical models. They usually can not simulate complicated flow boundaries, layered aquifer systems, or zones of differing transmissivity and recharge values. Because of the many limiting assumptions involved, the accuracy of an analytical solution may be questionable when applied to ground water flow through a heterogeneous aquifer with complicated boundary conditions.

Numerical models are extremely versatile. They can be used for modeling layered aquifers, partially penetrating wells and boundaries, variations of transmissivity and recharge, and many other common scenarios that cannot be addressed by analytical computer models (Figure 2-3 (e)). However, these capabilities are only relevant if supporting data are available. Moreover, numerical modeling is typically very expensive, in large part because of the extensive data needs, but also because the level of detail involved can consume many hours of staff time. Numerical models are the most appropriate method for delineating SWAP areas in complex aquifer systems, but staff resources and data collection limitations typically limit their use.

Hydrogeologic Mapping. Physical and hydraulic boundaries of an aquifer or ground water flow system can be used to delineate SWAP areas. For example, in river valley aquifers, bedrock valley walls often act as flow boundaries, especially when the bedrock is considerably less permeable than the valley sediments. Large deep rivers also may act as flow boundaries. These kinds of features are easily identified on a map. A SWAP area can be determined entirely, or in part, by simply identifying the location of such boundaries. Flow boundaries do not represent any particular time-of-travel; they may occur at a point that is 50 days' travel to the well, or 50 years.

Figure 2-3 (f) illustrates a SWAP area that has been delineated in accordance with flow boundaries *and* the five-year time-of-travel area. Assuming north is to the top of the figure, the valley walls (depicted as a cluster of closely-spaced topographic lines) form a flow boundary along portions of the eastern side of the SWAP area. The river forms a flow boundary along the western side of the SWAP area. Five-year capture lines were used to delineate the northern and southern boundaries of the SWAP area.

Hydrogeologic mapping may also involve delineating an entire aquifer, or distinct portion of an aquifer. For example, the surficial karst area within Seneca, Huron, Erie, and Sandusky Counties is a portion of the large regional carbonate aquifer that extends across most of northwestern Ohio. The karst area is very vulnerable to contamination, because surface water enters the aquifer directly through numerous sinkholes. Since ground water travels rapidly through the large fractures, the flow direction is difficult to predict, and the aquifer is vulnerable, a regional delineation approach that encompasses the entire surficial and near-surface karst is the most conservative and cost effective delineation method for this area.

Advantages and Disadvantages of Hydrogeologic Mapping. Hydrogeologic mapping provides a simple and inexpensive way to delineate SWAP area boundaries. It may be most useful in complex settings where obtaining the data needed to use other delineation methods is not possible. For example, in areas with bedrock aquifers that have large, widely-spaced fractures, hydrogeologic mapping may be the most useful method. Also, in river valley aquifer settings, determining the amount of ground water flow coming from the bedrock valley walls is usually very difficult and expensive. In these cases, simply assuming the walls are no flow boundaries may be a reasonable assumption.

Hydrogeologic mapping is not always as precise as other methods. In the examples provided above, a more accurate delineation would probably be obtained by conducting detailed fracture flow analysis or by actually determining the amount of ground water flow coming from the bedrock valley walls.

2.2.3 Selecting the Delineation Method

Delineation methods will be assigned based on the complexity of the aquifer hydrogeology, the amount of information available, and the type of public water system being delineated. The information needed to select the best delineation method will be collected during the Resource Characterization. Therefore, a decision on which methods are most appropriate for different types of public water systems in different hydrogeologic settings will be made on a geographic basis as Resource Characterization work is completed.

The delineation method selected should depend primarily on the complexity of the hydro-geologic setting. A more complex hydrogeologic setting warrants a more sophisticated delineation method. However, a method is only as good as the information it uses. A highly sophisticated computer model of a site that is based on only a few data points of uncertain quality may actually be less accurate, and certainly more misleading than a simple delineation based on those same data. Another consideration, in the real world of limited time and resources, is the usefulness of the final delineation. It makes more sense to appropriate more effort for delineations of systems that serve larger numbers of people, and where the public water system manager has the authority to control the activities occurring within the SWAP area. The following guidelines will be followed in selecting a method to delineate a SWAP area:

1. **Regional Delineations.** The shallow karst aquifer centered in Seneca County will be delineated as a regional SWAP area, based on hydrogeologic mapping. This delineation likely will be completed through a cooperative effort with the Ohio Department of Natural Resources and the Great Lakes Rural Community Assistance Program. The other major shallow karst areas in Ohio may be handled in a similar fashion.

2. **Regional Models.** In some cases, the most accurate and cost effective delineations will be achieved by developing a regional numerical model of the aquifer. This effort is most likely to be made in areas with a complex hydrogeology, with numerous public water systems, and where sufficient data has been collected on the aquifer. For example, portions of the Great Miami River valley aquifer system consist of multiple aquifers that are interconnected in places, and provide water for numerous large cities. Also, some portions of this aquifer have been intensively studied. Thus, portions of the Great Miami River valley aquifer are good candidates for regional modeling that could simultaneously yield SWAP area delineations for most (ground water-based) public water systems within those areas.

   In many cases a regional model may only be possible if additional information is collected through field studies. Due to resource constraints additional field work will only be done in rare instances. However, it is recognized that in some limited cases, especially where there are a large number of public water systems, conducting field studies to enable development of a regional model may actually be the most cost effective approach.

3. **Individual SWAP Area Models and Delineations.** It is anticipated that the vast majority of SWAP area delineations will be done on an individual basis for each public water system. While the delineation method to be used for the various types and sizes of systems may be determined for an entire aquifer, there will not be enough data to allow development of a regional model. As stated, other factors that will be used to determine which method to use include the complexity of the aquifer, the amount of available data, and time and costs considerations.

   3.a. Complex Aquifer - Extensive Data. In some instances the hydrogeologic setting of an individual wellfield has been sufficiently characterized to allow development of a numerical model. While the majority of delineations have been completed for the larger public water systems where this approach was found to be most applicable, there are still a few systems where this may be possible.

3.b. Complex Aquifers - Insufficient Data. SWAP areas in complex river valley aquifers for which there is little flow information--but also relatively few sizable public water systems--may be delineated using one of the volumetric equations or a simple computer model, depending on the amount and types of data available.

3.c. Fractured Bedrock. SWAP areas in fractured bedrock settings for which there is little flow information--but also relatively few sizable public water systems--may be delineated as in 3.b. or by hydrogeologic mapping.

3.d. Small Systems. It is possible that SWAP areas for public water systems pumping less than 100,000 gallons per day will be delineated using a volumetric equation, *regardless of the aquifer setting*. (This would address roughly 90% of Ohio's ground water systems, including most noncommunity systems.) There are two main reasons for this guideline:

1. The SWAP areas of these systems are so limited, they are less likely to encounter any flow boundaries that would complicate the shape of the SWAP area.

2. Public water systems typically report their pumping rate in terms of gallons per day. However, the majority of their water withdrawal occurs during a short period of the day. During that period, the area of contribution will be the cone of depression, which is roughly circular. A simple model, however, assumes uniform pumping over 24 hours, reducing the size of the cone of depression, and drawing more of the water from upgradient areas. As a result, the SWAP area will be disproportionately long and narrow, and may not capture sources within the cone of depression created during the sporadic pumping. Given these conditions, a SWAP area delineated using the volumetric approach may be more accurate and more protective.

4. **Overlapping capture areas.** Where there are many overlapping capture areas, it may make sense to delineate a single area that contains all the SWAP areas. The "single area" would ideally be based on numerical modeling, where supporting data are adequate. Some simpler computer models can also account for multiple pumping centers.

2.2.4 Who Will Delineate the SWAP Areas

The majority of SWAP area delineations for public water systems using ground water will be completed by staff from Ohio EPA's Division of Drinking and Ground Waters. However, in some instances delineations will be completed by other public or private organizations. For example, the regional models to be developed in some of the more complex settings may be done in partnership with the U.S. Geologic Survey and Ohio Department of Natural Resources. Other public or private organizations may be contracted to assist with delineations in other areas of the State. The final decision on who will complete the delineations for certain systems in a given hydrogeologic setting will be made after the Resource Characterization is completed in conjunction with the decision on which methods to use.

Both the Technical Advisory Committee and Public Advisory Groups felt strongly that SWAP areas should be delineated by Ohio EPA or its contractor. Most public water systems do not have the expertise or the resources required to complete the delineations. In addition, without state legislation requiring them to do so, Ohio EPA could not ensure that all delineations would

be complete by the statutory deadline. Other reasons for having Ohio EPA staff complete the majority of delineations include:

- **Knowledge.** The staff who have worked on wellhead protection for the last six years have a sound knowledge of delineation techniques, from application of the volumetric equations to numerical modeling, and have the resources (computer software and hardware, specialized training, etc.) to complete the majority of the delineations.

- **Communication Network.** Strong communication links will be needed to efficiently delineate 6,000 public water systems within a few years. The district and central office staff are used to working cooperatively, and have an effective communication network already established.

- **Consistency.** Assigning this effort to a single entity will provide for consistency in how the 6,000 ground water systems are delineated. Consistency would be extremely difficult to achieve if the entire effort were outsourced to multiple entities, each with its own procedures, communication styles, equipment, etc.

- **Educational Skills.** The staff who have worked on wellhead protection are experienced in explaining SWAP area delineations to the general public. They understand how to make this technical subject accessible to people without a scientific background.

- **Avoiding Duplication of Effort.** Detailed "reviews" will not be necessary, except for the outsourced projects, thereby avoiding duplication of effort. Also, it will not be necessary to spend time, money, and effort on developing training materials, training workshops, and certification procedures for outside delineators.

- **Public Preference.** Participants in various public advisory groups stated that they would prefer Ohio EPA to delineate their SWAP areas, because Agency "endorsement" of the delineation boundaries then would be assured.

Delineations by Public Water Systems. Wellhead protection areas endorsed by Ohio EPA are essentially SWAP areas; the delineation requirements are the same. Therefore, wellhead protection areas that have been endorsed by Ohio EPA as meeting the requirements of Ohio's WHP Program will be considered complete. This holds true for those public water systems that must assess both ground water and surface water SWAP areas (see Section 2.2.6 on "Conjunctive Delineations). If the system has a wellhead protection area that has been endorsed by Ohio EPA, the ground water delineation for that system will be considered complete.

Public water systems that are already engaged in delineating their SWAP areas--or wish to do their own delineations--will have the opportunity to do so. It is anticipated that prior to initiating delineations in a region of Ohio, Ohio EPA will contact the community public water systems in that region by letter and invite them to participate in the delineation effort, and request that they notify Ohio EPA if they have already begun that effort. Ohio EPA will plan to complete a SWAP area delineation for any public water system that has not contacted the Division of Drinking and Ground Waters by some specified date.

2.2.5 Procedures for Future Delineations and Redelineations

Ohio EPA is committed to implementing the SWAP program for all public water systems even after the federal mandate is met. New systems coming on-line will be expected to undertake SWAP assessments and protection. Also, existing systems that are installing new wells will be expected to adjust their SWAP efforts to new boundaries and new potential pollution sources, as warranted. Procedures for these efforts will be developed with the ongoing advisory committee and will be conditioned by future budget allocations. Ongoing assessment activities are discussed in more detail in Section 5.5.

2.2.6 "Conjunctive" Delineations

The Safe Drinking Water Act Amendments of 1996 and U.S. EPA guidance require states to consider the interconnectedness of ground water and surface water when delineating SWAP areas. There are numerous hydrogeologic settings where a significant hydraulic connection exists between a stream or lake and an underlying aquifer. Ground water in alluvial river valley aquifers typically exhibits a strong degree of hydraulic connection with the stream. In humid climates such as Ohio's, ground water typically flows from the deposits into the stream, and constitutes the base flow of the stream. However, when water levels in the stream are high (as during flood season), water may seep from the stream into the surrounding alluvial deposits. Also, many municipal water suppliers develop public wells along a stream precisely for the purpose of inducing recharge from the stream.

The integrated delineation of the ground water contribution area *and* the surface water contribution area for a public water system is called "conjunctive delineation." Conjunctive delineations may be completed for ground water systems that are directly recharged by surface water. They also may be completed for surface water systems that are derived almost exclusively from ground water. These two types of circumstances are discussed separately below.

Ground Water Under the Influence of Surface Water. Conjunctive delineations will be completed for ground water systems that:

A. are recharged directly by recharge lagoons,

B. have a surface water body that traverses or intersects the area between the one- and five-year capture areas AND have been designated as "ground water under the direct influence of surface water" due to recharge from the surface water body, or

C. have a surface water body that traverses or intersects the inner management area AND have water quality impacts OR a documented high level of infiltration.

There are only a few public water systems in Ohio that meet the conditions of A, and these are known to Ohio EPA staff. The public water systems that meet the conditions of B and C will be identified by the following line of questioning (summarized in Figure 2-4):

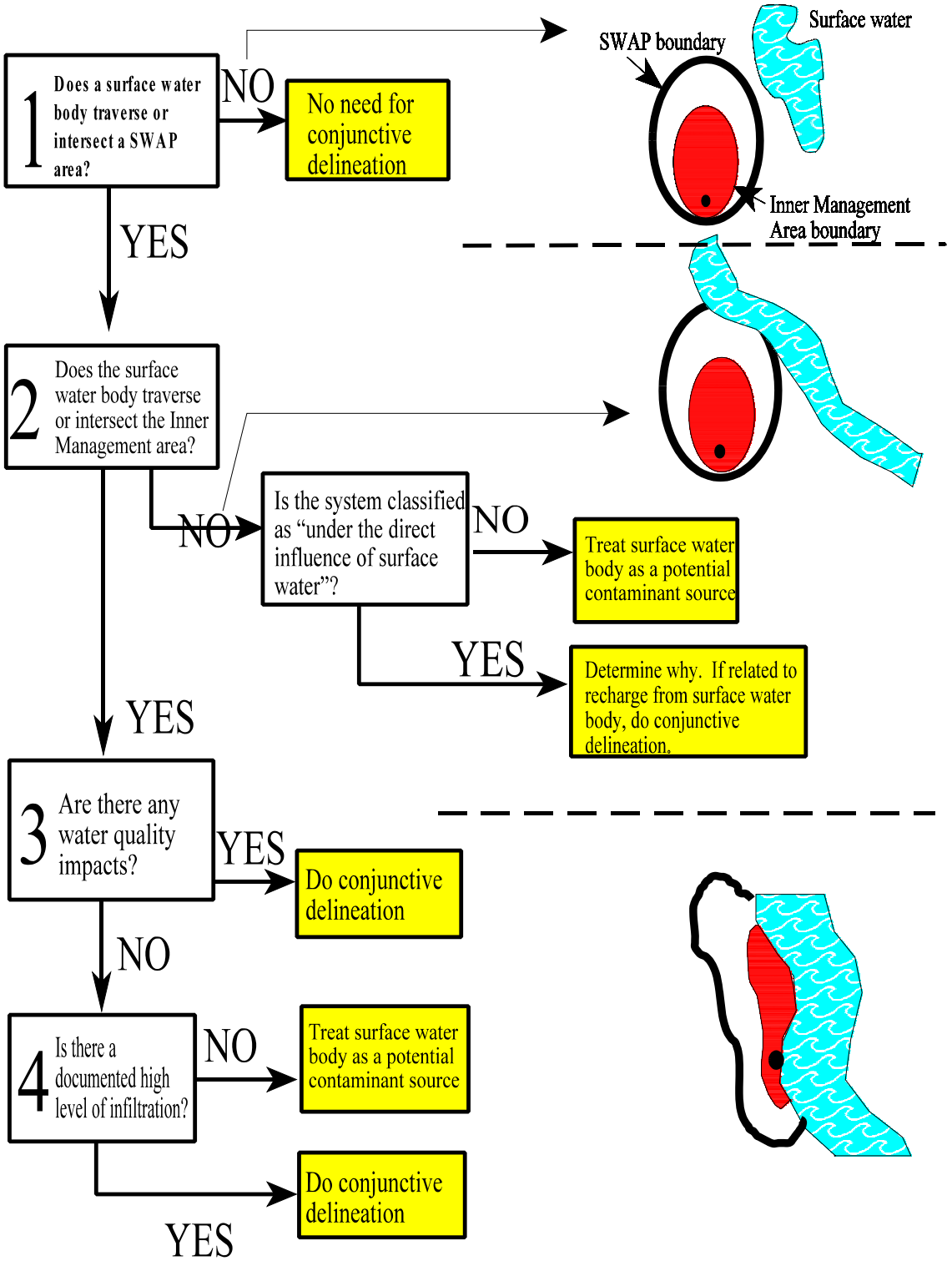


Figure 2-4. Flow Chart for Identifying Ground Water Systems That Should Have Conjunctive Delineations

1. ***SWAP Area.*** Does a surface water body traverse or intersect the SWAP area? If not, no conjunctive delineation is needed. If so, further evaluation is needed; go to (2).

2. ***Inner Management Area.*** Does the surface water body traverse or intersect the inner management area (one- or two-year capture zone)? If so, go to (3). If not, the surface water body is not close to the well(s) and while a large amount of surface water may be infiltrating, it takes at least a year of traveling through the soil to reach the well. Any pathogens or chemical constituents in the surface water should have been filtered out.

   Despite this, the system's source water may have been designated "ground water under the direct influence of surface water." If there is evidence that the system is actually being recharged by the surface water body, a conjunctive delineation will be done by Ohio EPA. Otherwise, the surface water body should be considered a potential significant contaminant source. The public water supplier should prioritize it along with other contaminant sources in the SWAP area. The individuals or groups responsible for protective strategies may wish to assess the area upstream on their own.

3. ***Water quality.*** For those systems with surface water bodies traversing or intersecting the inner management area, the system's water quality data should be examined for more than one detection of (a) microorganisms (bacteria sampling is done for all systems); or (b) other anthropogenic chemical constituents that do not appear to originate within the five-year capture area. If a water quality impact can be identified, the system should receive a conjunctive delineation.

   It should be noted that most of the systems that have received final designations as "ground water under the direct influence of surface water" have received that designation because they failed tests of bacteria in their treated water[2]. Therefore, most of these systems will be targeted for conjunctive delineations by step (3) of this flow chart. Systems that have been designated as "under the influence" due to poor well construction alone will <u>not</u> be targeted by this test. This is appropriate; it would be illogical to delineate or inventory entire portions of watersheds for such systems. It should be further noted that step (3) targets systems that have water quality impacts other than just bacteria. Where available, data for other types of pathogens and other chemical constituents will be evaluated. Therefore, step (3) has the potential to target systems that have water quality impacts related to surface water infiltration but have not been designated as "ground water under the direct influence of surface water."

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[2]Ohio EPA's Division of Drinking and Ground Waters has developed a methodology for designating certain public water systems as "ground water under the direct influence of surface water". The methodology involves consideration of the distance to surface water bodies, length of casing, well construction and maintenance, the presence of "hazards" within the sanitary radius, and water quality data. A public water system so designated will be required to treat the pumped water as stringently as a surface water system of similar size.

As of August 1998, all the community ground water systems and over half the noncommunity public water systems had been evaluated for being under the direct influence of surface water. Of the approximately 1,100 community systems, 40 were so designated. Of the 2,449 noncommunity systems evaluated, 94 had been designated. These evaluations are expected to be completed for all of Ohio's public water systems before the year 2000. If the ratio remains constant, **over 200** of Ohio's public water systems will end up being designated as ground water systems under the influence of surface water.

If no water quality impact is noted, the last consideration should be whether there is a documented high level of infiltration, as described in step (4).

4. ***Level of infiltration.*** It is possible that a system receives significant direct infiltration, but no water quality impacts have been identified due to infrequent sampling, sampling only of treated water, sampling only during periods of high water quality, or simply because there currently are few sources of contamination. These systems may be as vulnerable to current *or future* contamination as systems with known water quality impacts. Unfortunately, the level of infiltration is not a parameter that has been measured for all of Ohio's public water systems. In fact, it is not reliably known for more than a handful of systems, because it is expensive to make this determination. The systems that have such information usually are large systems that obtained it at their own expense by hiring an environmental consultant. The USGS currently is conducting studies that may lead to the development of a useful method for determining infiltration capacity. However, until a scientifically defensible and financially feasible method becomes available, Ohio EPA will evaluate infiltration capacity only where reliable infiltration capacity data exist at the time of the evaluation.

Delineating Surface Water SWAP Boundaries for Ground Water Systems. The "lower boundary" of the SWAP area will begin at the intersection of the inner management area's downstream boundary with the surface water body. The remainder of the SWAP boundary will be determined as it is for any other surface water system (see Chapter 3).

Delineation of Management Areas. In many cases, a full surface water assessment may not be necessary or appropriate for ground water systems that have received conjunctive delineations. For example, delineation of an emergency management area makes good sense for a ground water system that uses recharge lagoons; the area directly surrounding the lagoon should be protected from spills. Identifying a similar area for ground water systems deriving a portion of their water from a natural surface water body may be less straightforward. The same is true of corridor management areas. For systems that have been conjunctively delineated because of high infiltration but no water quality impacts, subwatersheds would not be delineated because there are no data indicating the existence of any particular water quality problem. Ohio EPA anticipates that complications such as these will arise during the implementation of the program. Policies for dealing with them will be developed through the ongoing advisory committee and will be made available to those systems with conjunctive SWAP areas.

Surface Water Under the Influence of Ground Water. Less commonly, there are surface water systems that are supplied almost entirely by ground water. The primary example is old quarries that have filled in with water. They have no streams leading into or out of them, and they may have almost no drainage basin. Virtually all the water in them has seeped in from the surrounding rock or sediments. A public water system drawing from this source is clearly a surface water system, but it is not connected to any stream, and may have a very limited watershed area. Such public water systems will be delineated using the five-year capture zone criterion and also the watershed criterion.

Another example of surface water systems drawing primarily from ground water are springs and dug wells. Because these systems are especially open to surface contamination, they require surface water treatment and are designated as 'surface water systems'. However, the source of

water is almost exclusively ground water. Therefore, in most cases the SWAP area will be based on a five year ground water capture zone. In some instances, it may also be appropriate to delineate a small emergency management area to address potential impacts from surface spills or runoff.

In discussions of surface water-ground water connections, U.S. EPA guidance suggests that the main concern for surface water systems is degradation of surface water supplies by contaminated ground water. It is true that some reaches of Ohio's streams are contaminated by leachate from leaking landfills and septage from malfunctioning septic systems, and any public water suppliers with downstream intakes could be affected. However, "conjunctive delineation" is not the solution to these situations. The leaking landfill or septic systems would be considered significant contaminant sources within the existing surface water SWAP area, and would need to be dealt with on that basis. Only if the ground water source lay outside the existing SWAP boundary would an additional delineation be recommended. (This would indicate that the original SWAP boundaries were incorrectly drawn or that the ground water and surface water divides do not coincide.) However, the delineated focus area would be based not on a five-year capture zone around a well, but rather on natural flowlines around the offending site. Such sites would be dealt with on a site-by-site basis.

Ohio EPA does not propose to identify all locations in the state where ground water divides and surface water divides do not coincide. (The point of such an effort would be to inform downstream surface water suppliers that certain sites located outside their surface water-based SWAP areas should be considered potential significant contaminant sources.) Historically, where ground water contamination has impacted streams, it is usually emanating from a site located next to the stream, such as malfunctioning septic tanks from riverside properties, or landfills located in the floodplain. These areas will be included automatically in a surface water SWAP area. For these reasons, Ohio EPA considers the inclusion of distant but potentially contributing ground water areas too resource-intensive and apply to relatively few water suppliers, with a marginal expected benefit.

2.3 POTENTIAL SIGNIFICANT CONTAMINANT SOURCE INVENTORY

After the SWAP area has been identified the next step in the assessment is a detailed inventory of potential significant contaminant sources. The purpose of the potential significant contaminant source inventory is to identify any activity or land use that has the potential to contaminate the public drinking water supply. The types of potential significant contaminant sources that will be inventoried include all of the regulated facilities in the delineated SWAP area, as well as other agricultural, residential, municipal, commercial and industrial activities. The information collected during the inventory will be essential to the water supplier in developing effective protection strategies. It is only after the potential significant sources of contamination are identified that options for protecting the source waters can be developed and evaluated.

2.3.1 Contaminants of Concern

According to U.S. EPA guidance, each state must identify what "contaminants of concern" its SWAP Program will address and what "significant potential sources" of those contaminants the State will inventory in assessment efforts. At a minimum, states must identify, to the extent practical, the 'origins' of contaminants regulated by the Safe Drinking Water Act (e.g., chemicals for which monitoring is required) located in SWAP areas. States may also choose to identify the origins of other contaminants determined to present a threat to public health. The SWAP public advisory groups recommended that Ohio should not limit the inventory to only sources of chemicals regulated by the Safe Drinking Water Act. An expanded list of chemicals that Ohio EPA will include in the inventory process was developed and is presented in Table 2-5.

Table 2-5. Chemicals to be Addressed in the Inventory Process

- All chemicals and pathogens with a Maximum Contaminant Level.
- All chemicals with a Secondary Maximum Contaminant Level.
- All chemicals that are targeted for regulatory review on the federal contaminant candidate list.
- All chemicals and pathogens that have federal Safe Drinking Water Act or state monitoring requirements.
- All chemicals that have Ohio water quality standards developed under the Clean Water Act.

The creation of this list does not indicate that Ohio will limit inventories only to the chemicals on the list. It just ensures that *at a minimum* potential significant sources of the listed chemicals will be incorporated into the inventory. The complete list of over 200 chemicals and pathogens is included in Appendix A-1.

2.3.2 Potential Significant Contaminant Sources

It would be extremely time consuming and difficult to determine with any certainty exactly which facilities actually have significant quantities of "chemicals of concern". This would require detailed site visits of almost every land parcel in every SWAP area in Ohio. Instead, Ohio EPA has developed a link between commonly identified sources of contaminants (e.g., dry cleaners, electroplaters, animal feedlots) and the contaminants commonly associated with those sources. For example, a dry cleaner is a potential significant contaminant source. If a dry cleaner exists within a SWAP area, then Ohio EPA will assume that a specific suite of contaminants may be present at that site (Figure 2-5). The linkages help ensure that the chemicals regulated by the Safe Drinking Water Act and other contaminants of concern are included in the inventory process.

Ohio EPA has established links between potential significant contaminant sources and nine general categories of contaminants, shown in Appendix A-2. These links are based on the Ohio EPA's guidance for conducting potential pollution source inventories (Ohio EPA, 1997a). For example, animal feedlots are linked to three contaminant categories: microorganisms, pesticides and nutrients. Next, Ohio EPA categorized all of the contaminants of concern into one or more of the nine general categories (Appendix A-1). The categorization was done by Ohio EPA, using best professional judgement. A list of all of the contaminants of concern that may be

present in a given protection area can be determined by cross referencing the two tables in Appendix A.

It is important to note that the links between potential significant contaminant sources and primary contaminant types are not intended to be comprehensive, but only those most commonly associated with the potential significant contaminant source. In addition, any specific potential significant contaminant source may actually have none, some, or more types of contaminants associated with it than indicated in Appendix A-2.

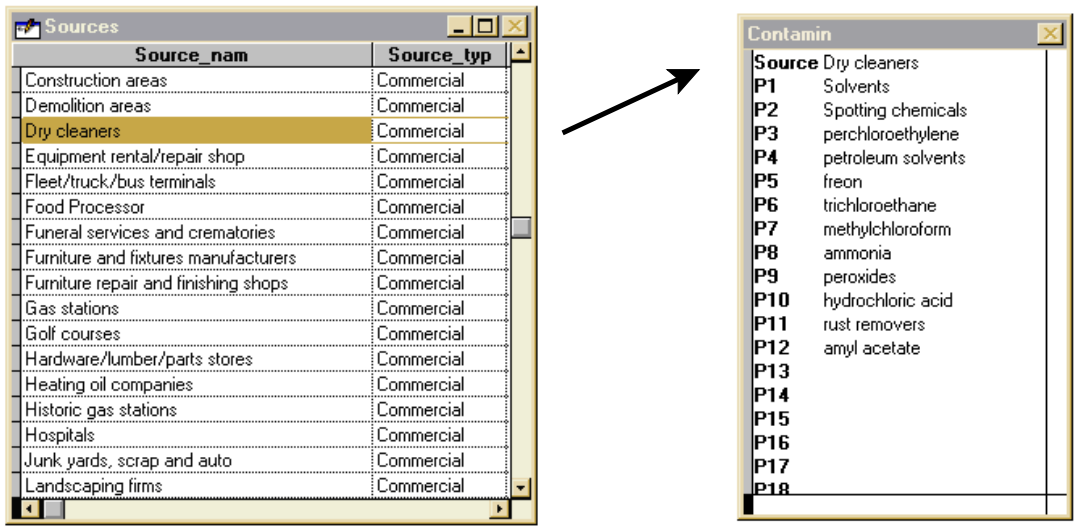


Figure 2-5. Linking Contaminants to Potential Pollution Sources

After the Susceptibility Analysis is completed for the public water system (Section 2.4), the supplier will be able to determine if a more detailed inventory (more information about a specific source obtained through surveys or site visits) will be necessary. Where possible, Ohio EPA will provide an indication of which potential significant contaminant sources probably present the greatest threat. It will be the responsibility of the public water system to make a further determination of which sources are "significant" and prioritize the sources for protection strategies. Ohio EPA has developed guidance on prioritizing sources and will be available to provide technical assistance to public water systems on prioritization and protection issues. For non-community public water systems, a high priority should be given to sources located on the property that they have direct control over.

2.3.3 Inventory Process

The inventory portion of the source water assessment consists of two primary steps. First, Ohio EPA will conduct a broad inventory based on existing databases and geographic information system coverages. The public water supplier will then be expected to work with Ohio EPA to complete a more detailed inventory of the SWAP area. The public advisory groups felt that participation of the public water system owners and operators was essential to their understanding the results of assessments and their willingness to implement protection strategies. The

inventory is a logical place for public water system involvement, since the owners of these systems will have the most detailed on-site source information and are often aware of other activities that threaten their water supply.

If a public water system has an endorsed potential contaminant source inventory under Ohio's Wellhead Protection Program, the inventory will also be acceptable (endorsed) under the SWAP program. Public water systems with endorsed inventories that have been identified as needing a conjunctive delineation will not need to conduct additional inventory work within their ground water protection areas. However, they may be expected to work with Ohio EPA to conduct additional inventory work with the watershed protection area.

2.3.4 Database Inventories

Ohio EPA will compile inventory information on regulated facilities and documented contaminant spills within the area surrounding a public water system wellfield. Databases that will be considered for inclusion in the inventory process include but are not limited to: Comprehensive Environmental Response, Compensation, and Liability Information System, Resource Conservation and Recovery Information System (large and small quantity generators and disposers), National Pollution Discharge Elimination System sites, and Toxic Release Inventory sites. In addition, solid and infectious waste facilities, construction and demolition debris sites, regulated livestock operations, registered underground storage tanks, the locations of past spills and releases, landfills, industrial and municipal ponds/pits/lagoons, and any other contaminant source data will be included when available.

To the extent feasible, the locations of the potential significant contaminant sources identified in the database inventory will be mapped and provided to each public water supplier. The locational data for these maps may not be accurate, so it will be the responsibility of the public water supplier to make the final determination on whether or not an identified potential significant contaminant source on the map is actually within the delineated SWAP area (site verification). Information that is not available in a geographical information system format (e.g. location of registered underground storage tanks), and therefore not located on the maps may be presented to the public water supplier in tabular form, listing source addresses by region (township, county, etc.). This database information will not be a complete inventory for the systems, but it will make the supplier aware of any known regulated facilities in the SWAP area (and be a good start with conducting the potential significant contaminant source inventory).

2.3.5 Detailed SWAP Area Inventories

Once the database inventory is completed, the public water system will be requested to complete a detailed inventory of the SWAP area within a specified period of time. Ohio EPA[3] will send each public water supplier a map of the protection area along with a set of inventory forms and detailed written instructions. Suppliers will also be sent a map of the area showing the potential contaminant sources identified in the database inventory.

Inventory Forms and Checklists. Ohio EPA is developing a set of inventory forms and checklists to assist the owners of all public water systems to identify, record, and report

[3] Ohio EPA will not have adequate staff to initiate and follow up on detailed inventories for all public water systems. It is anticipated that cooperative agreements or contracts will be signed with statewide or regional organizations such as the Ohio Rural Water Association, Great Lakes Rural Community Assistance Program, regional planning agencies or other entities to assist in this effort.

information on potential significant contaminant sources (see Appendix A-3 for draft forms). Potential pathogen sources (including *cryptosporidium*) are identified on the checklist by an asterisk after the name of the potential significant contaminant source. Identifying the location of these sources in the Inner Management Area will be a high priority for non-community public water systems.

Ohio EPA and the advisory groups decided that a checklist form would be the best method for inventory efforts because it serves as an educational tool informing public water suppliers of the types of activities that may pose a threat to their drinking water. In addition, the forms provide a uniform approach for recording data, making it easier to compile and analyze the data once it's collected.

The usability of inventory forms and checklists was tested on small public water systems (pumping rate < 75,000 gallons/day) as part of a small system pilot project. A survey was conducted and results show that all of the respondents had completed an inventory without assistance, and did not find it difficult to understand. The draft forms presented in this document were produced based on the results of the pilot study, comments through the public participation process, and Appendix E of the U.S. EPA SWAP guidance. The final draft forms will be pilot tested before distribution to the remaining public water systems in Ohio. The pilot testing will produce examples that can be sent to the public water systems to help them better understand how to complete the forms.

2.3.6 Public Water Systems Not Serving Political Jurisdictions

For public water systems not serving political jurisdictions, the focus of the detailed inventory will usually be on the property owned by the public water supplier. For most of these systems, due to the small amount of water they pump, the SWAP area will be relatively small and will not extend much beyond the property boundaries. In addition, protection strategies to be implemented by the owner will focus on those activities conducted on his/her property. The public water suppliers will be expected to identify potential pathogen contaminant sources located beyond their property boundaries, but detailed site visits at off-property potential contaminant sources will not be required.

The owners of these public water systems will use the provided checklists to identify potential significant contaminant sources and will then locate the identified sources on their SWAP area map. Ohio EPA, or some other cooperating organizations, will conduct follow up visits to these public water systems. The public water supplier will be contacted to set up a time to review the completed inventory and answer any questions that the supplier may have regarding the forms. If the inventory has not been completed by the time of the site visit, Ohio EPA will complete the inventory with the public water supplier.

2.3.7 Community Public Water Systems Serving Political Jurisdictions

Community public water systems serving a political jurisdiction such as city, municipality, township or county, will be expected to conduct a more extensive inventory than other public water systems. The SWAP area for these systems will typically be much larger than those of a non-community system and will encompass many different properties and land uses. The inventory for these systems will require a greater amount of field work to identify and verify all potential significant sources of contamination.

These systems will be expected to complete inventories consistent with recommendations in Ohio EPA's *Guidance for Conducting Potential Pollution Source Inventories in WHP Areas* (Ohio EPA, 1997a) prepared for Ohio's WHP Program. Table 2-6 outlines the principal recommendations included in the guidance document for completing comprehensive potential significant contaminant source inventories. Ohio EPA will provide inventory forms and checklists to these public water systems to assist them with their inventory. In addition, due to the magnitude of effort potentially required for these suppliers to complete their inventories, Ohio EPA anticipates providing a greater level of technical assistance to these systems (perhaps even assisting with the required field work). Public water systems should also consider enlisting the help of volunteer organizations and local civic groups to help gather inventory information.

Table 2-6. Guidance Document Recommendations for Potential Contaminant Source Inventories

- Map with numbered potential significant pollution sources and corresponding table
- Land use map
- Zoning map (if the area is zoned)
- Identification of sewered areas
- Identification of transportation routes and transmission lines
- Explore historic aspects of land use (old aerial photos, interviews with long time residents)
- Identification of areas with home fuel oil tanks
- Location of unused wells and injection wells
- Conduct site visits or survey potential significant contaminant sources

2.3.8 Data Capture

After the inventory has been completed and reviewed, the information will be captured into a database(s). The information that will be captured in the database and available to the public is summarized in Figure 2-6 and Table 2-7. The geographic locations of the sources will be captured either through scanning the inventory map, or by incorporating global positioning system-located sources into a geographic information system database. Ohio EPA is currently assessing the feasibility and resource demands necessary to capture source information by a global positioning system and what additional attributes could be collected for each source (i.e., name, address, latitude, longitude, Standard Industrial Codes)

2.3.9 Ongoing Inventory Efforts

A public water supplier may need to collect more detailed information after the initial inventory is completed. The susceptibility determination to be provided by Ohio EPA will provide guidance on what additional inventory work should be conducted, and where the system may want to focus its efforts. For example, public water systems located in extremely sensitive settings may want to conduct detailed on-site inventories at certain facilities to know the exact types and quantities of chemicals being used and stored in certain parts of the SWAP area.

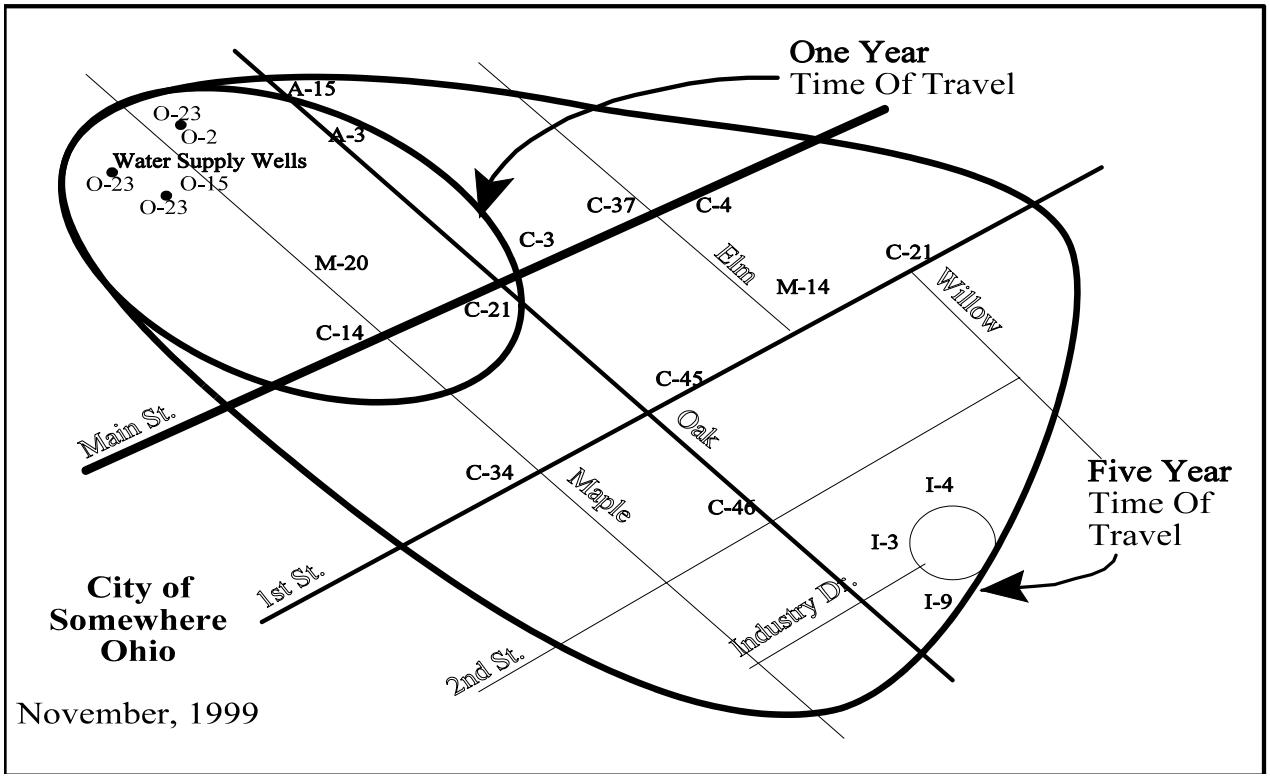


Figure 2-6. Map with Location of Potential Contaminant Sources

Table 2-7. Example Table of Potential Contaminant Sources

Potential Contaminant Sources in Somewhere, Ohio					
Map Code	**Source Category**	**Source**	**1 Year TOT**	**5 Year TOT**	**Source of Information**
A-3	Agriculture	Animal Waste Storage/Treatment*		1	Field Survey
A-15	Agriculture	Pasture*	1		Aerial Photos
C-3	Commercial	Auto Repair Shops		1	Field Survey
C-4	Commercial	Barber and Beauty Shops		1	Field Survey
C-14	Commercial	Dry Cleaners	1		Field Survey
C-21	Commercial	Gas Stations	1	1	BUSTR
C-34	Commercial	Paint Stores		1	Field Survey
C-37	Commercial	Pharmacies		1	Field Survey
C-45	Commercial	Veterinary Offices*		1	Field Survey
C-46	Commercial	Welding Shops		1	Field Survey
I-3	Industrial	Chemical Plants		1	RCRIS
I-4	Industrial	Electrical/electronic Manufacturing		1	RCRIS
I-9	Industrial	Machine/metalworking Shops		1	Field Survey
M-14	Municipal	Park Lands		1	Field Survey
M-20	Municipal	Road Maintenance Depots	1		Field Survey
O-2	On-Site	Chemical Drums/Storage	1		Site Visit
O-15	On-Site	Sewer Lines*	1		Site Visit
O-23	On-Site	Wells: Water Supply	3		Site Visit
* Potential Pathogen Source					

It will also be necessary to update the potential significant contaminant source inventory. Public water systems are encouraged to adopt mechanisms to update inventory information on a routine

basis. Ohio EPA will assist with updates when conducting routine inspections of public water systems.

2.4 SUSCEPTIBILITY ANALYSIS

2.4.1 Definition of Susceptibility

The Technical Advisory Committee and the Public Advisory Groups defined susceptibility for Ohio as:

> **The likelihood for the source water(s) of a public water system to be contaminated at concentrations that would pose a concern.**

The susceptibility of an aquifer to contamination is determined through an analysis of the geologic sensitivity (ease of contamination transport through earth materials present in the local hydrogeologic setting) and review of the potential significant contaminant sources identified in the SWAP area that if spilled or otherwise released could travel to the production aquifer. The purpose of a Susceptibility Analysis is:

> **...to provide a pointer to what actions a public water system should take to further define and reduce susceptibility. This may include recommendations for more detailed assessment work or an indication of the type and intensity of source water protection activities needed.**

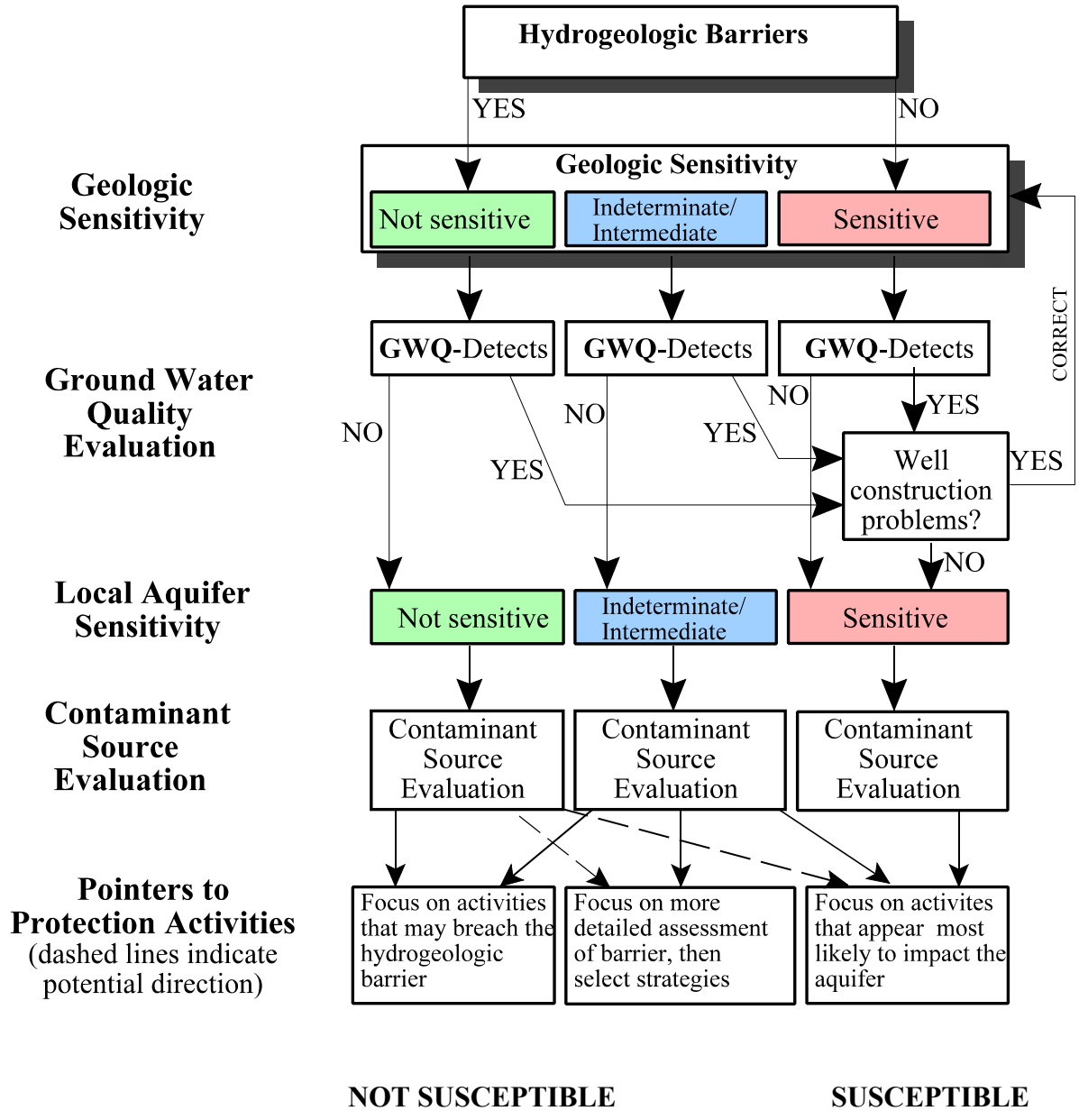
2.4.2 Components of a Susceptibility Analysis

The Susceptibility Analysis will integrate information compiled in the Resource Characterization with the results from the potential contaminant source inventory to determine the relative likelihood of contamination impacting the drinking water source. The Susceptibility Analysis will analyze and evaluate this information in order to provide pointers to the public water supplier and the community regarding potential significant contaminant sources that may be the greatest threat. It will also identify the level and types of protective actions that may be warranted, and indicate further assessment work that may be needed. The analysis will focus on the following components:

- **understanding of the hydrogeologic setting;**
- **review of water quality data; and**
- **summary of the potential significant contaminant sources.**

Ohio EPA staff will integrate these components using the general decision process illustrated in the susceptibility analysis flow diagram (Figure 2-7). The decision points in this flow diagram will be further defined in the SWAP Process Manual that is being developed. Because the public water systems occur in variable hydrogeologic settings and have a range of potentially significant contaminant sources, best professional judgement will be important in determining the

Figure 2-7. Susceptibility Analysis Flow Diagram



susceptibility of each of the public water systems to contamination, but the SWAP Process Manual will provide a uniform basis for the analysis. The results of the review will be reported to the public water systems in a Source Water Assessment Report. Factors considered in the decision points of the susceptibility analysis flow diagram are identified in general terms in the following sections.

Understanding of the Hydrogeologic Setting. The analysis of the hydrogeologic setting will evaluate the sensitivity of an aquifer. Aquifer maps from the Ohio Department of Natural Resources, in conjunction with other regional information and site specific data, will be used to understand the hydrogeologic setting of an area. One major goal of understanding the hydrogeologic setting is to determine if hydrogeologic barriers are present. Barriers may be physical barriers (like confining layers) or flow path barriers (for example, where intermittent pumping does not draw shallow ground water to a deeper screened interval). A joint Association of State Drinking Water Administrators- Ground Water Protection Council- U.S. Environmental Protection Agency workgroup has been formed to determine when hydrogeologic barriers for pathogens exist as part of the Ground Water Rule development. Ohio EPA will incorporate the results of this workgroup in the hydrogeologic barriers determination. The geologic sensitivity analysis will place public water systems in one of three categories; sensitive; intermediate or indeterminate; or not sensitive.

The ground water pollution potential maps, also prepared by the Ohio Department of Natural Resources using the DRASTIC process, are particularly important for evaluating the sensitivity of hydrogeologic settings. For the counties that do not have mapping complete, a modified DRASTIC evaluation will be completed by the Ohio Department of Natural Resources (see Section 2.1.1). The pollution potential ratings developed using DRASTIC, as well as the modified DRASTIC, applies only to the most sensitive aquifer, which in most cases is the uppermost aquifer. For public water systems that are utilizing confined or partially confined aquifers below the most sensitive aquifer, the pollution potential rating will not apply because a geologic barrier exists between the upper aquifer and the production aquifer. This illustrates the importance of identifying which aquifer is being used for water production and identifying hydrogeologic barriers during the Resource Characterization.

Tritium analyses, where available, will also be used to evaluate the hydrogeologic setting. Tritium is a radioactive isotope of hydrogen that can be used for some relative age dating of water. While tritium is produced naturally in the atmosphere, beginning in 1953 and continuing through the early 1960's, tritium concentrations in the atmosphere increased by up to three orders of magnitude in the northern hemisphere because of nuclear weapons testing (Clark and Fritz, 1997). Tritium analyses of well water can be used to determine if the water drawn from the aquifer has been in contact with the atmosphere in the last 50 years. If the analysis is below the detection limit of 0.8 tritium units, then it may be concluded that the water has not been recharged with post-1950, “bomb enriched” tritium, an indication of relatively low sensitivity to contamination. If the tritium result is greater than 0.8 tritium units, the travel time to the aquifer cannot be defined due to mixing effects, and therefore cannot be used to evaluate sensitivity (Dumouchelle et al., 1993). Public water systems that produce water from confined aquifers may want to analyze for tritium to confirm that the hydrologic setting of their production aquifer exhibits low sensitivity.

Review of Water Quality Data. Available water quality data will be evaluated to determine hydrogeologic sensitivity and to help direct protection activities. As illustrated in Figure 2-7, all public water systems with documented water quality contamination will be identified as sensitive/susceptible regardless of hydrogeologic sensitivity. It should be qualified that in some cases the hydrogeologic setting is in fact not sensitive, but the ground water quality data identifies the presence of pathways that breach the hydrogeologic barriers. It may be difficult to identify these pathways. Whether sensitive or not, in both cases the public water system is susceptible. If a water quality impact is known, evaluating the sources present may help to determine the origin of the contamination and where immediate protection efforts should be focused. The susceptibility analysis will review the activities that have been initiated at public water systems with documented water quality impacts.

A water quality impact for synthetic organic compounds and volatile organic compounds will be assumed if the result is at or above the level of detection, since the presence of these parameters usually indicates an anthropogenic source. A water quality impact for nitrates will be indicated if the result is three milligrams per liter or greater (Madison and Brunett, 1985). Background levels for all other inorganics vary depending on the hydrogeologic setting (e.g., northwest Ohio carbonates typically have naturally occurring high sulfate concentrations due to the geology of the area) and the geochemical nature of the specific parameters. These will be evaluated on a site- specific basis.

Water quality data for public water supplies are available within the Ohio EPA Division of Drinking and Ground Water's Model State Information System database. These data date back to 1980. The data quality and number of parameters sampled have increased to meet requirements of the Safe Drinking Water Act. Consequently, the more recent data will be given greater weight in water quality analysis, but if detections are present all of the data will be reviewed. Ohio EPA Public Drinking Water staff will be consulted when reviewing the water quality data to maximize the utility and to assure that these data are evaluated appropriately.

The sampling requirements for a public water system vary depending on the type of system. Community water systems are required to monitor for suites of inorganic, radiological, microbiological, and organic constituents, as well as trihalomethanes, asbestos, lead, copper, and nitrates. Non-transient non-community water systems have the same requirements as community systems with the exception of not having to sample for radiological constituents and trihalomethanes. Transient non-community systems, however, are only required to sample for microbiological constituents and nitrates. Since not all parameters are sampled at all systems, the lack of water quality impacts is not a certain indicator of a lack of contamination. Consequently, the lack of detections in ground water quality data does not change the hydrogeologic sensitivity, as mapped in the susceptibility analysis flow diagram (Figure 2-7) for flow lines passing through the ground water quality - no detections box.

Water quality impacts are more likely to occur in sensitive aquifers with potential significant contaminant sources present. If available well integrity data, resulting from source water designation efforts or sanitary surveys, suggests that rapid pathways exist for surface water transport down the well casing to the well intake and/or aquifer, Ohio EPA will identify this direct pathway as a threat due to well integrity in the susceptibility analysis. If water quality impacts are found in what is thought to be a non-sensitive aquifer, it may prompt evaluation of

the well integrity (poor well integrity may provide a pathway along the well casing for contaminants to enter the well intake and/or aquifer) or cause initiation of a more detailed hydrogeologic assessment. All final decisions on well integrity will be based on a site-specific information. These considerations are captured in the susceptibility analysis flow diagram in the well construction box.

Characterization of the Potential Significant Contaminant Sources. The potential significant contaminant sources that exist in the SWAP area will be characterized in various ways to evaluate threats to the public water system. This characterization will focus on factors that the community must consider to further prioritize potential significant contaminant sources, such as distance from the public water supply wells, volume of material stored, method of storage, density of potential sources, mobility and toxicity of chemical sources, and source control practices in place. The number and location of potential significant contaminant sources will be identified (e.g., "12 sources were identified in the SWAP area, four of which are located within the one-year time of travel."), or the ratio of number of potentially significant sources to the size of the SWAP area (e.g., "12 sources were identified in the SWAP area of one square mile.") will be identified. Potential significant contaminant sources within the one year time-of-travel may warrant more detailed investigation because of their proximity to public water system wells. In addition, the number of identified potential significant contaminant sources that store large quantities of potential contaminants will be estimated. Amounts or percentages of the land in various land uses also will be estimated (e.g., 20% residential, 80% agricultural). Information on the types of land uses may be especially useful in rural areas where non-point sources (e.g., agricultural activities, septic systems) are the dominant potential significant contaminant sources.

The goal of characterizing the potential significant contaminant sources is to provide an overview of their distribution and concentration, and to assess the likelihood of the source water being contaminated. It also leads the public water supplier and informed citizens to consider protective strategies. The Susceptibility Analysis will be tailored to the size of a public water supply and the location of the wellfield since both factors influence the number of the potential significant contaminant sources and the type and intensity of the land use.

The presence of potential significant contaminant sources in combination with the hydrogeologic setting determines what additional activities need to occur to reduce the likelihood of contaminating the production aquifer. The susceptibility analysis flow chart (Figure 2-7) illustrates that the types of activities recommended will be grouped according to the hydrogeologic sensitivity. For example, for an aquifer that is not sensitive, recommendations will be made to focus on activities that have the potential to breach the hydrogeologic barriers, such as evaluating the impact of abandoned wells or injections wells. Public water systems located in areas with intermediate sensitivity may be directed towards more detailed assessment work to evaluate the effectiveness of the local hydrogeologic barrier. Systems utilizing sensitive aquifers will be directed to focus their efforts on collecting additional information on the activities that appear to be the most likely to impact the production aquifer and on developing protection strategies to reduce that likelihood. Examples of Susceptibility Analyses are provided in Table 2-8 for systems located in aquifers that are sensitive /susceptible, not sensitive /susceptible, and intermediate sensitive/susceptible.

2.4.3 Source Water Assessment Report

The Public Advisory Groups and Technical Advisory Committee determined that simply labeling a public water system on some relative scale of susceptibility did not provide any meaningful information and may tend to hinder any further actions at the local level. Therefore, the Suscept- ibility Analysis will be summarized in a narrative format and provided to the public water systems to help determine the likelihood of contamination impacting their drinking water source.

The public water systems will be provided a four part narrative that summarizes the assessment results. The first three parts will describe the local aquifer sensitivity, summarize the Potential Significant Contaminant Source Inventory, and characterize the water quality data. The final part of the narrative will integrate this information to provide a description of the relative likelihood that contaminants could impact the public water system's source water. This narrative will also point the water system to those potential significant contaminant sources that appear to present the greatest threat, or that need additional evaluation. The goal of reporting the source water assessment results is to promote development and implementation of protective strategies for source water. Preliminary examples of the four-part narrative are provided in Table 2-8.

The Public Advisory Groups and Technical Advisory Committee agreed that a detailed risk assessment of potential significant contaminant sources was beyond the scope of what could be accomplished with available data and resources. This analysis is better done by local decision makers as the bridge from assessment work to protective strategies. Prioritization will take into account the type and volume of contaminants present, location within the source area, history of past releases or violations, and current protection activities at the sources. Further prioritization will not be effective unless done on the local level with input from public water supply owners and operators, residents, businesses, political leaders, and other local decision makers, to name a few. The people impacted by protection activities must be involved in the decision-making process. Guidance has been developed through Ohio's Wellhead Protection Program to help communities through the decision-making process of prioritizing the potential significant contaminant sources (the prioritization process is outlined in Section 5.1 of the *Guidance for Conducting Potential Pollution Source Inventories in Wellhead Protection Areas*, 1997). Ohio EPA will also provide technical assistance to the public water suppliers and the communities as requested. Most public water systems that have endorsed potential contaminant source inventories under Ohio's Wellhead Protection Program have already evaluated the susceptibility of their public water system when prioritizing their potential contaminant sources. Ohio EPA will evaluate public water systems with endorsed inventories on a system-by-system basis to determine if any additional susceptibility analysis information needs to be collected. In many cases, especially for public water systems with completely endorsed wellhead protection plans, additional susceptibility work will not be necessary.

2.5 SUMMARY

The overall assessment process for ground water systems is summarized as a flow chart in Figure 2-8. This chart shows the main tasks to be undertaken in each of the steps, and indicates who

will be responsible for fulfilling them. It also indicates the products that will come out of each of the steps, the audience, and the method of delivery.

Table 2-8. Examples of the Narratives for the Susceptibility Analyses: (a) for aquifers considered to be sensitive/susceptible; (b) for aquifers considered to be not sensitive/not susceptible; and (c) for aquifers that fall into the intermediate area.

(a) aquifer is sensitive/susceptible:

Hydrogeologic Setting: The aquifer that supplies drinking water to the Village of West Lafayette is a portion of the Tuscarawas River Valley aquifer. At West Lafayette this aquifer consists of sand and gravel approximately 100 feet thick that infills an ancient bedrock valley and has a depth to water of 45 feet below ground surface. Soils in the area are well-drained sandy loams, indicating that rainfall and snowmelt will drain reasonably well through the soil instead of running off or ponding. The aquifer is recharged by approximately 4 to 7 inches of precipitation per year. The aquifer at West Lafayette is unconfined, meaning that no clay rich, confining layer exists which could act as a barrier between the ground surface and the aquifer. Ground water flow direction down the valley is generally from east to west, with a local flow component to the north-west. This means that any major contamination of ground water in this aquifer east of West Lafayette has a potential to eventually impact the public drinking water supply.

Potential Significant Contaminant Sources: Fourteen potential sources exist in the source water protection area of approximately 0.25 square miles; three of these sources (20%) exist within the one year time-of-travel area. Potential sources consist of underground storage tanks, road salt storage, an old town dump, industrial operations and agricultural activities (corn and soybean farming). Some of the industrial sources may have large volumes of potential contaminants stored. All of these sources are off the property controlled by West Lafayette, with the exception of some of the agricultural activities. The land use in the source water protection area is approximately 25% agricultural, 55% residential and 20% commercial/industrial.

Aquifer Water Quality: A documented plume of volatile organic compounds exists in the aquifer supplying drinking water to West Lafayette and confirms the sensitivity of the hydrogeologic setting. This plume has reached West Lafayette's water supply wells, and an air stripper has been added to the treatment circuit to remove the contaminants.

SWAP Area Assessment and Protection Activities: The hydrogeologic setting indicates that the West Lafayette's wellfield is susceptible to contamination, which is confirmed by the presence of the contaminant plume. This points West Lafayette to placing a high priority on protecting their drinking water supply from the current contamination and from the potential of other contaminant sources impacting their water supply. Protection activities need to be considered for both on-site and off-site

Table 2-8. Examples of the narratives for the Susceptibility Analyses(cont'd).

(b) aquifer is not sensitive or susceptible:

Hydrogeologic Setting: The aquifer that supplies drinking water to the City of Somewhere is part of the Lockport Dolomite formation and has a depth to water of 80 feet below the ground surface. Ground water flow direction in the area is toward the south-west. Soils in the area are tight clay loams, meaning that rainfall and snowmelt are more likely to run off or pond up on the surface instead of draining into the soil. The aquifer is recharged by approximately 2 to 4 inches of precipitation per year, which is less than in many areas in Ohio. A 50 foot -thick tightly consolidated clay till confining layer exists at Somewhere, which acts as a barrier between the ground surface and the aquifer. Tritium data from the aquifer are below detection, indicating that it takes more than 40 years for recharge from the surface to reach the aquifer.

Potential Significant Contaminant Sources: Ten potential significant sources occur in the source water protection area of approximately 0.80 square miles; one of these sources (10%) exists within the one year time-of-travel area. Potential significant sources consist of septic systems and agricultural activities (corn and soybean farming). All of these sources are off the property controlled by Somewhere. The septic systems are also a potential bacteriological source of contamination. The land use in the source water protection area is approximately 60% agricultural, 25% residential and 15% commercial/industrial.

Aquifer Water Quality: The available water quality data do not indicate that contamination has impacted the aquifer. Sampling requirements are for treated water, and Somewhere is required to sample for volatile organic compounds, synthetic organic compounds, nitrates and bacteria. The lack of water quality impacts is not a certain indicator of the lack of contamination.

SWAP Area Assessment and Protection Activities: The confining layer overlying the aquifer at the City of Somewhere provides a significant degree of protection and a low likelihood that contaminants, if present, will reach the aquifer. However, potential significant contaminant sources do exist and may impact Somewhere's drinking water supply. The hydrogeologic setting suggests that protection activities should focus on abandoned wells or other features that may provide direct pathways for contamination to enter the aquifer.

Table 2-8. Examples of the narratives for the Susceptibility Analyses(cont'd).

(c) aquifer is of intermediate sensitivity/susceptibility:

Hydrogeologic Setting: The aquifer that supplies drinking water to the Village of Bob is a sand and gravel aquifer and has a depth to water of 20 feet below the ground surface. Soils in the area are clay loams, meaning that some rainfall and snowmelt will drain into the soil; heavy rains may result in water ponding up or running off the surface. The aquifer is recharged by approximately 4 to 7 inches of precipitation per year. A 10 foot-thick clay-rich till confining layer exists at Bob, which may act as a barrier between the ground surface and the aquifer.

Potential Significant Contaminant Sources: Eight potential significant contaminant sources exist in Bob's source water protection area of 0.10 square miles; two of these sources (25%) are located in the one year time-of-travel area. Potential significant sources include septic systems and agricultural activities (corn and soybean farming). All of these sources are off the property controlled by Bob. The septic systems are also a potential bacteriological source of contamination. The land use in the source water protection area is approximately 50% agricultural, 25% residential and 25% commercial.

Aquifer Water Quality: The available water quality data do not indicate that contamination has impacted the aquifer. Sampling requirements are for treated water, and Bob is only required to sample for nitrates and bacteria. The lack of water quality impacts, therefore, is not a certain indicator of the lack of contamination.

SWAP Area Assessment and Protection Activities: Although a confining layer exists, it is relatively thin and only allows limited protection from contaminants that may be present from infiltrating into the aquifer. This suggests that there is a likelihood that the potential significant contaminant sources may impact Bob's drinking water supply. Protection activities should focus on obtaining additional information on the sources present to evaluate their risk. Bob may want to consider monitoring for pesticides and herbicides because of the agricultural activities that are occurring near the well. Other efforts should include looking for abandoned wells or other features that may provide direct pathways for contamination to enter the aquifer.

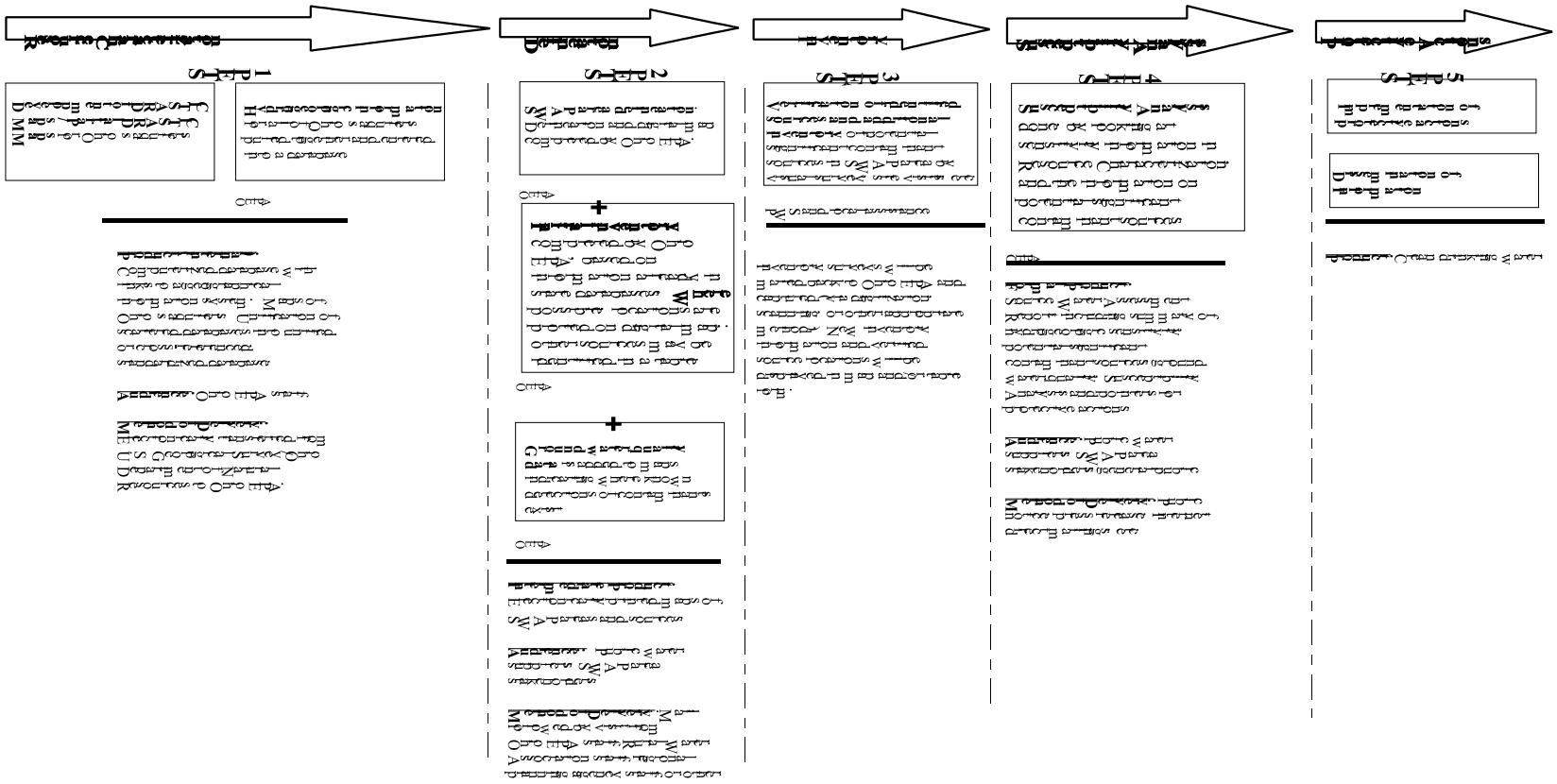


Figure 2-8. Source Water Assessment and Protection Process for Ground Water Systems

CHAPTER THREE
Surface Water Systems
Source Water Assessment and Protection Approach and Implementation

3.0 INTRODUCTION

Source water assessments for public water systems using surface water will build on Ohio EPA's existing watershed approach to water quality improvement and protection. The watershed approach is based upon the geographic unit of a watershed--an area of land from which surface water drains into a common outlet, such as a river, lake or wetland--and relies on local stakeholder involvement to conduct watershed planning and implementation. Source water assessments for the 160 public water systems that derive their water directly from a surface water body[1] will provide the opportunity for either initiating local watershed action planning or dovetailing with existing efforts.

Of these 160 public water systems, the majority use water that is drawn from Ohio's inland waterways and the remainder draw water from either the Ohio River or Lake Erie. This chapter will focus on how Ohio EPA will conduct source water assessments for public water systems drawing water from the inland waterways. Sections 3.5 and 3.6 of this chapter summarize the source water assessment process developed for the public water systems using the Ohio River and Lake Erie, respectively.

3.0.1 Process Overview

The overall process for conducting source water assessments for public water systems using Ohio's inland waterways is similar to the process for conducting source water assessments for public water systems using ground waters. However, the assessment process for surface water systems differs from that for ground water systems in that the resource characterization phase of the source water assessment occurs *after* the delineation phase for surface water systems whereas it occurs before the delineation phase for ground water systems. The flow chart (Figure 3-1) summarizes the SWAP process for surface water based public water systems in Ohio. A source water assessment for a surface water public water system includes four components: delineation of the SWAP area, resource characterization of the SWAP area, potential significant contaminant source inventory of the SWAP area and susceptibility analysis of the SWAP area.

As illustrated in Figure 3-1, the source water assessment process is not linear, but cyclical. As more cycles in the process are completed, the level of detail in the assessment process increases. The level of detail in conducting the source water assessments will vary depending on the size of the SWAP area and the issues associated with it. In general, an increased level of local involvement will be needed when collecting the more detailed information. This part of the

[1] As of July 1998, 317 public water systems used water that was drawn from surface water bodies, but almost half of these systems purchased their water from other systems. Only those public water systems that operate a surface water intake will be expected to participate in SWAP activities.

process, which is highlighted in the "protective actions" box, is critical to developing effective strategies for protecting source waters. The more detailed the information about the SWAP area, the more appropriate and effective protective actions will be.

The first cycle of the source water assessment process will be conducted by Ohio EPA and will

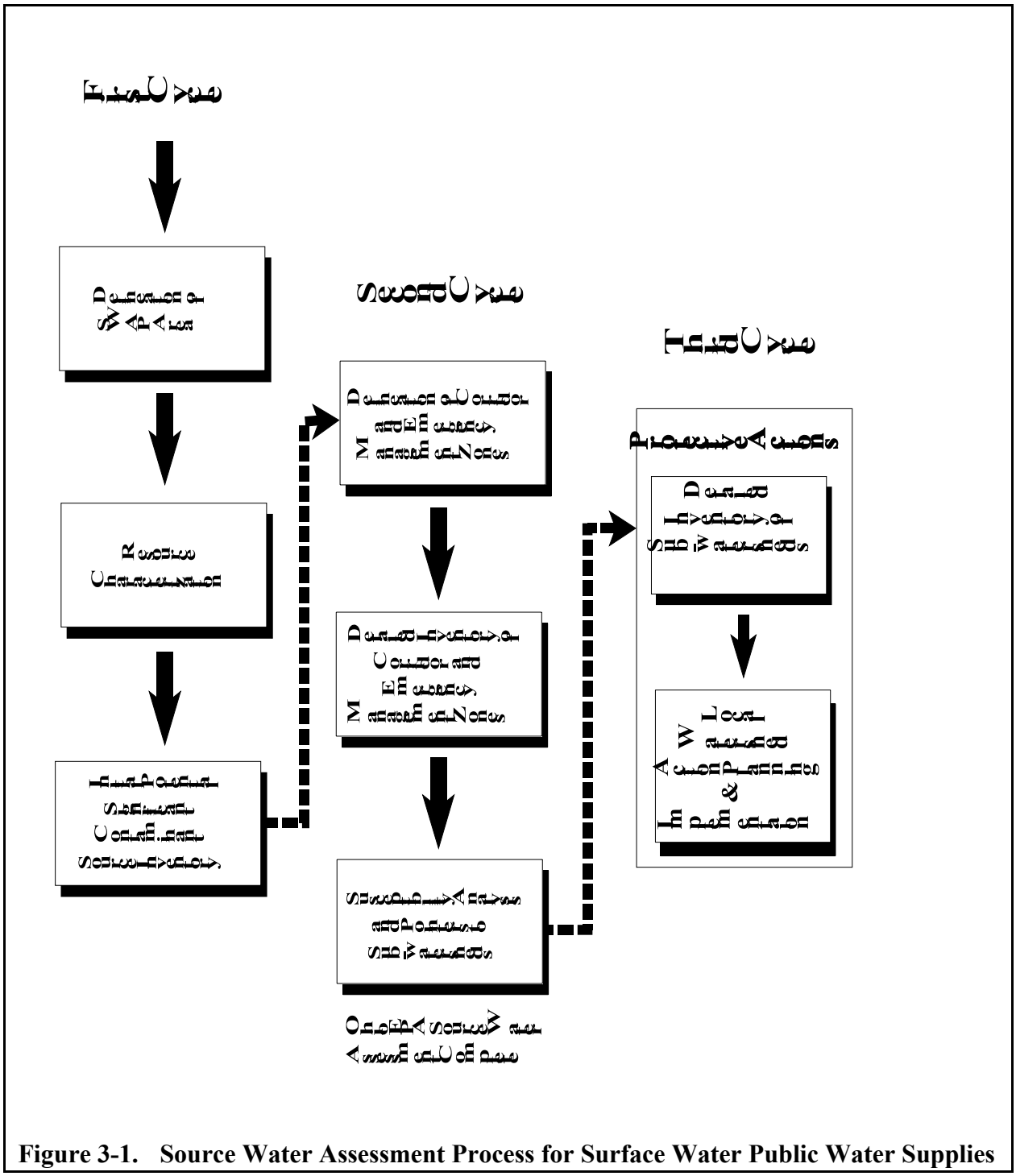


Figure 3-1. Source Water Assessment Process for Surface Water Public Water Supplies

largely be conducted in the office using existing databases, geographic information systems coverages, and established technical methods. This cycle includes the following steps:

1) Delineation of the entire SWAP area or watershed;
2) Resource Characterization of the SWAP area; and
3) Potential Significant Contaminant Source Inventory.

Delineations of SWAP areas will be based on a combination of the U.S. Geological Survey hydrologic cataloging units and other hydrologic units. The resource characterization will describe the physical, biological, chemical and hydrological features of the SWAP area. Unlike aquifers which have a natural protective layer above them, all surface waters are susceptible to contamination because they are exposed at the surface and have no barrier that protects them from contamination. Some surface waters may actually be more readily contaminated than others because of unique natural features that could facilitate the transport of spills more rapidly into the source water. The Resource Characterization provides an opportunity for assessing this aspect of SWAP areas which can then be used in conducting the susceptibility analysis. All available water quality data will be used as a preliminary contaminant screen in the resource characterization. Similar to the resource characterization, an inventory of human activities within the SWAP area will be conducted in the initial potential significant contaminant source inventory. This inventory will be based on existing databases that identify regulated facilities and known areas of concern such as Superfund sites and other hazardous waste sites. The results of this first cycle of the assessment will provide baseline maps that can be used in conjunction with local assistance to accomplish some of the tasks in the second cycle of the assessment.

The second cycle will include coordination with the public water system in identifying the boundaries of the emergency management zone immediately surrounding the intake. Owners and operators of public water systems need to be aware of this area since any accidents or emergencies occurring within this zone allow for little or no response time. In addition, during the second cycle of the source water assessment, a corridor management zone along the streams within the SWAP area will be identified where public water system operators have a limited response time -- usually a matter of hours or less to respond to emergency situations. Because of the importance of both of these areas in protecting source waters, both the emergency management and corridor management zones will be inventoried in detail. Ohio EPA will work directly with the public water system and other interested parties in surveying these areas and inventorying potential contaminant sources. Finally, a Susceptibility Analysis will be conducted. The Susceptibility Analysis takes into account water quality data (both chemical and biological), Resource Characterization information, and Potential Significant Contaminant Source Inventory data. The analysis will identify critical areas within the SWAP watershed as well as provide actions a public water system can take to further define or reduce susceptibility.

Finally, the third cycle in the assessment process will provide yet another level of inventory detail that is completed at the local level. It is a critical piece in source water assessment and protection because it is where protective actions are implemented.

3.1 DELINEATION OF SWAP AREAS

3.1.1 Initial Delineation

The process for delineating SWAP areas for surface water public water supplies is somewhat different than the process developed for groundwater public water supplies. This is due primarily to the very different conditions in which these two sources of drinking water are located. The visible topographic features that determine surface drainage patterns are used to delineate the SWAP area for public water supplies utilizing surface water. A relatively accurate representation of surface features can be found on readily available topographic maps, making the process of delineating the SWAP areas for surface water public drinking water sources a relatively simple one -- identifying a ridge line from which water does or does not drain to a water supply intake.

Delineation of surface drainage areas is the process of determining the boundaries of a discrete area such as a watershed. When delineating a watershed, topographic divides are used to determine where a boundary line will be drawn. This boundary line highlights the point where water either drains in one direction or another or drains into one body of water or another. A second factor which directly affects how watersheds are delineated is scale. The scale, or size, of a watershed can vary depending on the purpose and intent of the delineation. For example, the State of Ohio can be divided into just two large watersheds -- all streams and rivers that drain north to Lake Erie, and all streams and rivers that drain south to the Ohio River. Or, it can be divided into as many as 900 or more smaller watersheds.

The initial delineation of the SWAP areas in Ohio will be based on a watershed network established by the U.S. Geological Survey. The U.S. Geological Survey has delineated watershed boundaries at a variety of different scales. One scale is referred to as the eight digit hydrologic cataloging units (Figure 3-2). An eight digit number is assigned to each of approximately 44 hydrologic units--otherwise known as watersheds-- that make up Ohio and parts of bordering states. A network of smaller watersheds that nests within the eight digit hydrologic units are the 11-digit hydrologic units. Smaller yet, the 14-digit hydrologic units nest within the 11-digit hydrologic units. The 17-digit hydrologic units are the smallest units in this watershed numbering system and they nest within the 14-digit hydrologic units. These different scales have been delineated for different purposes such as regional and local planning.

Ohio EPA will base the delineation of the SWAP areas on the eight, 11 and 14- digit hydrologic units. However, since these hydrologic units were not created with the SWAP program in mind, some of the downstream boundaries extend well beyond the public water supply intake or what is needed in the SWAP program. Therefore, Ohio EPA will be delineating additional downstream boundaries as needed to supplement the existing hydrologic unit boundaries as it delineates the SWAP areas.

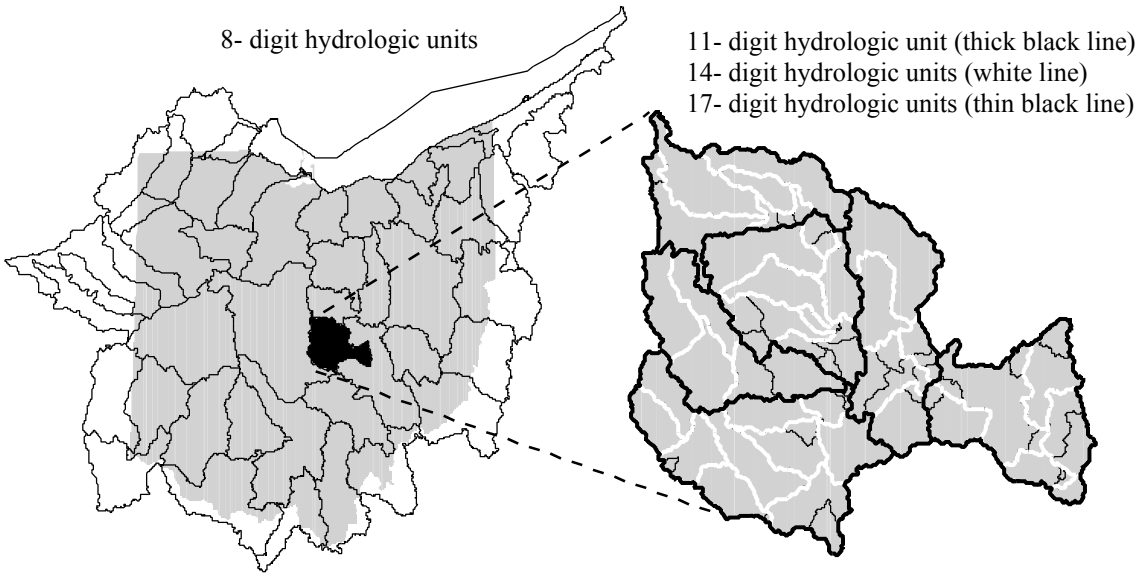


Figure 3-2. Eight, Eleven, Fourteen, and Seventeen Digit Hydrologic Units

3.1.2 Delineating SWAP Areas Based on the Maumee Test Area

The Maumee River Basin in northwest Ohio was used as a test area to develop a method for delineating SWAP areas. First, the location of the intakes for each surface water supply were identified and incorporated in a geographic information system. Then, a combination of the existing watershed boundaries for the eight, 11, 14, and 17-digit hydrologic units (Figure 3-2) were used to delineate the SWAP areas. The smallest hydrologic unit that included the public water supply intake of interest was used in the delineation.

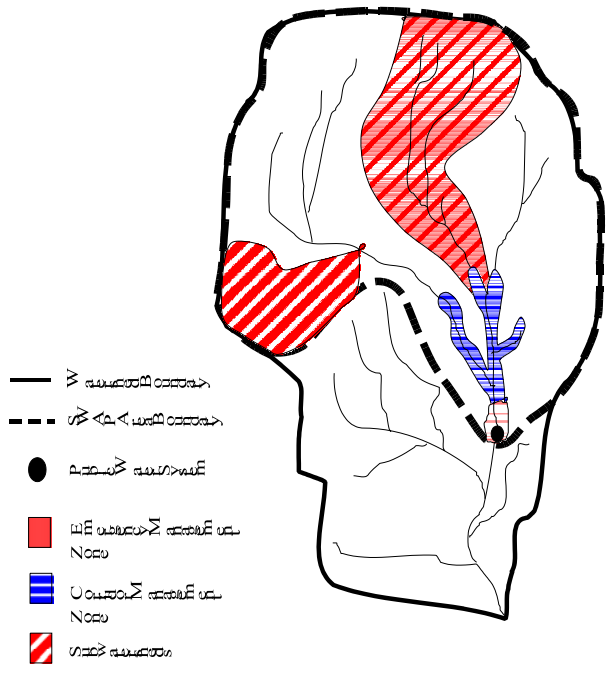


Figure 3-3. Delineation of a SWAP Area Based on Watershed Boundaries

Figure 3-3 illustrates the hydrologic unit boundary as a single black line. The SWAP

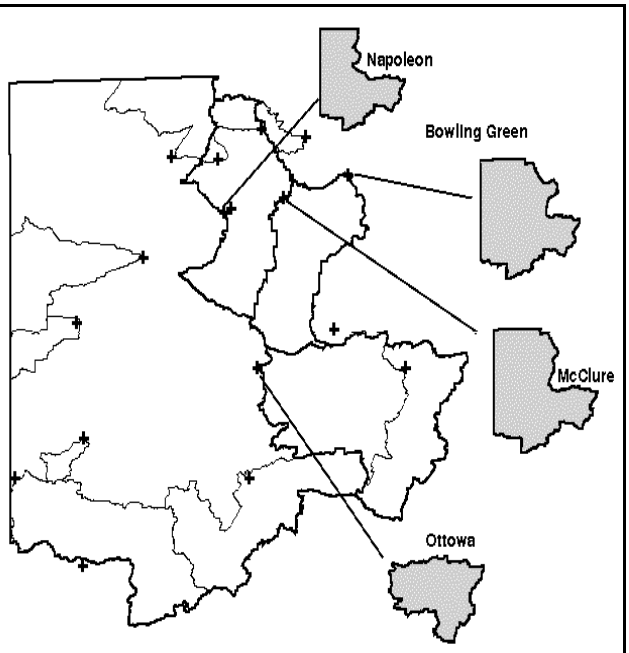


Figure 3-4. Maumee River Basin Test Area

area is delineated by the dashed line. Since the existing hydrologic unit boundaries are typically not located at a point that is representative of the downstream end of the SWAP area, topographic maps, digital line graphs, and digital elevation models are being used to delineate the downstream boundary of most SWAP areas, as illustrated in Figure 3-3. If the public water system has off-stream reservoirs that are not located within the natural topographic boundaries of the SWAP area, the delineation line will be modified to include the off-stream reservoir.

A total of fourteen SWAP areas were delineated for surface water systems in the Maumee River Basin. These delineations were developed as geographic information system coverages. Of the fourteen public water supply systems, only four of the systems have SWAP areas that contain the surface water intakes of another upstream public water supply. The SWAP areas that contain multiple public water supplies are Bowling Green, McClure, Napoleon, and Ottawa (bold lines) (Figure 3-4). The Wauseon public water supply is located in the smallest SWAP area, with an area of about 10 square miles. By contrast, the Bowling Green SWAP area comprises an area of about 4,500 square miles in Ohio, with additional area in Indiana and Michigan.

The remaining SWAP areas for Ohio will be delineated using the same methodology as in the Maumee River Basin test area. SWAP areas will be delineated for a total of 108 inland waterway systems by Ohio EPA. Digitized watershed boundaries of Indiana, Michigan, and Pennsylvania have been acquired to facilitate delineation of SWAP areas that cross state boundaries. Otherwise, the same process developed for the Maumee River Basin test area will be used in delineating SWAP areas that extend into other states.

A work group initiated by the Ohio River Valley Sanitation Commission developed a tiered-delineation system for public water supplies utilizing the Ohio River (see Section 3.5). Likewise, a work group comprised of representatives from each state in U.S. EPA Region 5 has developed a proposed SWAP protocol for Great Lakes sources (see Section 3.6). For quarries with little or no surface drainage, both a ground water and surface water delineation will be conducted (see Section 2.3.6).

Due to various factors such as inaccurate or incomplete information on existing topographic maps, the SWAP area boundaries will not always be delineated as accurately as is desirable. To account for potential accuracy problems, the SWAP area boundaries will be considered to be dynamic.

3.1.3 Emergency Management Zone Delineation

The emergency management zone is defined as an area in the immediate vicinity of the surface water intake in which the public water supply owner-operator has little or no time to respond to a spill. The purpose of delineating the emergency management zone is to identify an area to conduct a detailed inventory of the land use and potential significant contaminant sources so that the public water supplier will have all of the information necessary to anticipate and manage emergency situations. The public water suppliers should also have a contingency plan in place to manage such emergency situations.

Ohio EPA will delineate the boundary of the emergency management zone in cooperation with the public water supply owner-operator using the criteria listed in Table 3-1. Local information such as the type of public water supply (upground reservoir, on-stream impoundment) and the presence or absence of potential significant contaminant sources will be taken into consideration. For example, public water supply systems that are located downstream of a dam may not include the dam in their emergency management zone. The dam itself provides a barrier by which a spill or contaminated plume could be contained. As a result, the emergency management zone for such a public water supply might be limited to the areas between the dam and the water supply intake. Water supply systems that utilize off-stream reservoirs can continue to supply the public water even while the plume is passing, whereas a public water system utilizing an on-stream reservoir cannot, and will need earlier notification in order to have adequate time to fill its reservoirs. Some site-specific factors also may affect the size of the emergency management zone, such as the surrounding topography and the types of potential significant contaminant sources located in the immediate vicinity of the water intake. If a public water system has multiple intakes that are not situated in close proximity to one another, SWAP areas, emergency management zones, and corridor management zones will be delineated for each intake.

If there are none of the above factors on which to base the emergency management zone delineation, the standard emergency management zone boundary will consist of a semi-circle that extends 500 feet upstream of the intake and 100 feet downstream of the intake.

Table 3-1. Emergency Management Zone Delineation Criteria

- Boundaries identified in an existing emergency management plan;
- Upstream hydrology/topography such as permeability of soils, gradient of slopes;
- Type of system (on-stream vs. off-stream reservoirs, etc.);
- How quickly the intake can be closed; how long the system can supply its daily demand while the intake is shut off; how quickly specialized treatment can be put on-line;
- Number and type of potential significant contaminant sources within an established critical distance from the intake; location of potential significant contaminant sources that have created water quality problems in the past; existence of major transportation routes (e.g.., highways and railways) or pipelines that cross the streams; and
- Existence of barge traffic or shipping on the upstream waterway(s).

3.1.4 Corridor Management Zone Delineation

The corridor management zone is an area along streams within the SWAP area that warrants delineation, inventory, and management because of its proximity to the source water. Accidental spills, releases, and sudden precipitation events that result in overland runoff or storm sewer discharges can allow pollutants to readily enter the source water and potentially contaminate the drinking water at the

intake. Ohio EPA will delineate the corridor management zone for all streams within a SWAP area using the criteria presented in Table 3-2.

Table 3-2. Corridor Management Zone Delineation Criteria

width:	1,000 feet on each bank of the principal stream and 500 feet on each bank of tributaries draining into the principal stream
length:	10 miles upstream of the intake, including the principal stream and all tributaries that drain into it

The length of the corridor management zone is based on an Ohio EPA toxics policy (Ohio EPA, 1988) which suggests screening for all contaminant sources within ten miles upstream from a surface water public water supply intake. The ten mile distance not only includes the stream on which the water supply intake is located, but also extends up to ten miles upstream on any tributaries to the principal source water. Therefore, if a tributary is located at or near the intake, the corridor management zone could extend as far as ten miles up the tributary, as well as ten miles up the principal stream. Conversely, if a tributary enters the principal stream five miles upstream of the intake, the corridor management zone would only extend five more miles up the tributary. Once such an area is delineated, time of travel through the corridor management zone over a variety of flow regimes will be generated so that in the event of an accidental spill the owner-operator of the public water supply can determine the amount of time needed to respond to the event.

In lieu of the standard corridor management zone delineation, if a public water supplier so chooses, they may request to delineate the corridor management zone using the following criteria in consultation with Ohio EPA:

- total drainage area (square miles) of the entire SWAP area
- stream gradient
- stream order
- soil permeability
- road crossings/bridges
- other factors as determined by Ohio EPA.

Since local factors very considerably from one public water supply to the next, it is the intent of Ohio EPA to be flexible in working with local water utilities to cooperatively produce the best possible delineations of the emergency management and corridor management zones.

3.1.5 Identification of Sub-Watersheds

As Ohio EPA conducts the water quality contaminant screening (see Section 3.2.5) and potential significant contaminant source inventory (see Section 3.3.4), certain sub-watersheds may be identified where a more detailed inventory, additional water quality monitoring or immediate protective actions could take place. These areas could be identified either because of detections of contaminants of concern or because of a significant concentration of potential significant contaminant sources. Ohio EPA will identify sub-watershed drainage areas on maps of the SWAP areas as illustrated in Figure 3-3.

3.1.6 "Conjunctive" Delineations

Some surface water systems that derive their water primarily from ground water (such as systems whose source is an abandoned quarry) may need a separate SWAP area based on the five-year criterion that is used for ground water systems. This is discussed in Chapter Two, Section 2.2.6 ("Surface Water Under the Influence of Ground Water", page 2-18).

3.2 RESOURCE CHARACTERIZATION

3.2.1 Overview

The purpose for conducting the Resource Characterization analysis of the delineated SWAP area is to obtain an understanding of its physical, biological, chemical and hydrological characteristics. The results of the Resource Characterization analysis will be used to evaluate the relative potential for the overland transport of contaminants across the SWAP area as well as the biological and chemical quality (or health) of the water resource. The outcome of this analysis will be directly incorporated into the Susceptibility Analysis described in Section 3.4 of this report.

The primary focus of the Resource Characterization will be the collection, compilation and evaluation of readily available regional information about the SWAP area. The principal sources of this information will be Ohio EPA, Ohio Department of Natural Resources, Natural Resources Conservation Service and U.S. Geological Survey. In addition, as time and resources allow, every effort will be made to obtain available information from established local watershed groups and organizations to supplement the information collection efforts.

Four resource characteristics will be evaluated:

- the potential for surface runoff to occur;
- the ease with which surface runoff transported material can be delivered into the stream system;
- the movement of water through the SWAP area; and
- the biological and chemical health of the surface water resource composing the SWAP area.

Table 3-3 presents the resource characteristics which will be evaluated and the type of information that will be collected, compiled and evaluated in the Resource Characterization analysis.

3.2.2 Potential for Surface Runoff to Occur

The type of soil present in the SWAP area as well as its associated soil parameters has a direct influence on the potential for surface runoff to occur. As the infiltration rate of the soil increases (more precipitation soaking in rather than running off), the contaminant load associated with the reduced amount of surface runoff should decrease. The soil associations and soil series for each SWAP area will be determined by using the county soil surveys and state soil geographic database. When used in conjunction with the associated soil parameters, the relative runoff potential for the SWAP area will be determined.

3.2.3 Ease of Material Delivery into the Stream System

The size, shape and slope of the SWAP area has a direct influence on the ease with which surface runoff transported material can be delivered into the stream system. In general, the longer the overland travel distance and travel time that surface runoff has to take in order to reach a stream channel, the greater the chance for filtration and deposition of the contaminants to occur. After the SWAP area is delineated, an analysis of its size, shape and slope will be conducted to determine the relative potential to deliver surface runoff transported materials into the stream system.

Table 3-3. Resource Characteristics and Types of Information Used in the SWAP Area Resource Characterization Analysis

Resource Characteristic	Type of Information Collected
Potential for Surface Runoff to Occur.	Soil Associations Soil Series Soil Properties
Ease of Material Delivery into the Stream System. (Rate of overland material transport.)	Watershed Size Watershed Shape (Long and Narrow, Fan-shaped, Short and Wide) Terrain (Topography or Slope)
Movement of Water Through the SWAP Area.	Miles of Streams Average Stream Gradient Average Rainfall Average Runoff Stream Flow Characteristics
Biological and Chemical Health of the Surface Water Resource Composing the SWAP Area.	Chemical water quality monitoring results from utility (raw and finished water) Chemical and biological water quality monitoring results from Ohio EPA Chemical water quality monitoring results available through STORET Chemical and biological water quality monitoring results from local watershed groups and organizations Sediment quality data from Ohio EPA

3.2.4 Movement of Water Through the SWAP Area

A number of physical and natural factors can influence the movement of water through the SWAP area. An evaluation of the hydrologic cycle will provide an indication as to the amount of annual rainfall that soaks into the ground or runs off. In general there is a greater potential for a negative surface water quality impact if the ratio of run-off to rainfall is high. The pattern and development of the drainage network of the SWAP area directly influences the rate of water movement. Typically, well-developed, well-defined drainage networks reduce the travel distance and travel time, increase the stream gradients and increase the contaminant transport capacity of a watershed. There is a greater potential for negative impact on the surface water when the length of rivers and streams in the SWAP area is high.

3.2.5 Biological and Chemical Health of the Water Resources

A key aspect of characterizing the condition of the water resources within a SWAP area is an analysis of available biological and chemical water quality data. The characterization will primarily rely on data collected as part of Ohio EPA's implementation of the federal Safe Drinking Water Act and Clean Water Act. Monitoring conducted to support these two programs provides a wide array of chemical, physical and biological measures, most of which will be used in the characterization of the SWAP area (see Table 3-4).

In addition to the chemical, biological and physical water quality information collected by Ohio EPA, every effort will be made to obtain information from existing local watershed groups and organizations to supplement the information collection efforts.

3.2.6 Ohio EPA Surface Water Monitoring and Assessment

A principal goal of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of the surface waters of the United States. To meet this goal, the State of Ohio established surface water quality standards. Water quality standards are numerical and narrative criteria that help to determine how clean a water resource must be. In essence, they serve as benchmarks for measuring water quality. Water quality standards are designed to protect human health and welfare, enhance water quality, and identify water quality problems.

Table 3-4. Available Ohio EPA Water Quality Data

- Test results from treated drinking water (finished water) and untreated source water (raw water) conducted by the water supplier;
- Ambient water chemistry (sampling conducted in rivers, lakes and reservoirs);
- Sediment chemistry;
- Biological criteria and monitoring (bacteria, macroinvertebrates and fish);
- Habitat evaluation;
- Use attainment assessments; and
- Identification of causes and sources of water quality impairments.

Another key component of the Ohio Water Quality Standards is use designations. Use designations are goals that are established for specific water bodies in the state. There are four types of use designations for surface waters in the state of Ohio: Aquatic Life Habitat, Water Supply, Recreation and State Resource Waters. Water bodies in the State are assigned one or more aquatic life habitat use designation and may be assigned one or more water supply use designation or one or more recreational use designation. In addition, a water body may also be designated a state resource water. Surface waters are assessed as to whether they are attaining or not attaining the assigned designated uses.

The water quality criteria used to assess and protect the non-aquatic life habitat designated uses listed above are based primarily on chemical indicators. Attainment of the aquatic life habitat designated uses are based primarily on biological criteria, or measures of resident macro-invertebrates and fish communities. In reporting on the attainment of established water quality standards, Ohio EPA emphasizes aquatic life habitat use attainment because:

1) aquatic life criteria frequently result in the most stringent requirements compared to those for the other use categories, (i.e. protecting for aquatic life uses should assure the protection of other uses);

2) aquatic life uses apply to virtually every Ohio water body and the diverse criteria (conventional contaminants, nutrients, toxics, habitat, physical and biological factors) apply to all water resource management issues;
3) aquatic life uses and the accompanying chemical, physical and biological criteria provide a comprehensive and accurate ecosystem perspective toward water resource management; and
4) the existence of an extensive and comprehensive database of aquatic life, physical habitat, water chemistry, sediment, and effluent data, most of which is accessible via electronic databases. In addition to assessing use attainment, this array of data on chemical, physical, and biological factors is used to ascribe causes and sources of impairment of surface waters (Ohio EPA, 1997b).

Ohio EPA's ecosystem approach to surface water resource monitoring and assessment provides a rich supply of data that can be applied toward a characterization of the SWAP area. The first step in the water resource characterization will be to bring together the various data available from public water suppliers and Ohio EPA's surface water resource monitoring and make this data accessible and available in map and table formats. The second step is to apply the finished characterization, either by itself or in combination with the source inventory, to provide pointers to sources of contamination and/or sub-watersheds where additional potential contaminant source evaluation or water quality monitoring should take place.

Providing a reliable pointer, or indication to SWAP area sub-watersheds that may warrant additional evaluation depends upon the factors such as: the location(s) where monitoring for a contaminant has taken place, whether or not it was detected, the concentration it was detected at, and whether or not the monitoring was conducted within a suitable time frame or under conditions favorable to lead to the detection of the contaminant. The time frame within which the monitoring occurred is critical for contaminants that vary seasonally. In addition, monitoring data that are more than five to seven years old, for example, may not reflect current conditions in the SWAP area. These variables will have to be taken into account when using the results of the SWAP area Resource Characterization. The available data collected for a SWAP area will likely range from areas where the data are limited only to finished drinking water monitoring, to areas with recent, relatively comprehensive chemical and biological data.

Figure 3-5 presents a map containing a few features of a SWAP area and the data linked to each of those features. The map of the SWAP area shows the stream network and the location of a public water supply, the intake and a water chemistry sampling site. The width of the stream segment on the map indicates whether or not it has been assessed and its most recent aquatic life attainment status. The thin lines on the map indicate the streams that have not been assessed.

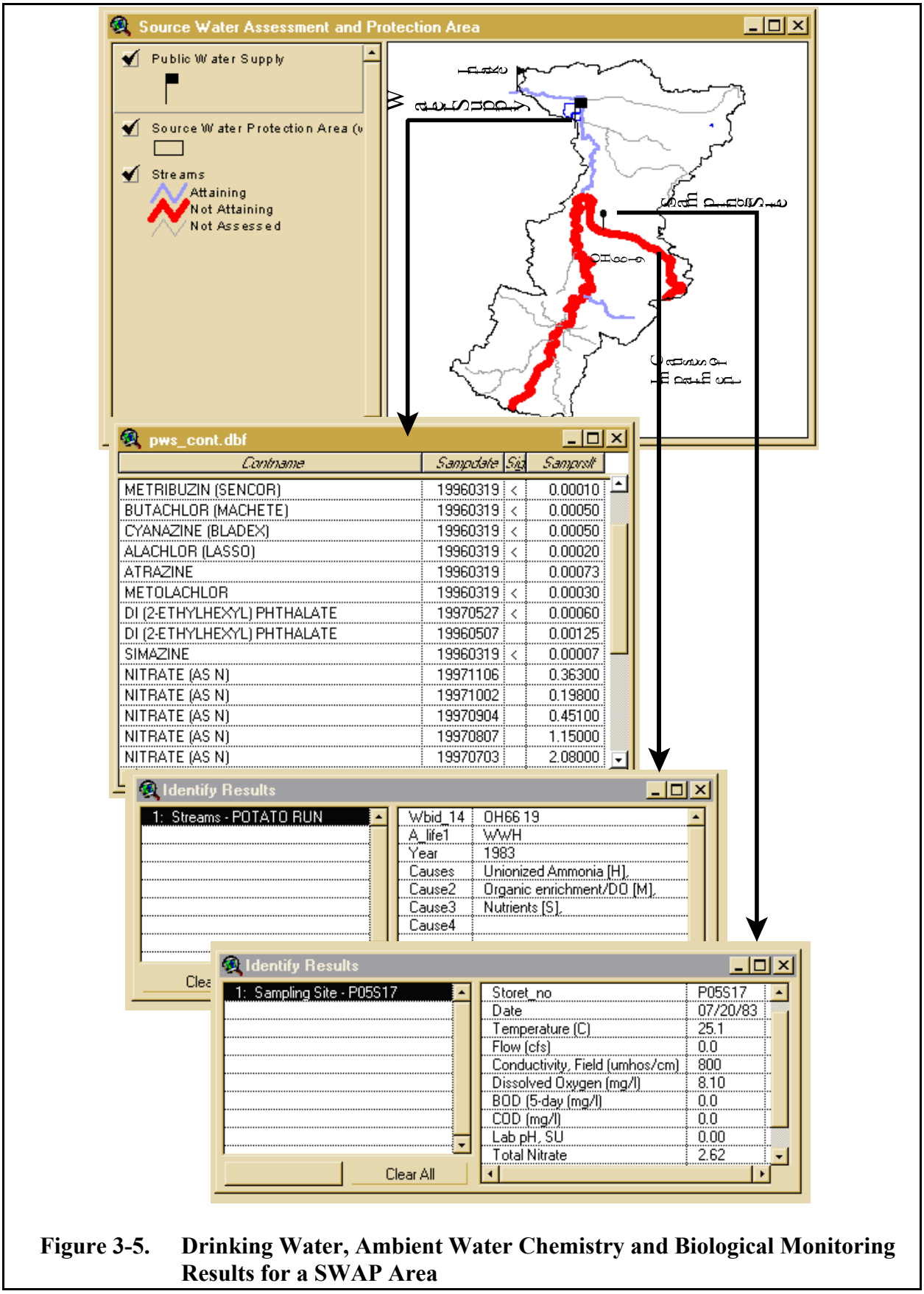


Figure 3-5. Drinking Water, Ambient Water Chemistry and Biological Monitoring Results for a SWAP Area

The medium lines indicate the streams that have been assessed and where most of the assessed miles are in attainment of the aquatic life habitat use designation (good water quality). The thick lines indicate the assessed streams that are predominantly not in attainment of the aquatic life habitat use designation (poor water quality). Also shown are links to the data tables containing results of the finished water monitoring, identified causes of impairment for one of the stream segments that is not attaining its aquatic life habitat use designation, and the results from a water chemistry sampling site.

Another feature revealed in Figure 3-5 is the variability in space and time of the available water quality data. As shown by the number of thin lines, not all the waters upstream of the water supply intake have been assessed. Looking at the various data tables also reveals that the results of the drinking water tests are as recent as 1997 for some contaminants, whereas the water chemistry results are from 1994, and the most recent use attainment assessment is from 1983. Variations in the time and location where the various types of water quality monitoring have occurred within the SWAP area will be impossible to avoid in most cases. Decisions on identifying the locations where additional evaluations are necessary or whether management activities are warranted will likely have to be made on a case-by-case basis. They will have to take into account the specific contaminant of concern, the time frame of any past monitoring, the inventory of potential contaminant sources, and changes in land use or other conditions in the watershed. Successful Resource Characterization will provide as much of the available information as possible in a format that facilitates the analysis and necessary decision making that will take place when protective strategies are implemented.

3.3 POTENTIAL SIGNIFICANT CONTAMINANT SOURCE INVENTORY

The purpose of a Potential Significant Contaminant Source Inventory is to identify any activity or land use that has the potential to contaminate the public drinking water supply. Such activities or land uses will be referred to collectively as “potential significant contaminant sources” throughout this document. The types of potential significant contaminant sources that will be inventoried include all of the regulated facilities in the delineated SWAP area, as well as existing agricultural, residential, municipal, commercial and industrial potential significant contaminant sources. The information that is being collected during the inventory will be essential in order for the water supplier to develop effective protection strategies.

3.3.1 Inventory Process

The inventory process will identify potential significant sources of the contaminants of concern using a range of inventory methods. An inventory of potential significant contaminant sources utilizing existing databases (primarily regulated sources) will be conducted for the entire SWAP area. Potential Significant Contaminant Source Inventories conducted in the emergency management zone and corridor management zone will be more comprehensive, using methods such as detailed land use analysis, air photography and field surveys (see Table 3-5). To the extent feasible, the results of water quality monitoring analysis, and the broad and detailed contaminant source inventory processes will be incorporated into a geographic information

system application, and the data made available as maps and tables.

3.3.2 Contaminants of Concern

The 1996 amendments to the Safe Drinking Water Act require that each state must identify the contaminants of concern that will be addressed in the SWAP. At a minimum, the list must include the water contaminants regulated under the Act [i.e., chemicals with Maximum Contaminant Levels (MCL) or chemicals that have monitoring requirements]. Through the public participation process it was determined that the state should not limit the contaminant of concern list to only the constituents with a MCL or monitoring requirement. An expanded list of chemicals that Ohio EPA will include in the potential significant contaminant source inventory process was developed using the criteria listed in Table 3-6.

Table 3-5. Contaminant Source Inventory Methods

Area	Inventory Type	Inventory Methods
Source Water Assessment and Protection Area	Broad potential significant contaminant source inventory	Physical characterization Land use analysis Identification of regulated facilities
Emergency Management Zone	Detailed potential significant contaminant source inventory	Review of regulatory databases Air photography Detailed land use analysis Visual field surveys and searches
Corridor Management Zone	Detailed potential significant contaminant source inventory Detailed inventory of all point source dischargers and storm water discharges	Review of regulatory databases Air photography Detailed land use analysis Visual field surveys and searches

Table 3-6. Contaminants of Concern Identification Criteria

- All chemicals and pathogens with a Maximum Contaminant Level.
- All chemicals with a Secondary Maximum Contaminant Level.
- All chemicals that are targeted for regulatory review on the federal contaminant candidate list.
- All chemicals and pathogens that have federal Safe Drinking Water Act or state monitoring requirements.
- All chemicals that have Ohio water quality standards developed under the Clean Water Act.

The creation of the expanded contaminant of concern list does not imply that Potential Significant Contaminant Source Inventories will be limited to only the potential sources of chemicals on the list. It just ensures that, *at a minimum*, the listed chemicals will be incorporated in the inventory process. The complete list of over 200 chemicals and pathogens is included in Appendix A-1.

3.3.3 Potential Significant Contaminant Sources

All potential sources of contaminants, including regulated sources and unregulated sources listed in Appendix A-2, are considered potentially significant contaminant sources. After the Susceptibility Analysis is completed for the SWAP area**,** the public water supplier or local organization implementing the SWAP program protective actions will be able to determine if a more detailed inventory (more information about a specific source, obtained through surveys or site visits) will be necessary. It will be the responsibility of the public water supplier to determine which of the inventoried potential sources are "significant" and how to prioritize them for possible protective strategies.

3.3.4 Potential Contaminant Source Inventories

The inventory portion of the SWAP program consists of two steps. The first step is the broad Potential Significant Contaminant Source Inventory based on existing databases. The inventory will consist of a general land use analysis, the identification of regulated entities in the delineated SWAP area, and an analysis of roads and rails crossing or adjacent to the streams in the SWAP area.

The second step is the detailed inventory of potential significant contaminant sources in the emergency management and corridor management zones. The detailed source inventory will be conducted to identify potential significant contaminant sources that were not captured in the broad source inventory and to field verify the location of the potential significant contaminant sources in the emergency management and corridor management zones.

3.3.5 General Land Use

A generalized land use analysis will be conducted for the entire SWAP area. The Ohio Department of Natural Resources has completed a statewide land use/land cover analysis that provides Anderson Level 1 land use classifications (see Table 3-7). The land cover inventory for the State of Ohio was produced by digital image processing of Landsat Thematic Mapper Data acquired in Sept September and October of 1994. More detailed land use classifications (Anderson levels 2-4) are available for selected areas of the state, and where available, may also be used.

The generalized land use analysis will provide an indication of the land uses which predominate throughout the SWAP area, near the intake, or adjacent to the rivers, streams, lakes and reservoirs. The land use information can be used during the Susceptibility Analysis (see Section 3.4.2), and in combination with water quality monitoring information to point out sub-watersheds where additional source evaluation should be considered.

Table 3-7. Anderson Level 1 Land Use Categories

- URBAN (open impervious surfaces: roads, buildings, parking lots and similar hard surface areas which are not obstructed from aerial view by tree cover.)
- AGRICULTURE / OPEN URBAN AREAS (cropland and pasture; parks, golf courses, lawns, and similar grassy areas not obstructed from aerial view by tree cover.)
- SHRUB / SCRUB (young, sparse, woody vegetation; typically areas of scattered young tree saplings)
- WOODED (deciduous and coniferous)
- OPEN WATER
- NON FORESTED WETLANDS (includes wetlands identified from the 1994 Thematic Mapper data as well as from the Ohio Wetland Inventory)
- BARREN (strip mines, quarries, sand and gravel pits, beaches.)

3.3.6 Regulated Sources

Ohio EPA will complete an inventory of all regulated facilities and documented contaminant spills within the source water watershed. Databases that will be considered for inclusion in the inventory process include: Comprehensive Environmental Response, Compensation, and Liability Information System, Resource Conservation and Recovery Act Information System (large and small quantity generators and disposers), National Pollution Discharge Elimination System sites, and Toxic Release Inventory sites. In addition, solid and infectious waste facilities, construction & demolition debris sites, regulated livestock operations, registered underground storage tanks, the location of past spills and releases, landfills, industrial lagoons/ponds/pits, and municipal lagoons will be included. To the extent feasible, the location of these sources will be mapped. Information that is not available in a geographical information system format (e.g., location of registered underground storage tanks), and therefore not located on the maps may be presented to the public water supplier in tabular form, listing source addresses by region (township, county, etc.). The locational data for these maps may not be accurate, so it will be the responsibility of the public water supplier to make the final determination on whether or not an identified potential significant contaminant source on the map is actually within their delineated SWAP area (site verification). The maps would not be a complete inventory for the systems, but they would make the supplier aware of any known regulated facilities in the SWAP area (and be a good start with conducting the Potential Significant Contaminant Source Inventory).

3.3.7 Transportation Networks

The following information will be compiled to aid in the Susceptibility Analysis, and in planning for transportation related accidents that could result in contamination of the source water:

- Miles of Train Tracks (Total, Within 100 feet of a Stream)
- Miles of Primary Roads (Total, Within 100 feet of a Stream)
- Miles of Secondary Roads (Total, Within 100 feet of a Stream)
- Miles of Pipe Lines (Total, Within 100 feet of a Stream)
- Number of Stream Crossings (Total, Train, Primary Roads, Secondary Roads, Pipe Lines).

3.3.8 Detailed Source Inventories

A detailed inventory of potential significant contaminant sources will be conducted in the emergency management and corridor management zones. The delineation of these areas has been previously discussed in Sections 3.1.3 and 3.1.4 respectively. The detailed inventory process will be conducted by Ohio EPA, or by Ohio EPA in partnership with the public water supplier and/or local stakeholder based organizations. The results of the detailed inventory process will be incorporated into the final assessment for the SWAP area, and to the extent feasible, incorporated into geographic information system coverages of the SWAP area.

The types of potential significant contaminant sources targeted in the detailed inventory process are expanded beyond regulated facilities to include agricultural, residential, municipal, commercial and industrial sources that may not be covered under existing regulatory programs. The potential sources targeted through the detailed inventory process are listed in Appendix A-2.

The detailed inventory will identify the source name, type, any conveyances to ground or surface waters such as storm drains, locational information such as address, and latitude and longitude.

Methods to be used in the detailed source inventory include:

- Aerial photography
- Detailed land use characterizations, Anderson Level 2 - 4 (where available)
- Field surveys and searches (windshield, stream walks and stream reach screening).

To aid in screening for potential contaminants that may be present in the corridor management and emergency management zones, links have been made between potential significant contaminant sources and general categories of contaminants. Specific contaminants of concern are grouped into nine categories, which are shown in Appendix A-1. The links between potential significant contaminant sources and types of contaminants are shown in Appendix A-2 and are based on Ohio EPA guidance documents for conducting potential pollution source inventories (Ohio EPA, 1997a). For example, animal feedlots, a potential significant contaminant source, is linked to three contaminant types: microorganisms, pesticides and nutrients.

It is important to note that the links between potential significant contaminant sources and primary contaminant types are not intended to be comprehensive or exhaustive, but only those most commonly associated with the potential significant contaminant source. In addition, any specific potential significant contaminant source may actually have none, some, or more types of contaminants associated with it than indicated in Appendix A-2. Identifying the specific contaminants associated with a particular potential contaminant source most often requires a site visit. However, the source water assessment process conducted by Ohio EPA will not include site visits to unregulated potential significant contaminant sources.

3.4 SUSCEPTIBILITY ANALYSIS

3.4.1 Definition of Susceptibility

The Technical Advisory Committee and the Public Advisory Groups defined susceptibility for Ohio as:

> **The likelihood for the source water(s) of a public water system to be contaminated at concentrations that would pose a concern.**

It is recognized that due to their inherent nature (open system with no confining layer, easy access for contaminant movement and relatively short time of travel) all surface water sources of public drinking water are susceptible to contamination. The degree to which a particular surface

water supply is susceptible will be determined through an analysis of the SWAP area hydrological and physical characteristics and a review of both the broad potential pollution source inventory for the SWAP area and the detailed potential significant contaminant source inventories conducted for the emergency management and corridor management zones. The purpose of a Susceptibility Analysis is:

> **...to provide a pointer to what actions a public water system should take to further define and reduce susceptibility. This may include recommendations for more detailed**

inventory and assessment (monitoring) work or an indication of the type and intensity of source water and other protection activities needed.

3.4.2 Components of a Susceptibility Analysis

The Susceptibility Analysis will integrate information about the physical characteristics of the SWAP area with the results from the Potential Significant Contaminant Source Inventories and known water quality data to determine the relative likelihood of contamination impacting the drinking water source. The Susceptibility Analysis will analyze and evaluate this information in order to provide pointers to the public water supplier, the community, and local watershed groups regarding potential significant contaminant sources that may be the greatest threat, to identify the level and types of protective actions that may be warranted, and to indicate areas where further assessment work that may be needed. This analysis will focus on the following components:

- **understanding of the hydrologic setting;**
- **summary of the potential significant contaminant sources; and**
- **review of water quality data.**

Ohio EPA staff will integrate these components utilizing a general decision process and their best professional judgement to determine the susceptibility of each of the public water systems to contamination. The results of the review will be reported to the public water system in a Source Water Assessment Report. Factors considered in the review of each of these components are identified in general terms in the following sections.

Understanding of the Hydrologic Setting. Numerous readily available databases and geographic information system data layers will be utilized to analyze the hydrologic setting of the SWAP area. The hydrologic setting will be evaluated to determine the sensitivity of the SWAP area to the overland transport of contaminants. The parameters that will be used to define the hydrologic setting sensitivity will include (if available) the size, shape and average slope of the delineated SWAP area, general soil associations and series present, number of stream miles, average stream gradient, average rainfall and runoff amounts, and stream flow characteristics.

Characterization of the Potential Significant Contaminant Source Inventories. The potential significant contaminant sources identified in the SWAP area as a result of the three source inventories will be characterized in various ways to evaluate the threats to the public water system. This characterization will focus on factors that the community must consider to further prioritize potential significant contaminant sources, such as distance from the public water supply intake, volume of material stored, method of storage, density of potential sources, mobility and toxicity of chemical sources, and source control practices in place. The purpose of the characterization is to identify the distribution of potential significant contaminant sources within the SWAP area. An indication of the number (high, medium, low compared to other public water supply of similar type and size) of potential sources identified will be determined along with an indication of the proximity of these potential sources to the surface water intake (percentage of sources within the emergency management and corridor management zones). Potential significant contaminant sources within the emergency management and corridor management zones may warrant more detailed investigation because of their proximity to the

public water system intake. In addition, an evaluation of the number of identified potential significant contaminant sources that store large quantities of the identified contaminants of concern will be completed. A generalized watershed land use analysis will be performed to provide an indication as to the relative importance of potential significant point and nonpoint contaminant sources.

The goal of characterizing the potential significant contaminant sources is to provide an overview of the distribution and concentration of the potential significant contaminant sources and to assess the likelihood of the source water being contaminated. The intent of the characterization is to summarize the information to lead the public water supplier and informed citizens to consider protection options for source water. The Susceptibility Analysis will be tailored to the size of the watershed, the type of public water supply (run-of-the-river, reservoir, inland lake) and the location of the surface water intake since each of these factors influence the intensity of land use and the resulting concentration of potential significant contaminant sources.

Review of Water Quality Data. As discussed in Section 3.2.5, all available chemical and biological water quality data (Ohio EPA, water utility, local watershed groups, other regulatory databases) will be collected and evaluated to help provide direct pointers to a source of contamination, to direct the focus for additional source evaluation, or to identify immediate source water protection efforts. If a water quality impact is known, evaluating the potential contaminant sources present may help to determine the origin of the contamination. This in turn may help to focus immediate source water protection efforts.

A water quality impact will be determined by reviewing chemical and biological water quality data from the stream system of the SWAP area and raw and/or finished water from the public water supplier. A water quality impact for synthetic organic compounds and volatile organic compounds will be assumed if the result is at or above the level of detection, since the presence of these parameters usually indicates an anthropogenic source. A water quality impact for nitrates will be indicated if the result is three milligrams per liter or greater (Madison and Brunett, 1985). A contaminant-by-contaminant analysis will take place to establish the concentration of concern for the remaining contaminants of concern. Factors that can be used in the establishment of the concentration of concern include: a percentage of the established maximum contaminant level, human health water quality criteria, or a multiple of the reporting limit or method of detection limit. Background concentrations will be established.

Water quality data for public water systems are available within the Ohio EPA Division of Drinking and Ground Water's Model State Information System database. These data date back to 1980. The data quality and number of parameters sampled have increased to meet requirements of the Safe Drinking Water Act. Consequently, the more recent data will be given greater weight in water quality analysis, but if detections are present all of the data will be reviewed. Ohio EPA Public Drinking Water staff will be consulted when reviewing the water quality data to maximize its utility and to assure that these data are evaluated appropriately.

The sampling requirements for a public water system vary depending on the type of system. Community water systems are required to monitor for suites of inorganic, radiological, microbiological, and organic constituents, as well as trihalomethanes, asbestos, lead, copper, and nitrates. Non-transient non-community water systems have the same requirements as

community systems with the exception of not having to sample for radiological constituents and trihalomethanes. Transient non-community systems, however, are only required to sample for microbiological constituents and nitrates. Since not all parameters are sampled at all systems, the lack of water quality impacts is not a certain indicator of a lack of contamination.

If available intake integrity data suggest that rapid pathways exist for nearshore surface water transport into the public water supply system, Ohio EPA will identify this direct pathway as a threat due to intake integrity in the Susceptibility Analysis. All final decisions on intake integrity will be determined on a site-specific basis using best professional judgement.

3.4.3 Source Water Assessment Report

The Public Advisory Groups and Technical Advisory Committee determined that simply labeling a public water system on some relative scale of susceptibility did not provide any meaningful information and may tend to hinder any further actions at the local level. This is especially true for surface water public water systems since they are all susceptible to contamination. Therefore, the Susceptibility Analysis will be summarized in a narrative format and provided to the public water systems to help determine the likelihood of contamination impacting their drinking water source and to help to identify appropriate protection activities.

The public water systems will be provided a four-part narrative that summarizes the assessment results. The first three parts will describe the sensitivity of the local watershed, summarize the Potential Significant Contaminant Source Inventory, and characterize the water quality data. The final part of the narrative will integrate this information to determine the degree to which the surface water supply is susceptible and to help identify watershed areas (sub-watersheds) for additional evaluation and to direct source water protection activities. The Susceptibility Analyses will be conducted after the source water protection area, emergency management zone, and corridor management zone delineations and inventories are complete and results compiled. This report will provide fundamental and credible information to the public water supply and communities, but it will not provide a simple ranking. The goal of reporting the source water assessment results is to provide pointers to what actions a public water supplier may take to further define and reduce susceptibility through additional evaluation, and development and implementation of protective strategies for source water. An example of the narrative portion of the Source Water Assessment Report is shown in Tables 3-8a and 3-8b. The emergency management zone and the corridor management zone locations will be indicated on a map that accompanies the Source Water Assessment Report.

The Public Advisory Groups and Technical Advisory Committee agreed that a detailed risk assessment of potential significant contaminant sources was beyond the scope of what could be accomplished with available data and resources. This analysis is better done by local decision makers as the bridge from assessment work to protective strategies. Prioritization will take into account the type and volume of contaminants present, location within the source area, history of past releases or violations, and current protective activities at the sources. Experience in watershed management in Ohio has shown that the further prioritization will not be effective unless it is conducted at the local level with input from all individuals potentially impacted (public water supply owners and operators, residents, businesses and politicians, etc.). In order for the planning and implementation of protection activities to be successful, it is imperative that

the individuals impacted by protection activities are involved in the decision making process. Therefore, prioritization will not be conducted during this stage of the assessment process. *A Guide to Developing Local Watershed Action Plans in Ohio* (Ohio EPA, 1997c) helps groups prioritize protection activities in watersheds.

Table 3-8a. Example of the Narrative Portion of the Source Water Assessment Report for Surface Water Sources

Community of Lawrenceville Water Supply SWAP Area

Hydrologic Setting: The Community of Lawrenceville obtains its drinking water directly from Packer Creek which is a portion of the Michael's River basin. The delineated SWAP area has a long narrow shape and a total drainage area of 85.3 square miles. The Packer Creek watershed lies in the Eastern Corn Belt Plains ecoregion of central Ohio. The topography of the basin is typical of that for the ecoregion being gently rolling and exhibiting local relief of less than 50 feet.

The Packer Creek drainage network consists of 70.47 miles of perennial streams. Packer Creek mainstem has an overall length of 28.1 miles and an average fall of 6.5 feet per mile. The major tributaries of Packer Creek are Whiskey Switch Run, Cheesy Creek and Dinner Fork. The tributaries exhibit a much steeper descent (10.2 to 25.3 feet per mile) than those of the Packer Creek mainstem. The average annual precipitation for the area is 38 inches of which 11.6 inches becomes surface runoff and 6.4 inches have the potential to infiltrate and recharge local aquifers. A U.S. Geological Survey stream gauge is located near the mouth of Packer Creek 0.8 miles downstream from the Community of Lawrenceville's drinking water intake. The stream gauge has been in operation since 1982. The annual mean discharge for Packer Creek for water years 1982 - 1996 is 70.6 cubic feet per second (cfs), ranging from a low of 28.7 cfs to a high of 107 cfs.

The soils of the Packer Creek watershed show the influence of continental glaciation and can be grouped into two soil associations: Medway-Genesee-Sloan and Bennington-Pewamo. Both of these soil associations are poorly drained and have moderately slow permeability indicating that rainfall and snowmelt will not drain reasonably well.

Potential Significant Contaminant Sources: The review of the available regulated facility databases indicate that a total of ten (10) potential significant contaminant sources exist in the SWAP area for the Community of Lawrenceville. One (1) potential significant contaminant source (10%) is located in the emergency management zone and three (3) additional potential significant contaminant sources (30%) exist within the corridor management zone. The remaining six (6) potential significant contaminant sources (60%) are clustered in the Cheesy Creek sub-watershed.

Additional potential significant contaminant sources that were identified as a result of the detailed inventories of the emergency management and corridor management zones consist of agricultural activities (corn and soybean production and livestock pasturing), above ground pesticide and fertilizer storage, residential septic tanks, industrial operations (metal plating and plastics production) and a municipal landfill. Some of the industrial sources may have large volumes of potential significant contaminants stored.

The SWAP area for the Community of Lawrenceville is highly dissected by transportation networks due to its long narrow shape. There are 39.6 miles of primary highways that cross the 70.47 miles of perennial streams in a total of 27 locations. Likewise, 79.4 miles of secondary highways cross the drainage network at 49 locations and nine (9) miles of railroad track cross the streams at three (3) locations. Other than the stream crossings themselves, none of the remaining portions of the 128 miles of transportation networks lay within 100 feet of the drainage network.

Table 3-8a. Example of the Narrative Portion of the Source Water Assessment Report for Surface Water Sources (Con't)

The land use in the SWAP area is 72% agricultural, 13% wooded, 11% urban and 4% shrub/scrub.

Water Resource Quality: In 1992, the Ohio EPA conducted biological and chemical water quality monitoring on 37.7 miles (53%) of streams in the middle and lower portions of the Packer Creek watershed. Ten miles (26%) of the monitored streams were found to be attaining their aquatic life habitat use designation. These streams were primarily those associated with the Whiskey Switch Run sub-watershed. Elevated levels of nutrients, especially nitrate-nitrogen, and fecal coliform bacteria were common in the 27.7 miles of the middle and lower portions of Packer Creek and in the Cheesy Creek sub-watershed where the monitored streams were not attaining aquatic life habitat use designation.

The water quality monitoring conducted by Ohio EPA in 1992 was the first time that the ecological health of the Packer Creek watershed was evaluated.

Water sampling conducted by the Community of Lawrenceville's water utility indicates seasonally elevated nitrate-nitrogen and agricultural pesticide concentrations in both the raw and finished water. There have been no occasions when the observed concentrations have been above the established MCLs for these parameters.

SWAP Area Assessment and Protection Activities: The Resource Characterization and analysis of the hydrologic setting of the SWAP area for the Community of Lawrenceville indicates that the water supply is susceptible to possible future contamination. The long narrow shape, relatively small size and soils of the SWAP area present a situation where materials can be easily transported from the land surface to the stream drainage network. In addition, the large number of stream crossings (85 total) provides the opportunity for an accidental release/spill of material to easily get directly into the stream drainage network. Source water protection efforts should be directed toward the establishment of an effective and efficient emergency response plan if one does not currently exist.

Present land use practices appear to be having an adverse impact on the ecological health of the middle and lower portions of Packer Creek and in the Cheesy Creek sub-watershed. This is evidenced by the relative "poor" health of the water resource (74% of the monitored streams not attaining water quality standards) being caused by excessive loading of nutrients. The health of Cheesy Creek may be also impacted by the "cluster" of regulated facilities located in its sub-watershed. Protection activities should focus on the collection of additional information on the sources present in these sub-watersheds to evaluate their risk. In addition, since no water resource information is currently available for the upper 10.1 miles of Packer Creek, Whiskey Switch Run and Dinner Fork, management efforts should focus on the collection of baseline information for these sub-watersheds.

The analysis of the water quality data collected by the Community of Lawrenceville's water utility indicates that the potential exists for contaminant sources to impact the water supply. Potential significant contaminant sources are present in the SWAP area and must be properly managed. Protection options need to be actively considered to further evaluate and manage all potential sources and the Community of Lawrenceville should place a high priority on protecting its drinking water supply.

Table 3-8b. Example Summary Table for the Narrative Portion of the Source Water Assessment Report for Surface Water Sources

Community of Lawrenceville Water Supply SWAP Area

HYDROLOGIC SETTING SUMMARY

Size of SWAP Area	85.3 square miles
Shape of SWAP Area	Long narrow
Number of Stream Miles	70.47 miles
Average Watershed Slope	Local relief of less than 50 feet
Average Stream Gradient	6.5 feet per mile (Packer Creek mainstem)
Average Annual Rainfall	38.0 inches
Average Annual Runoff	11.6 inches
Soil Associations	Medway-Genesee-Sloan & Bennington-Pewamo
Soil Series	Medway, Genesee, Sloan, Bennington and Pewamo

TRANSPORTATION NETWORK SUMMARY

	Within 100 Feet of	Total
Miles of Train Tracks	0.05	9
Miles of Primary Roads	0.25	39.6
Miles of Secondary Roads	0.30	79.4
Miles of Pipelines	0	0

Number of Stream Crossings	Train Tracks	Primary Roads	Secondary Roads	Pipelines
	3	27	49	0

POTENTIAL SIGNIFICANT CONTAMINANT SOURCE SUMMARY

Inventory Summary - Regulated Facilities

	Number	Percent
Source Water Protection Area	10	100
Emergency Management Zone	1	10
Corridor Management Zone	3	30

Inventory Summary - Checklist Facilities

	Emergency		Corridor	
Potential Significant Source Category	Number	Percent	Number	Percent
Agricultural	2	4	30	65
Residential	1	2	7	16
Municipal	0	0	1	2
Commercial	0	0	0	0
Industrial	1	2	4	9

Land Use Analysis

	Area (Acres)	Percent of Total
Urban	6,000	11
Agriculture / Open Urban	39,300	72
Shrub / Scrub	2,180	4
Wooded	7,100	13
Open Water	30	less than 1
Non-Forested Wetlands	0	0
Barren	0	0

3.5 OHIO RIVER SOURCES

3.5.1 Introduction

In 1997, the Ohio River Valley Water Sanitation Commission initiated a work group, comprised of representatives of state drinking water agencies and members of the Commission's Water Users Advisory Committee, to discuss the interstate aspects of SWAP Programs for the Ohio River. As a result, the Ohio River Valley Water Sanitation Commission has taken the lead in the cooperative development of an approach for Ohio River states to use in order to delineate and inventory SWAP areas for public water supplies utilizing the Ohio River as their source water. The goal of the development process was to provide Ohio River states with a consistent approach to conduct Ohio River source water assessments. The cooperative effort has resulted in the development of a process which is very similar to the one developed by Ohio EPA. The Draft Source Water Assessment Strategy for the Ohio River as prepared by the Ohio River Valley Water Sanitation Commission (October 1998) is included in Appendix B of this report. The following summarizes how Ohio EPA will implement this strategy in the State of Ohio.

3.5.2 Delineation

The size and complex nature of the Ohio River led to the development of a tiered delineation system consisting of three protection zones for each Ohio River surface water intake. The tiered delineation system described below is intended to serve as a minimum guideline. Ohio EPA maintains the flexibility to modify the delineated zones based upon site specific needs of the Ohio River water supply intake.

Zone I - Zone of Critical Concern

The area directly adjacent to the Ohio River from 1/4 mile downstream of the intake to a distance of 25 miles (equivalent to a 5 hour time-of-travel using maximum stream velocities) upstream or 1/4 mile below the next upstream intake. The lateral extent of this zone extends 1/4 mile on both sides of the river and major tributaries as identified in U.S. EPA Reach File 1.

Zone II - Zone of High Concern

All 14 digit hydrologic units adjacent to the Ohio River from a distance of 1/4 mile downstream of the intake up to a distance of 1/4 mile below the next upstream intake and all 14 digit hydrologic units adjacent to the major Ohio River tributaries a distance of 25 miles upstream or to the next upstream intake.

Zone III - Source Water Area

The entire portion of the Ohio River basin upstream of the surface water intake.

At a minimum, the entire watershed upstream of the surface water supply intake will be classified Zone III. Within Zone III are Zone II, the "Zone of High Concern", and Zone I the "Zone of Critical Concern". While the protection responsibility of a public water supply ends 1/4 mile below the next upstream intake, as part of the established emergency response/contingency plan, communication channels should be established to warn downstream water supply intakes of an upstream contamination event.

3.5.3 Potential Significant Contaminant Source Inventory

The size and complex nature of the Ohio River led to the development of a tiered approach for conducting Potential Significant Contaminant Source Inventories. Ohio EPA will be performing potential contaminant source inventories within the State of Ohio and will share this information with neighboring states. To insure that data transfer between states can be accomplished, inventory data minimums were established. Table 2 in the draft Ohio River document (October 1998) identifies the information that should be collected about each inventoried potential significant contaminant source. In addition, the following identifies the specific potential contaminant sources that will be inventoried by Ohio EPA in each of the three delineated zones:

Zone I - Zone of Critical Concern

All of the potential significant contaminant sources identified in Table 3 in the draft Ohio River document (October 1998) using existing national, regional and state databases plus field verification.

Zone II - Zone of High Concern

All of the potential contaminant sources identified in Table 3 in the draft Ohio River document (October 1998) using existing national, regional and state databases as well as "localized" in-state information resources.

Zone III - Source Water Area

All of the potential contaminant sources identified in the information that is readily available from U.S. EPA's Envirofacts Warehouse web home page (www.epa.gov/enviro/).

3.5.4 Susceptibility Analysis

Ohio EPA will conduct a susceptibility analysis for each Ohio River public water supply following the process developed for surface water public water supply systems (see Chapter Three, Section 3.4, page 3-18).

3.6 LAKE ERIE SOURCES

3.6.1 Introduction

Two reports evaluating the quality of the finished drinking water produced at the 31 Lake Erie-fed drinking water treatment plants located on Ohio's North Coast were released in mid-1998 (Ohio Lake Erie Commission, 1998; L'Italien and Thorstenberg, 1998). The conclusions presented in these reports indicate that Lake Erie is an exceptional source of high quality drinking water. All of the 31 water treatment plants using Lake Erie as source water were meeting established drinking water quality standards. Also at the same time, no restrictions have been placed on the consumption of Lake Erie drinking water for human health reasons and there have been no identified taste and odor impairments to drinking water in the Lake Erie basin. Efforts to maintain this high quality source water will be promoted by utilizing organizations and agreements with authority over Lake Erie water quality. Examples include the Lake Erie Commission developing the Lake Erie Restoration and Management Strategy, and the International Joint Commission and the associated Great Lakes Water Quality Agreement with the Lake Erie Lakewide Management Plan and the Remedial Action Plans which are mandated

by the Great Lakes Critical Program Act.

For the public water supply systems with intakes located in Lake Erie, the unique nature of each intake will necessitate that a site-specific assessment be conducted. Based on concern over how to establish a protocol for conducting these site-specific assessments, a work group comprised of representatives from each of the U.S. EPA Region 5 states (Illinois, Indiana, Minnesota, Michigan, Ohio and Wisconsin) as well as U.S. EPA Region 5 staff was formed in 1997 to discuss the interstate aspects of SWAP Programs for the Great Lakes.

The State of Michigan has taken the lead in the cooperative development of an approach for each of the Great Lakes states to use in order to delineate and inventory Great Lakes SWAP areas. The goal of the development process was to provide each of the Great Lakes states with a consistent approach on how to conduct source water assessments for public water supplies utilizing the Great Lakes as their source water. The proposed source water assessment protocol for Great Lakes sources (revised 7/30/98) is included in Appendix C of this report. The following summarizes how Ohio EPA will implement this protocol in the State of Ohio.

For the 31 Lake Erie-fed drinking water treatment plants, Ohio EPA will continue to participate in the development of the source water assessment protocol for the Great Lakes sources. Determinations of the potential for local contaminant impact will be made according to the established protocol.

3.6.2 Initial Survey

As with other surface water systems, the SWAP area for the public water systems utilizing Lake Erie as their source water is the watershed upstream of Lake Erie. The general high quality of the Lake Erie source water, however, allows source water assessment efforts to focus on impacts from shoreline activities, lake tributaries discharging close to system intakes, and spills. Ohio EPA will conduct an initial survey of each Lake Erie public water supply in order to assess possible local source water impacts. Staff will review the intake siting reports and past water quality records. In addition, each water treatment plant superintendent will be interviewed in order to gain knowledge of any raw water quality fluctuations (including fluctuations caused by intake integrity). As a result of this review, a determination will be made, following the protocols established by the workgroup, if the source is impacted from localized sources of contaminants.

3.6.3 Source Water Assessment

If the initial public water supply system survey indicates that the intake is not impacted by potential shoreline contaminants, the assessment would reference the general Lake Erie water quality trends within the source water assessment area.

For those public water supply systems where the initial survey indicates a potential for shoreline impacts, the assessment will become more complex and site specific. The next step in the process is to delineate the area that contributes to the potential impacts. All potential significant contaminant sources in the delineated area will be inventoried and evaluated for their impact on the quality and treatability of the raw water.

The source water assessment will evaluate the following factors:

- General condition of Lake Erie,
- Discharge on the shoreline, runoff from the shoreline or the location of facility near the intake,
- Prevailing wind direction,
- Quality of the sediment ,
- Potential for accidental spills to occur, and
- Potential treatments at or near the intake.

3.6.4 Susceptibility Analysis

Ohio EPA will conduct a susceptibility analysis for each Lake Erie public water supply following the process developed for surface water public water supply systems (see Chapter Three, Section 3.4, page 3-18).

3.7 SUMMARY

Figure 3-6 illustrates the products from each step in the assessment process. Step 1 provides a visual tool that will aid Ohio EPA and the public water supplier in delineating the emergency management zone. In addition, it involves the public water system owner-operator, a key stakeholder in SWAP implementation, early in the assessment process. The product from step 2 provides an opportunity to inform the public water supplier and community stakeholders about SWAP while also encouraging local stakeholder participation in inventory and protection activities. At the same time, it allows Ohio EPA to verify locational data and delineation boundaries of the emergency management zone and corridor. Step 3 incorporates corrections and changes from Step 2, adds in new corridor and emergency management zone inventory data, and the Susceptibility Analysis. Once Step 3 is done, Ohio EPA's assessment is complete.

The four step assessment process for surface waters--Delineation, Resource Characterization, Potential Significant Contaminant Source Inventory, and Susceptibility Analysis--lays the foundation for the most critical step in source water assessment--protective actions. Without protective actions, conducting source water assessments will do little to protect Ohio's drinking waters. As communities continue to grow and change after the initial assessments are completed, assessments will need to be updated periodically. Experience with local watershed action groups throughout the state indicate that plans generally need to be updated every five years. Therefore, Ohio EPA recommends that once the first cycle of source water assessments is completed, updates should be undertaken every five years. In addition, as new public water systems are built and new intakes added to existing systems, new assessments will need to be done.

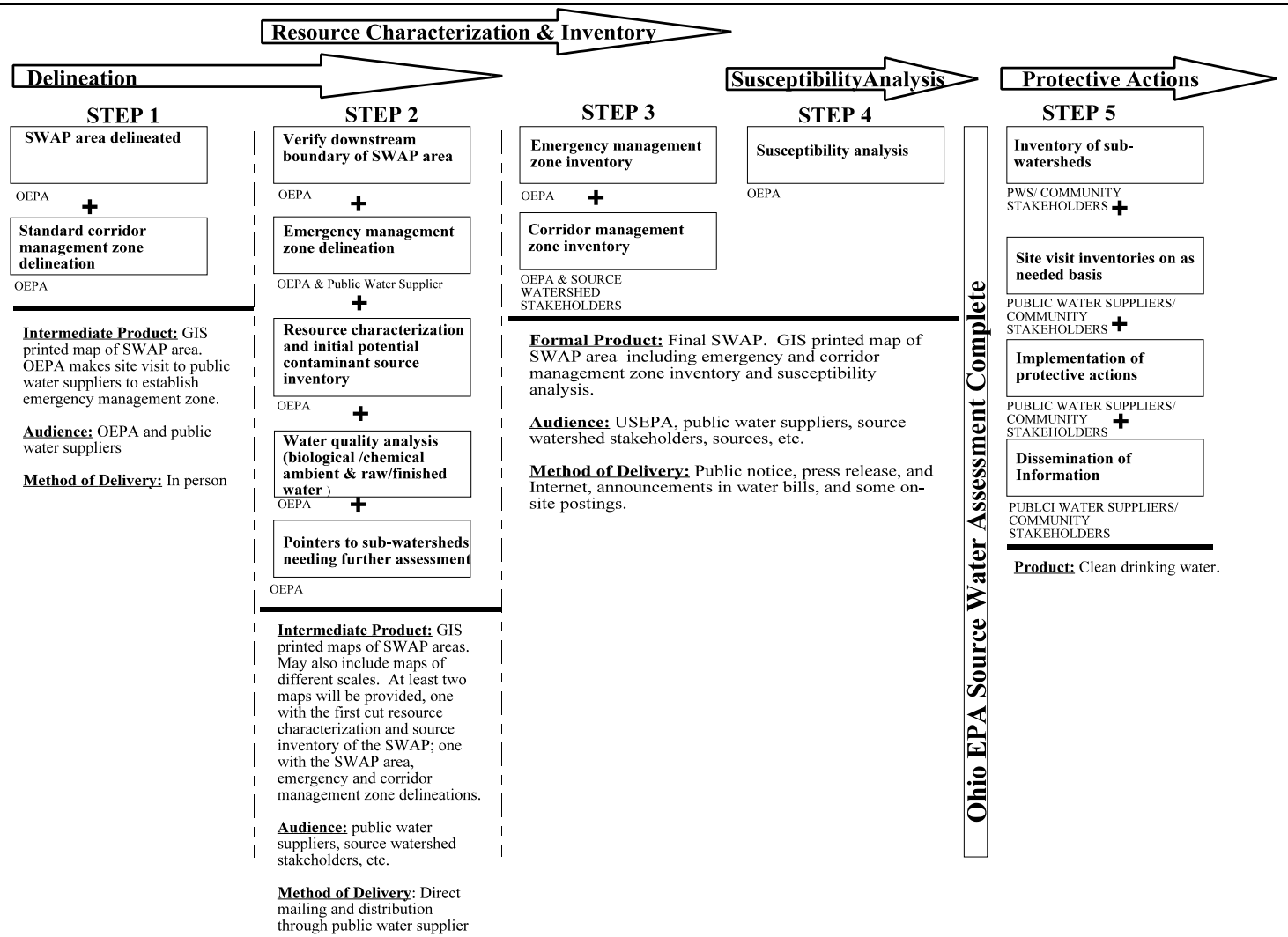


Figure 3-6. Source Water Assessment and Protection Process for Surface Water Systems

CHAPTER FOUR
Disseminating Results of Assessments and Public Awareness

4.0 INTRODUCTION

A primary goal of Ohio's SWAP Program is to raise public awareness and build capacity throughout the State to implement ongoing assessment and protection activities. Without adequate public knowledge and awareness of SWAP activities, local support of protection activities is likely to be weak. Participants in the public groups that helped develop the Ohio SWAP Program repeatedly emphasized the importance of educating people about public drinking water and the need to protect it. All agreed that building public awareness throughout the assessment process and making assessment results easily accessible and understandable is critical to protecting Ohio's source waters.

4.1 DISSEMINATION OF RESULTS

Once a source water assessment has been completed, the information must be transmitted into the hands of the people who can implement protective measures. As discussed repeatedly throughout this document, implementing effective protection programs requires the involvement of a large number of different individuals and organizations. Both the Technical Advisory Committee and the Central Office Public Advisory Group spent an entire day brainstorming to identify key stakeholders and define what role they play in source water protection. A master list of over 150 stakeholder groups was developed and then further divided into five major categories:

- Public water systems owner/operators
- Local state and federal agencies
- Local officials/decision makers
- Consumers of public water
- Owner/operators of potential significant contaminant sources

The list of categorized stakeholder groups is included in this document as Appendix D.

The Central Office Public Advisory Group also discussed what type of information each of these groups needs to either promote or support their source water protection efforts. This included the results of assessments as well as other informational needs. It became readily apparent that each group needs different types of information and that the information needed to be organized in various formats adapted to their levels of interest and familiarity with the subject.

It is proposed that four basic types of information packages will be created for dissemination of SWAP information: (1) detailed SWAP area reports; (2) general SWAP area reports; (3) state and regional summaries of SWAP information; and (4) general information about Ohio's water

resources, public drinking water, and SWAP efforts. In several instances the target audience is broad, but the active distribution of reports may only be to a subset of this audience for reasons of practicality. Wherever this occurs, Ohio EPA expects recipients of the reports to make copies available to the broader audience. Public water suppliers are required under Consumer Confidence Report requirements to make the information available. The following sections describe this in greater detail, as well as what will be included in each of these packages, to whom they are targeted and why, and how they will be made available.

4.1.1 Detailed SWAP Area Reports

The main product of source water assessments will be a detailed SWAP area report for each SWAP area in Ohio. Table 4-1 highlights the components of these reports. The core of each of these reports will be the four-part susceptibility narrative, which will be written in nontechnical language and will discuss the hydrogeologic sensitivity of the area, numbers and types of potential significant contaminant sources, water quality, and recommendations regarding appropriate protection strategies (see examples presented as Tables 2-8 and 3-8 in previous chapters). Also included with each narrative will be a map of the SWAP area showing features such as roads, rivers, municipal, township and county boundaries, the location of the SWAP boundaries, and the locations of the potential significant contaminant sources (see Figures 4-1 and 4-2 for sample maps). The locations of the potential significant contaminant sources will be keyed to a table listing the sources' names and addresses, and the types of chemicals that are likely to be handled at that source (see Table 4-2 for sample table).

Other supporting information will be provided as part of the detailed SWAP area reports. "Meta-data", or information concerning where, when, how, and by whom the data was collected may also be provided. Finally, the package will include a generic fact sheet describing how the assessment was conducted. This fact sheet will be different for ground water and surface water systems, since the assessment process for these two types of systems is different.

Table 4-1. Detailed SWAP Area Report

Report includes:
- Susceptibility Analysis
- Map
- Table of potential significant contaminant sources
- "Meta-data" key
- Database printout
- Fact sheet

Target Audience:
Public water system operators
Local decision-makers

Distribution:
1. Ohio EPA direct mailing to public water systems.
2. Public water systems post on-site, announce availability to customers, and keep file on copy at local libraries.
3. Available from Ohio EPA upon request.

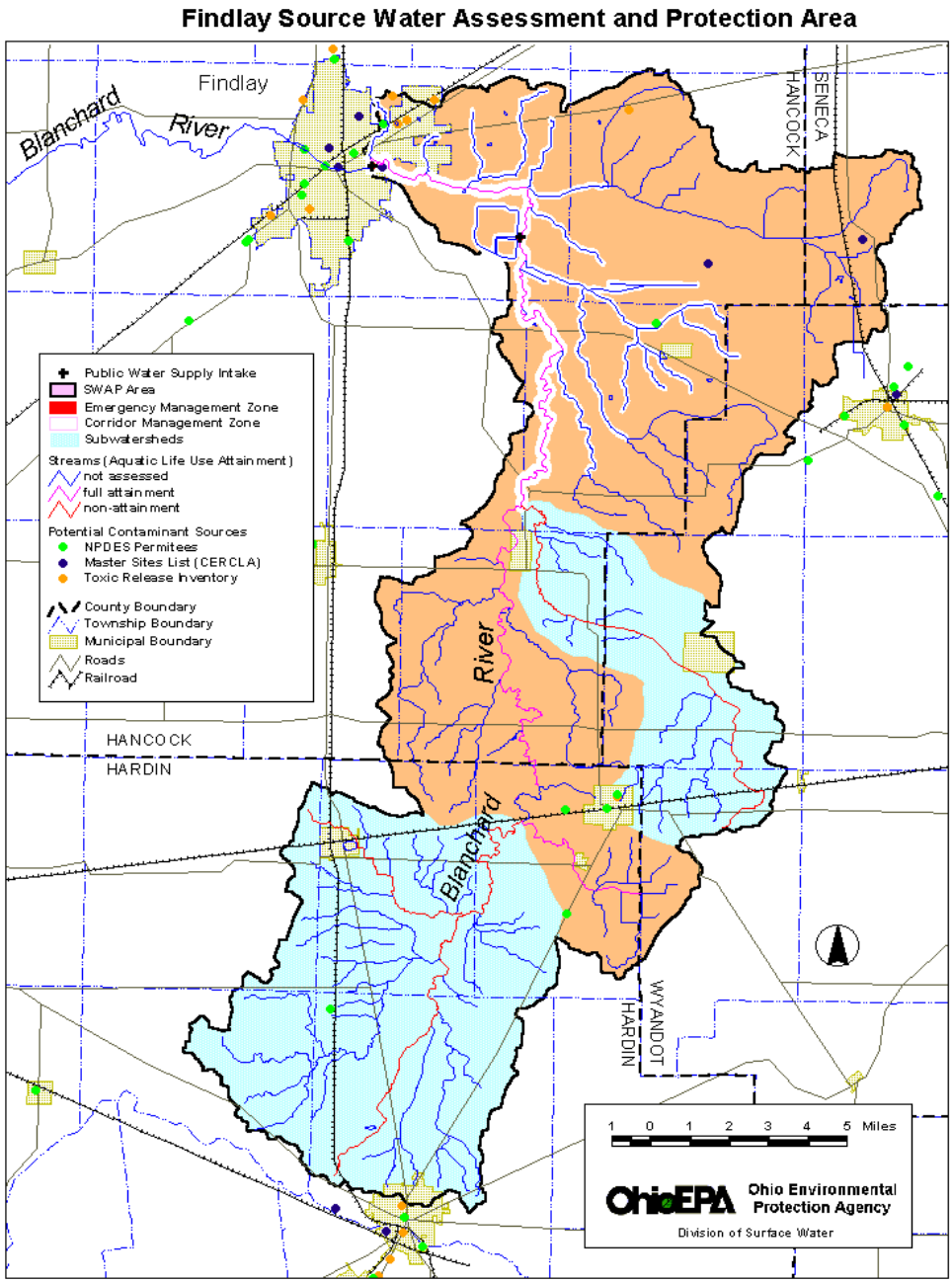


Figure 4-1. Example of a SWAP Map for a Surface Water System (completed for the City of Findlay's public water system)

Notes:

(1) This is a sample map for illustrative purposes, based on existing data. The final format of these maps may reflect minor adjustments.

(2) The emergency management zone is too small to be visible on this map.

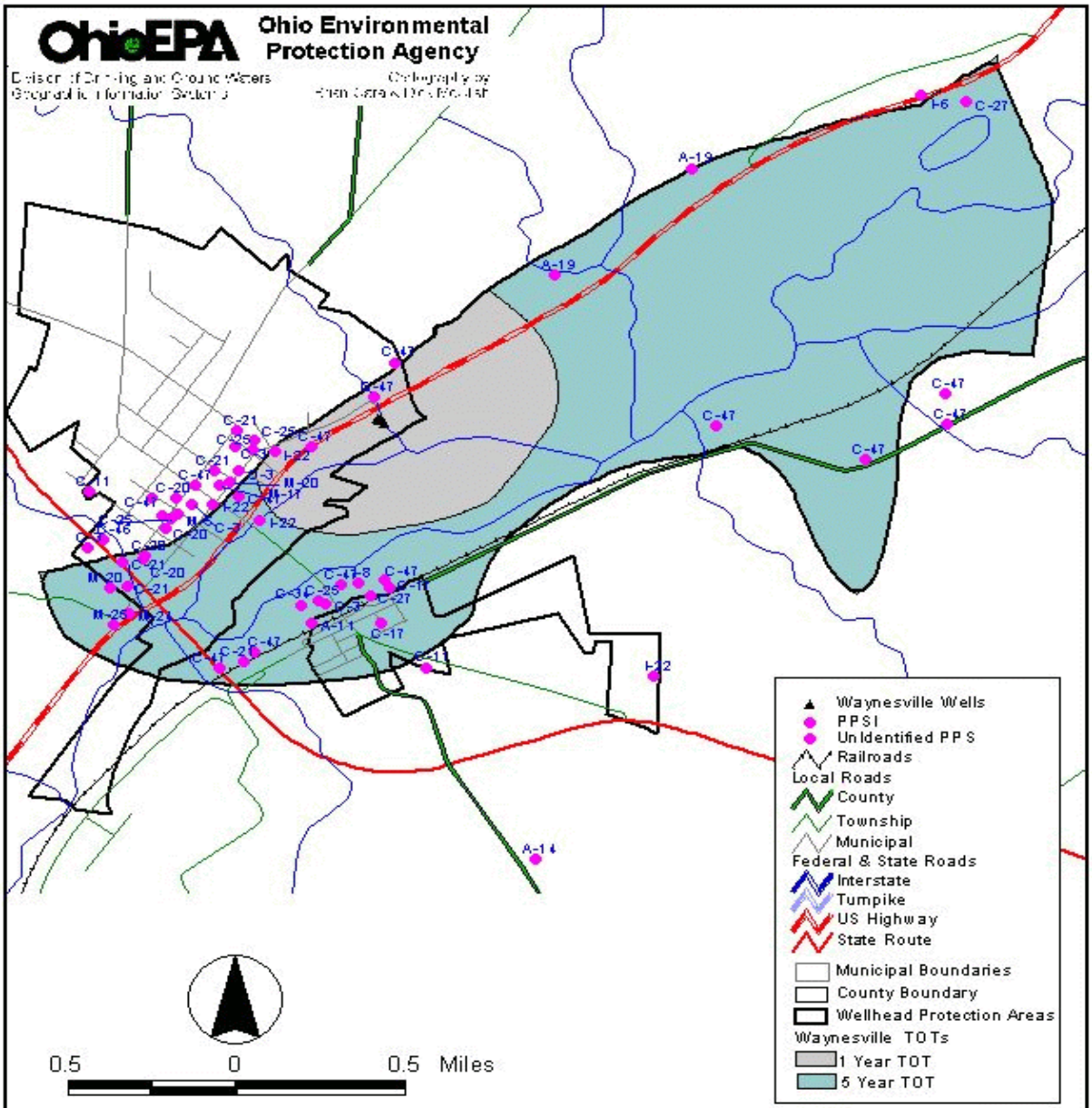


Figure 4-2. Example of a SWAP Map for a Ground Water System (Completed for the Village of Waynesville's public water systems).

Note:
This is a sample map for illustrative purposes, based on existing data. The final format of the maps may reflect minor adjustments.

Table 4-2. Sample Table of Potential Contaminant Sources (completed for the Village of Waynesville's public water system).

Key to Chart Abbreviations

UST = Underground Storage Tank AST = Aboveground Storage Tank LP = Liquid Petroleum
LUST = Leaking Underground Storage Tank WWTP = Wastewater Treatment Plant

Map Code	Source Category	TOT Zone	Source	Source of Information
A-11	AGRICULTURAL	5	ASTs,UST, Possible pesticides and nutrients	Windshield Survey/Database Search
A-14	AGRICULTURAL		ASTs, Possible pesticides and nutrients	Windshield Survey
A-19	AGRICULTURAL	5	old farm, farm equipment, Possible pesticides and nutrients	Windshield Survey
A-19	AGRICULTURAL	5	ASTs,farm equipment, Possible pesticides and nutrients	Windshield Survey
C-3	COMMERCIAL		barrel in front	Windshield Survey
C-3	COMMERCIAL		storage of petroleum products	Windshield Survey
C-3	COMMERCIAL		3 temporary gas tanks	Database Search
C-3	COMMERCIAL	5	garage, hardfill, construction debris	Windshield Survey
C-3	COMMERCIAL		body shop	Windshield Survey
C-11	COMMERCIAL		cemetery	Windshield Survey
C-11	COMMERCIAL		cemetery	Windshield Survey
C-17	COMMERCIAL	5	USTs, saw mill, old dog food factory	Windshield Survey
C-17	COMMERCIAL	5	slaughterhouse	Windshield Survey
C-20	COMMERCIAL	5	furniture stripping	Windshield Survey
C-20	COMMERCIAL	5	furniture stripping	Windshield Survey
C-20	COMMERCIAL		furniture stripping	Windshield Survey
C-20	COMMERCIAL		furniture stripping	Windshield Survey
C-21	COMMERCIAL	5	gasoline, oil, and kerosene tanks	Windshield Survey/Database Search
C-21	COMMERCIAL	5	gas tanks removed/site is no longer a gas station	Windshield Survey/Database Search
C-21	COMMERCIAL	5	storage of petroleum products	Windshield Survey/Database Search
C-21	COMMERCIAL		gas tanks	Windshield Survey/Database Search
C-21	COMMERCIAL		gas tanks	Database Search
C-25	COMMERCIAL		current carpet store was a gas station	Windshield Survey
C-25	COMMERCIAL		old Marathon Gas Station	Windshield Survey
C-25	COMMERCIAL		once a gas station/still an auto repair	Windshield Survey
C-25	COMMERCIAL	5	USTs recently removed	Windshield Survey/Database Search
C-27	COMMERCIAL	5	ASTs,heavy equipment, barrels	Windshield Survey
C-27	RESIDENCE	5	junked appliances, debris in yard	Windshield Survey
C-34	COMMERCIAL	5	lumber and paint store	Windshield Survey
C-46	COMMERCIAL		LP tank, machinery, AST debris	Windshield Survey
C-47	COMMERCIAL	5	hard fill, cinder blocks, DERR incident	Windshield Survey/Database Search
C-47	COMMERCIAL	1	camper sales&bottled gas	Windshield Survey
C-47	COMMERCIAL		fuel oil for home heating	Windshield Survey
C-47	COMMERCIAL	1	old canal, lagoon, partially filled	Windshield Survey
C-47	COMMERCIAL		AST	Windshield Survey
C-47	COMMERCIAL		location of Hazardous Material OKI 91	Database Search
C-47	COMMERCIAL	5	fill area	Windshield Survey
C-47	COMMERCIAL	5	barrels, debris(plastic scraps)	Windshield Survey
C-47	RESIDENCE		AST	Windshield Survey
C-47	RESIDENCE	5	ASTs, misc. debris	Windshield Survey
C-47	RESIDENCE		fuel oil tank	Windshield Survey
C-47	RESIDENCE	5	junked vehicles, tires	Windshield Survey
C-47	RESIDENCE	5	residence with barrels and junk	Windshield Survey
C-47	RESIDENCE	1	debris in yard-possible AST	Windshield Survey
C-47	RESIDENCE		ASTs	Windshield Survey
C-47	RESIDENCE	5	AST heating oil	Windshield Survey
I-6	INDUSTRIAL		lagoon, old gravel pit	Windshield Survey
I-8	INDUSTRIAL	5	demolition landfill-closed	
I-9	INDUSTRIAL		machine shop	Windshield Survey
I-22	INDUSTRIAL	1	old oil well	Database Search
I-22	INDUSTRIAL		old oil well	Database Search
I-22	INDUSTRIAL		old oil well	Database Search
I-22	INDUSTRIAL		old oil well	Database Search
M-5	MUNICIPAL		gas tanks	Windshield Survey/Database Search
M-17	MUNICIPAL		Used to have LUST	Windshield Survey/Database Search
M-20	MUNICIPAL		UST Leak, gasoline	Windshield Survey/Database Search
M-20	MUNICIPAL	5	gas, kerosene, diesel, salt storage	Windshield Survey/Database Search
M-24	MUNICIPAL	5	WWTP	Database Search
M-25	MUNICIPAL	5	solid fill area, old WWTP closed	Database Search

Target Audience. While the detailed reports will be mailed directly to only the public water systems for practical reasons, the target audience for the detailed SWAP area reports is the owners and operators of public water systems and local decision-makers. As the persons responsible for leading protection activities within their SWAP areas, public water system owner/operators will need to know as much as possible about why their SWAP area is sensitive (or not), where the potential significant contaminant sources are located, whatever information is available about those sources, and any other detailed information related to the quality of the source waters. The owners of public water systems are also responsible for informing their customers and other local stakeholders about their SWAP efforts.

Similarly, local officials are the first group of people who need to understand and support source water protection efforts, because many of them will be key figures in promoting, developing, and implementing protection efforts. Local officials include elected officials such as mayors, city council members, county commissioners, and township trustees, as well as appointed officials such as the utility, emergency management agency, planning and health directors. While others such as watershed groups, businesses, agencies and planners may also play an important role in implementing protection activities, local officials are normally in the positions to make local decisions regarding land uses.

Dissemination and Notification. Ohio EPA will mail each system's SWAP area report directly to the system operator immediately after it is complete. Other audiences interested in obtaining this detailed information will be able to request it from Ohio EPA and the public water system.

4.1.2 General SWAP Area Reports

A general SWAP area report will be the primary tool used to disseminate the results of individual assessments at the local level (Table 4-3). It will be very similar to the detailed report only it will not include as much of the supporting information. It will include the narrative and the map of the SWAP area showing the locations of the potential significant contaminant sources. Rather than providing details such as the name and address of each potential significant contaminant source, the map will be keyed to a table indicating the general categories

Table 4-3. General SWAP Area Report

Report includes:
- Susceptibility Analysis
- Map
- Fact sheet

Target Audience: local decision-makers, consumers, watershed groups, owner-operators of facilities/areas identified as potential contaminant sources.

Distribution:
1. Ohio EPA direct mailing to public water systems, county libraries, county commissioners, and administrators of municipalities.
2. Publication on Ohio EPA's web site.
3. Available from Ohio EPA upon request.

of contaminant sources (see Figures 4-1 and 4-2, and Table 4-2 for example maps and table of

general categories to be used).[1] The generic fact sheet describing how the assessment was conducted will be included as well as some of the supporting educational materials described in Section 4.1.4.

Target Audiences.
Public Water System Owners and Operators. (see Section 4.1.1)

Local officials/Decision makers. (see Section 4.1.1)

Local watershed groups. Over seventy active watershed groups exist in Ohio. It is anticipated that many of these local watershed groups will be active in source water protection. Information generated from the assessments may also support their current activities. At a minimum, they will want to know what other activities are occurring in the watershed related to their efforts.

Owner/operators of facilities/areas identified as potential contaminant sources. These individuals need to be aware that they are located in a SWAP area. How they and their employees conduct their daily activities may have a profound effect on the quality of the public drinking water. Most people do not intentionally cause environmental problems, and are willing to do their part to avoid them, provided they understand the situation.

Consumers. Consumers of public drinking water need to be made aware and encouraged to support local source water protection activities. While it may seem that this group would naturally support any efforts to protect the source of their drinking water, this is not always the case, especially when it means they may have to pay more for their water. The general SWAP area reports will provide important information about their public water supply in clear, nontechnical language.

Dissemination and Notification. The general SWAP area reports will be sent directly to owners and operators of public water systems along with the detailed report. In addition, Ohio EPA will make these reports available through its web site, in county libraries, and by request. As discussed in Chapter 5, Ohio EPA staff will be conducting extensive outreach activities to promote protection activities at the local level as assessments are completed. The general SWAP area reports will be a valuable tool and will be disseminated through these efforts.

The general SWAP area report is intended to aid the public water suppliers in their public outreach efforts. The Consumer Confidence Report rules that emerged from the Safe Drinking

[1]Most members of both the Technical Advisory Committee and the Public Advisory Groups felt strongly that the names and addresses of potential significant contaminant sources should not be distributed automatically to everyone. While that information will be available from Ohio EPA upon request, members of the committees felt that *actively* distributing that level of detail would have the potential to create hard feelings with the owners of those potential significant contaminant sources. Because local business communities tend to be more organized and active than other segments of most communities, that antagonism could actually inhibit the implementation of local protection activities. Overall, providing the names and addresses of potential significant contaminant sources is not needed to promote local support for protection activities. A map of general categories of potential contaminant sources in relation to the SWAP area, along with the Source Water Assessment Report, provides good information on the relative susceptibility of a public water system.

Water Act amendments of 1996 require community public water supply operators to notify their customers that the SWAP report is available and where/how they can get a copy. It also requires systems to include a brief summary of the susceptibility of the drinking water source using language provided by the State. The narratives being prepared by Ohio are designed to meet these requirements and to provide uniform reporting on public water system susceptibility across the state. The last paragraph of the Susceptibility Analysis Report will provide a summary of the system susceptibility that is suitable for inclusion in the Consumer Confidence Report. Local governments may also wish to post the information to their web sites.

It is anticipated that both individual and regional summaries of assessments will be made available on a regional basis as assessments are completed. For example, if SWAP summaries are completed on a county basis, Ohio EPA will wait until a group of counties is complete, integrate them into a summarized regional report, and then announce both the individual and regional reports are available through press releases and/or citizen advisories. As noted in Chapter 2, SWAP efforts for ground water systems are tied directly to the schedule of aquifer mapping that is being completed by the Ohio Department of Natural Resources' Division of Water. Once the Division staff complete aquifer mapping for one portion of the state, Ohio EPA will begin SWAP assessment work in that portion of the state. Therefore, regional SWAP summaries for ground water systems likely will be issued in accordance with that schedule. Regional SWAP summaries for surface water systems may be issued on their own schedule; however, if all SWAP summaries are organized *by watershed*, it is likely that the summaries for ground water systems and surface water systems will be issued simultaneously.

4.1.3 Statewide and Regional SWAP Reports

Ohio EPA will utilize a geographic information system and database to generate statewide and regional reports of source water assessment information. These reports will consist of a map of a region, showing the boundaries of the various SWAP areas, along with a narrative listing the number and names of the ground water and surface water public water systems in that region, a general description of regional susceptibility issues, and summaries of land uses and various types of potential significant contaminant sources (Table 4-4). For example, a report may note the percentage of land designated as agricultural, commercial, residential, industrial, and undeveloped within a particular SWAP area. It may also state the number or percentage of the various types of potential significant contaminant sources. By reviewing one of these regional reports, an interested party can determine the areas with the highest density of various types of contaminant sources or land uses. The SWAP areas that are of greatest interest to a given group can then be

Table 4-4. Regional SWAP Report

Report includes:
- Regional map showing SWAP boundaries, locations of public water systems and potential significant sources
- Resource Characterization
- Land use and potential significant sources statistics

Target:
Planning agencies, state/federal agencies, environmental groups

Distribution:
1. Ohio EPA direct mailing to planning agencies and possibly to environmental groups.
2. Direct mailing to county libraries.
3. Publication on Ohio EPA's web site.
4. Available from Ohio EPA upon request.

identified. For more detailed information, the group will be able to request the specific SWAP reports from Ohio EPA or from the individual public water suppliers.

By using a geographic information system, Ohio EPA is able to generate regional summaries for basically any geographic area. This may be a municipality, a county, a watershed, or any other area of interest. Ohio EPA currently generates maps using GIS for the entire state and for each county on a routine basis for distribution. Because these reports will be widely publicized and available through several avenues, they will be a major part of the general public education process. In addition, they will guide interested parties toward specific SWAP reports.

Stakeholder Audiences.
Local decision-makers. (see discussion of this group under Section 4.1.1)

Local, state, and federal regulatory and management agencies. Local, state and federal agencies will be the principal audience for state and regional reports. The agencies listed on the Key Stakeholder List in Appendix D all have some responsibility for protecting Ohio's waters. They can enhance this effort by incorporating recognition of Ohio's SWAP areas into their own regulations and procedures. They also can prioritize their own educational and protective outreach efforts to focus on SWAP areas, especially the areas that are most impacted by human activities. For example, the "319 grants" of the Clean Water Act, awarded annually by U.S. EPA (and administered by Ohio EPA) are required to be targeted to those areas with the most serious water quality problems. The regional SWAP reports can be used to target such areas.

Environmental organizations and associations. These groups clearly have an interest in such information. The quality of public drinking water is a high priority issue with most environmental groups. Regional SWAP reports will help these groups focus their own grass roots efforts.

Others. Students researching environmental topics and environmental consultants will be able to use these summaries to target their own searches for detailed information about the hydrogeologic characteristics of an area. Developers may use these summaries to determine where development may be less desirable and may be resisted by the local residents. Anyone with an interest in Ohio's source waters and/or public drinking water supplies will be able to get an overall picture of the situation without having to sift through 6,000-plus individual reports.

Dissemination and Notification. Ohio EPA currently mails county maps showing the locations of SWAP areas for ground water systems to the Natural Resources Conservation Service, the Ohio and county emergency management agencies, the Ohio Department of Transportation, the State Fire Marshal's Office, the Division of Environmental and Financial Assistance and Ohio EPA district offices. Other audiences Ohio EPA may target for regional summaries include county commissioners and the six designated Ohio planning agencies in Ohio. Efforts are also underway to make these summaries accessible through the Ohio EPA web page.

4.1.4 General Educational Materials on SWAP

As discussed in Chapter 5, Ohio EPA will be developing a variety of general educational materials on Ohio's water resources, public water systems and SWAP activities. The following items are some of the educational materials suggested by the public advisory groups:

Brochure/Fact Sheet on SWAP Program. A brochure or fact sheet on the SWAP program goals and objectives, and what individuals can do to get involved.

Brochure/Fact Sheet on Summary Data. A brochure or fact sheet summarizing facts about Ohio's source waters including: numbers of ground water and surface water public water systems and SWAP areas, general description of regional susceptibility issues, summary of source information, nature of regional issues, etc.

Guidance on Protective Strategies for Contaminant Sources. One of the most needed types of educational materials identified by the SWAP advisory groups was information on how each type of potential significant contaminant source can reduce their impact or threat of impact to public drinking water. Fact sheets or brochures may be created or developed from existing materials that will highlight pollution prevention methods. Many of these types of brochures are already available through other programs such as Ohio EPA's Office of Pollution Prevention.

Articles. Articles may be submitted to trade journals and newsletters, magazines, newspapers, and the Internet, concerning various aspects of the SWAP process as it evolves.

Public Service Announcements. Another idea was to develop 15-30 second public service announcements for audiotape or videotape, that could be run by radio and television stations around the state.

Press packet. Once Ohio's SWAP Program is approved by the U.S. EPA, Ohio EPA plans to organize a "kickoff" press event, which would involve distributing press packets including some of the information listed above. At a minimum the packets would include a press release announcing the program, and the brochure/fact sheet describing the goals and objectives of the program

Posters. A poster will be created featuring a map or maps of Ohio that show the locations of the ground water and surface water public water systems and their SWAP areas.

Assistance from U.S. EPA. U.S. EPA Region 5 has expressed interest in assisting states with the development of general educational materials that could be disseminated by all the states within the region (i.e., Minnesota, Wisconsin, Illinois, Indiana, Michigan, and Ohio). It is possible, for example, that a SWAP video could be completed by the Region. Developing a coloring book for children similar to Ohio EPA's coloring book about wellhead protection (titled *Once Upon A Wellfield*) is another possibility. Developing the fact sheets/brochures on protective strategies for individual sources (described above) would greatly assist the Region's public water suppliers in initiating source water protection strategies.

4.2 PROVIDING INFORMATION ON HOW TO GET INVOLVED

Distributing results of completed assessments is just one aspect of dissemination. One of the key recommendations from the combined technical and public advisory groups was that Ohio EPA provide ample opportunity for local stakeholder participation in source water assessment and protection activities *from the beginning*. Specifically, the advisory groups suggested that Ohio EPA disseminate information about *how* to get involved in source water assessment and protection activities as a part of its statewide SWAP Program dissemination plan. The advisory groups felt strongly that early involvement of the public could make or break the success of the program. Specific recommendations of the advisory groups included:

- **Personal presentations and workshops.** These informational workshops would improve awareness at the local level about the program as well as provide the opportunity for the public to learn how they can become involved. Ideally, these workshops would be conducted prior to and during the assessments, held in the regions where the assessments are being conducted.

- **Training.** The advisory groups also suggested that Ohio EPA consider developing a training program for individuals interested in assisting Ohio EPA in conducting the source water inventories, particularly those for surface waters. Training would also provide an outlet for involving and raising awareness levels in students at local schools and universities.

To better inform the public of opportunities for involvement with SWAP, Ohio EPA will also initiate and continue a media campaign while assessments are being conducted. Prior to commencement of the first assessments and again, as groups of assessments are completed, Ohio EPA will announce a schedule of how and when assessments will be done, how to get involved, and how to get copies of completed assessments. This information will at a minimum be broadcast through press releases, and over the Internet.

4.3 SUMMARY OF DISSEMINATION PLAN

Table 4-5 highlights the dissemination plan for the various packages and their stakeholder groups. Since these reports are public information, anyone will be able to request a copy of any specific report from Ohio EPA's Division of Drinking and Ground Waters. However, the table identifies with check marks the stakeholder groups that will receive a copy of a report either through an Ohio EPA direct mailing, or via the local public water supplier.

As Ohio EPA begins to conduct source water assessments, the dissemination packages and plan may need to be modified to meet changing needs. However, Ohio EPA is committed to providing (1) detailed, site-specific SWAP information designed to help move public water system owner/operators and other stakeholders toward protective strategies; and (2) regional summaries of SWAP information for all stakeholders, to help integrate water quality efforts by other agencies, and to help prioritize water quality monitoring and protective activities. Finally, Ohio EPA is committed to disseminating general information about the SWAP Program and protection of drinking water supplies, throughout the implementation of the SWAP assessment

activities, and into the future. All of these materials will be written at a level appropriate to the background knowledge of the target audiences.

Table 4-5. Dissemination Plan

Stakeholders*	Information Packages			
	Individual Assessment	Generalized Assessment	Regional Summary	General Information
water suppliers	✔			
potential contaminant sources		✔		✔
media			✔	✔
municipal and township officials		✔	✔	
county elected officials		✔	✔	
planners			✔	✔
regional planning agencies			✔	
cooperating state and local agencies			✔	
environmental groups			✔	✔
watershed groups		✔		
transportation			✔	
business and industry (associations)			✔	
federal agencies and organizations			✔	
resource extraction		✔		
development		✔		
land holding agencies			✔	
consumers		✔		
developers (consumers)		✔		
businesses (consumers)		✔		
civic and local associations		✔		✔

*A detailed list of stakeholders can be found in Appendix D.

CHAPTER FIVE
Ongoing Source Water Assessment and Protection Activities

5.0 INTRODUCTION

The purpose of the Ohio SWAP Program is to protect the health of people using public water supply systems and to preserve Ohio's water resources for future generations. Completing source water assessments alone does not achieve this purpose. Once an assessment has been completed and potential significant sources of contamination have been identified, strategies for preventing and remediating water quality impacts must be determined and put in place. In addition, mechanisms need to be established for updating assessments and for measuring the effectiveness of chosen protection activities.

This Chapter discusses how Ohio EPA proposes to implement protection activities and ongoing assessments after the initial source water assessments are completed and disseminated. It first describes Ohio EPA's commitment to pursue protection programs for all public water systems (Section 5.0). It then provides an overview of the general protection strategies that will be promoted at both the statewide and the individual SWAP area level (Sections 5.1, 5.2 and 5.3). The last two Sections (5.4 and 5.5) describe approaches for updating assessments and for measuring the effectiveness of Ohio's SWAP Program and local protection efforts.

5.0.1 Ohio EPA's Commitment to Source Water Protection

Ohio EPA is committed to the ongoing assessment and protection of all public water systems in Ohio. The Agency will continue to implement its approved Wellhead Protection Program through the SWAP Program. This includes provisions to promote and implement source water protection measures. Ohio EPA will also integrate the SWAP Program with the Clean Water Act programs established to protect Ohio's water resources. Specifically, the Agency will incorporate source water protection initiatives into its ongoing Watershed Strategy. This Strategy provides an overall framework for addressing environmental problems on a watershed basis. The Division of Surface Water is the vanguard of the watershed approach for Ohio EPA and will be instrumental in not only pursuing source water protection initiatives for public water systems using surface water, but also in making source water protection an integral part of the Watershed Strategy.

For the foreseeable future, source water protection activities will be pursued primarily through intensive education, outreach, and incentive programs, rather than by enforcement. There currently are no state regulations specifically requiring either assessment or protection activities. Moreover, the federal mandate from the Safe Drinking Water Act is only for completion of the *initial* assessments. Ohio EPA will, however, continue to use existing authorities to require source water protection planning for certain water systems. For example, the agency currently requires source water protection planning as a condition of new public water system well approvals. It will also continue to examine the legal framework for additional ways to promote and implement protection activities. One example would be requiring source water protection

plans to be developed by public water systems as a condition for receiving a Water Supply Revolving Loan Account Program loan. Additionally, the development of a source water protection plan could be promoted in the form of a Supplemental Project (SEP) as part of an enforcement settlement against a public water system.

While requiring source water protection may seem to be the best alternative, experience has shown that for source water protection to be effective, it needs to be locally driven. The public water system, local decision makers, and those people who could potentially be affected by protection requirements, have to recognize the need for source water protection. They also have to be willing to commit the time, the resources and the energy needed to establish effective protection measures. Simply requiring public water systems to prepare source water protection plans does not achieve the objectives of the program.

5.0.2 Key Partners in Source Water Protection

As discussed in Chapter 4, an effective SWAP program requires the cooperation of a large number of different individuals and organizations at the federal, state and local level. This includes the public water supplier, local officials and decision makers, state and federal officials, owners and operators of potentially significant contaminant sources, a variety of public and private organizations and associations, and private citizens. Many of these groups will have a role in developing source water protection initiatives at both the statewide and individual SWAP area levels. Table 5-1 provides a brief listing of a few of the key partners in source water protection. Appendix D provides a more detailed listing. A general description of the roles these stakeholders may have in source water protection has been produced as an attachment to this document and is available upon request.

Ohio's public water systems owners and operators have the most important role in protecting their source waters. Source water protection needs to be an integral part of their day-to-day activities. In Ohio, land use decisions are controlled at the local level; therefore, public water suppliers serving municipalities or other political jurisdictions are in a good position to control land uses that present a threat to their public water systems. Even the thousands of small noncommunity systems often are in a good position to manage threats to their drinking water because the greatest threats to their source waters are often associated with their own chemical use and disposal practices.

As the lead agency for developing and implementing Ohio's SWAP Program, Ohio EPA is responsible for: promoting development of source water protection initiatives at the state and local level; providing guidance and direct one-on-one technical assistance to public water systems developing source water protection strategies; and, reviewing source water protection plans to ensure they adequately address requirements of the State program. Other state and federal agencies are also instrumental in providing technical assistance and promoting proper management of potential significant sources of contamination.

5.1 OVERVIEW OF SOURCE WATER PROTECTION ACTIVITIES

The number, diversity and available resources of public water systems require innovative and flexible approaches for reducing susceptibility to contamination. The options available for protecting source waters are largely dependent on the type of public water system. Privately owned community and non-community water systems have either limited or no legal authority to control land use or other activities beyond their property boundaries. The options available to them will be different than those available to a system serving a city or other political jurisdiction. To be effective, protection strategies must address the potential contaminant sources that have been identified in the SWAP area. In addition, the strategies must reflect the system's hydrologic and geologic setting, as well as its financial and administrative resources. Clearly, no single approach to source water protection will work for all public water systems.

Table 5-1. Key Partners in Source Water Protection

Public Water System Owners and Operators
- Municipal, county, township governments
- Mobile home park owners
- Private business owners

State Agencies
- Ohio Environmental Protection Agency
- Ohio Department of Natural Resources
- Ohio Department of Health
- Ohio Department of Agriculture
- Ohio Public Utilities Commission
- Ohio Department of Commerce
- Ohio Department of Development
- Ohio Department of Transportation

Federal Agencies
- U.S. Geological Survey
- Natural Resources Conservation Service

Local Officials and Decision Makers
- Mayors and City Council Members
- County Commissioners
- Township Trustees
- Health, Safety, Emergency Response Directors
- Soil and Water Conservation Districts

Associations & Organizations
- Ohio Rural Water Association
- Rural Community Assistance Program
- Environmental Groups
- Watershed Groups

Private Citizens
- Water consumers
- People that live in SWAP areas

Owners of Contaminant Sources
- Businesses in SWAP areas
- Chambers of Commerce
- Industry associations

Source water protection activities will occur on a **statewide** basis as well as on the **individual SWAP area** level. A large number of public water systems face similar threats to their source waters that can be addressed using a common approach. In addition, some contaminant sources fall under the regulatory purview of state and federal agencies. Therefore, many protection activities are best accomplished by developing and implementing source water protection initiatives at the statewide level. At the same time, each SWAP area will have unique characteristics and problems that will need to be addressed on a case-by-case basis. To be effective, many protection activities can only be accomplished if developed and implemented at the local level for individual SWAP areas.

Whether developed and implemented on a statewide basis or in an individual SWAP area, or whether they are part of a comprehensive plan or implemented as individual actions, protective strategies for public water systems will fall into one or more of the following three categories: education, training and public participation; emergency response/contingency planning; and, potential contaminant source control strategies. Each of these is defined in Table 5-2 and then described in detail in Sections 5.2 and 5.3.

5.2 STATEWIDE SWAP ACTIVITIES

While the public water system has the primary responsibility for protecting its source of drinking water, Ohio EPA has the lead responsibility for establishing source water protection measures on a statewide basis. This section outlines what Ohio EPA will do to establish source water protection initiatives on a statewide basis as well as to support source water protection efforts for each public water system.

Table 5-2. Major Protection Activities

Education, Training and Public Participation — to increase the awareness about Ohio's water resources, public drinking water systems, SWAP areas, the importance of protecting source water, and what can be done to protect it. The overall success of the SWAP Program depends on people understanding where their drinking water comes from, and how their actions can affect the quality of their drinking water. They also need to understand what can be done to prevent contamination from occurring. Education is the key to ensuring this awareness and therefore it is the cornerstone to effective SWAP activities, regardless of the size or type of the public water system.

Emergency response/contingency planning— to protect the source water and the public water system from contamination in the event of leaks, spills, illegal discharges and other activities in the SWAP area. Even if a water system develops excellent contaminant control measures, contamination can still occur due to accidental releases. A properly prepared and updated contingency plan helps ensure that local officials are prepared to respond to emergency situations and ready to provide alternative sources of water. Coordination with the state and county level emergency management agencies is an important element of emergency preparedness.

Potential contaminant source control strategies— to reduce the threat from specific contaminant sources or types of contaminant sources. Strategies to manage contaminant sources will be developed and implemented at the state and local level and can range from state or local regulations that restrict or prohibit certain activities in SWAP areas to simply implementing voluntary best management practices to reduce contaminant use or waste.

5.2.1 Education, Training and Public Participation

A primary task of Ohio EPA is to promote Ohio's SWAP Program and local source water protection initiatives through increased public awareness. Ohio EPA has already produced a number of general educational materials including a video, coloring book, fact sheets and news articles that discuss Ohio's water resources, public drinking water, threats to water quality and efforts to protect both surface and ground water resources. Giving presentations at schools and different statewide and local associations is also an effective means of reaching a variety of audiences. Both the Division of Surface Water and the Division of Drinking and Ground Waters have established Internet web pages to present information about Ohio's surface and ground water resources and programs to protect them. These outreach efforts, targeted to both adults and children, are essential to development of statewide and local protection initiatives and will continue to be a high priority for the Agency.

Ohio EPA will also continue to produce a variety of educational tools that can be used by water suppliers to increase public awareness of their own source water protection efforts. While Ohio EPA expects public water systems to conduct their own education and training, it is not cost effective for each system to start from scratch and develop their own materials. Examples of the type of materials Ohio will produce to assist systems in this effort include a generic water bill

insert, brochures directed to the owners of various types of contaminant sources, and posters that

can be used in the work place. Ohio EPA will continue to work with the Ohio Department of Transportation to develop a standardized road sign that communities can use to indicate the boundaries of their SWAP areas.

Ohio EPA is also responsible for providing effective guidance, education, training and technical assistance to public water systems and other potential stakeholders in development of local source water protection programs. Table 5-3 highlights some of these statewide activities. Many public water system owners are very concerned about protecting their source water but are uncertain how to accomplish that. Ohio EPA will continue to develop and refine simple guidance documents and conduct training programs to support local initiatives. For example, Ohio EPA will revise *A Guide to Developing Local Watershed Action Plans in Ohio* (Ohio EPA, 1997c) to highlight public drinking water issues. The Agency is also planning to conduct regional workshops tailored to specific types of water supplies, problems and alternative protection approaches. Of course, one-on-one technical assistance is probably the most critical in supporting local protection initiatives. Ohio EPA district staff will be responsible for working with individual systems and stakeholder groups to assist them in their protection efforts.

Table 5-3. Statewide Education, Training and Public Participation Activities

- Develop and distribute general educational materials
- Develop and provide educational materials to public water suppliers to educate the public about their own source water protection efforts.
- Provide guidance, training and technical assistance in support of local protection initiatives.
- Educate the owners of potential contaminant sources how to reduce the water threats of their operations.
- Continue public participation in ongoing development and implementation of Ohio's SWAP Program

Since certain types or categories of contaminant sources are found throughout the state, owner/operators of these contaminant sources may be able to use similar approaches to reduce the likelihood their operations will actually cause contamination. For example, farmers located in different areas of the state may use the same best management practices to reduce chemical runoff into surface water bodies. Ohio EPA will help educate the owners of potential contaminant sources about source water protection and what they can do to reduce the threat of their operations causing water quality impacts.

Public involvement is another major component of source water protection initiatives at the statewide level. Ohio EPA will continue to work with the SWAP Advisory Group and other organizations and associations to develop effective techniques for protecting Ohio's public water systems.

5.2.2 Emergency Response/Contingency Planning

Ohio EPA will assist public water systems and local officials in developing emergency response and contingency plans and in coordinating those plans with State and local emergency management agencies. Table 5-4 highlights statewide emergency response/contingency planning activities. The Ohio EPA has prepared a state *Drinking Water Supply Emergency Plan* (Ohio EPA, 1996) which is available to public water systems. This plan outlines an organizational structure and procedural guidelines utilized by Ohio EPA in confronting a typical water supply crisis. It was also developed to assist local officials by outlining what factors should be addressed by each water supplier's own contingency plan.

Table 5-4. Statewide Emergency Response/Contingency Planning Activities

- Assist public water suppliers in developing contingency plans.
- Provide advisory assistance to public water systems during emergencies .
- Respond to spills (Division of Emergency and Remedial Response).
- Coordinate emergency response planning with state and county emergency management agencies.

Chapter 3745-85 of the Ohio Administrative Code requires each community water system in Ohio to prepare and maintain a contingency plan for providing safe drinking water during emergency conditions. This section of the code also outlines the required contents of each public water system's contingency plan. Ohio EPA provides technical assistance to public water systems in developing contingency plans. Agency staff will also review emergency plans to ensure they adequately address state requirements.

The Ohio EPA will also provide advisory assistance to any water system during an emergency. A primary function of this assistance is to coordinate relief efforts with outside agencies including the state and county emergency management agencies. The Ohio EPA Division of Emergency and Remedial Response is also responsible for coordinating the emergency containment and remediation of chemical spills.

Coordination with the state and county level emergency management agencies is an important element of source water protection programs. Ohio EPA has worked with the Ohio Emergency Management Agency and the directors of county emergency management agencies to ensure coordination with local source water protection efforts. The Division of Drinking and Ground Waters provides county maps of all public water systems and SWAP areas to the state and local agencies on a semi-annual basis so they can incorporate them into their planning efforts. Local emergency planning committees are encouraged to include at least one representative of a public water system in their membership.

5.2.3 Potential Contaminant Source Control Strategies

Many techniques for controlling specific types of potential contaminant sources are applicable to all areas of the State. Implementing these techniques can be accomplished by either developing a standardized technique that can be adopted on a case-by-case basis in individual SWAP areas or by incorporating special requirements for SWAP areas into state regulations, rules, or policies. Ohio EPA will take the lead role in pursuing both of these mechanisms.

Integration and Coordination with Existing Programs. Source water protection must build on existing regulatory, voluntary, and incentive based pollution prevention programs at all levels of government. Many activities fall under the authority of local and state agencies, and in some instances, federal agencies. Coordinating pollution prevention activities among these three levels of government is essential to ensure enforcement of the appropriate regulations, avoid duplication of effort, and prevent conflicts with existing regulations and programs.

Ohio EPA will coordinate activities among its respective divisions. The Division of Drinking and Ground Waters and the Division of Surface Water will continue the partnership established at the beginning of the SWAP Program development process. Ohio EPA is also proposing a multi-media watershed committee with representatives from each division and district. This committee would collectively assess and recommend statewide priorities for the district Basin Teams. This type of committee would also serve to coordinate source water protection initiatives.

Several Ohio EPA programs have already adopted differential management or more stringent source control strategies in SWAP areas. For example, the Unified Watershed Assessment, developed under U.S. EPA's Clean Water Action Plan, incorporates public water systems using surface waters into the watershed categorization. Ohio's solid waste rules (Ohio Administrative Code 3745-27) prohibit the siting of new landfills within a five-year time-of-travel boundary of a public water supply well. They also require owners of existing landfills within wellhead protection areas to prepare closure plans and implement post-closure ground water monitoring. The Ohio EPA's Voluntary Action Program (a program for cleaning up the "brownsfield" industrial sites) requires more stringent clean-up standards for properties located in wellhead protection areas. The Ohio EPA Division of Hazardous Waste Management started a program called "Drinking Water at the Tap" which directs priorities for inspection and enforcement to regulated facilities located near public water system wells. The Bureau of Underground Storage Tank Regulation is proposing to incorporate wellhead protection areas into its definition of "sensitive areas." Underground storage tanks located in sensitive areas must have secondary containment. Ohio EPA's Office of Pollution Prevention provides information and direct technical assistance to facilities handling chemicals on how to reduce the amounts of chemicals used, and how to reduce the amounts of chemical waste produced.

Ohio EPA will also work to integrate source water protection objectives into other Statewide planning initiatives. For example, the Division of Surface Water will integrate Source Water Protection goals into surface water planning documents such as the Clean Water Act's Continuous Planning Process, the Nonpoint Source Management Program, and Water Quality Management Plans. Other planning efforts include the State Management Plan for Pesticides and the Ohio Water Resources Strategic Plan.

Several mechanisms have already been established to coordinate the activities of the many agencies and programs involved in water resources protection and management. These include the State Coordinating Committee on Ground Water, the Natural Resources Coordinating Committee and the Ohio Water Resources Council. Ohio EPA will utilize these existing mechanisms to coordinate on SWAP Program issues, particularly source water protection initiatives.

5.3 INDIVIDUAL SWAP AREA ACTIVITIES

This Section outlines what activities should occur to protect source waters in individual SWAP areas. It focuses on the role of the public water suppliers, who have the primary responsibility for protecting the source of their water. It also outlines what Ohio EPA considers an acceptable level of effort for various types of systems and indicates what Ohio EPA and other state programs will do to support these local protection efforts.

5.3.1 Public Water Systems Serving Political Jurisdictions

For Ohio's SWAP Program, community public water systems are separated into two different categories: those that serve a political jurisdiction (e.g., a city, village, county or township), and those that do not. The latter group includes systems serving mobile home parks and other residential centers (see Section 5.3.2). This separation is needed because Ohio law gives local governmental entities some ability to determine land uses within their jurisdictions. Therefore, those systems serving a political jurisdiction are in a better position to influence the control of land uses beyond the property they own and even those located in other political jurisdictions. Local governments through the use of joint powers can accomplish protection activities that individually they would unable to undertake.

Ohio EPA expects most public water systems serving political jurisdictions to develop a comprehensive source water protection plan for protecting the source of drinking water. For some extremely small systems serving villages or portions of a county or township, it may be more reasonable to use the simplified approach discussed in Section 5.3.2 for other community systems and non-transient-noncommunity systems.

Ohio EPA has developed guidance under the Ohio Wellhead Protection Program to assist public water systems using ground water to develop a source water protection plan. While this guidance will need to be updated and modified, it does outline the most important elements that should be addressed in any protection plan. No two plans need be alike, but they should include the same basic elements. A comprehensive plan should discuss each of the three categories of protection strategies: education, training and public participation; emergency preparedness/contingency planning; and, contaminant source control strategies.

Education, Training and Public Participation. Public awareness is the cornerstone to an effective source water protection plan. In fact, in some communities education and training efforts may be the primary strategy for protecting their source waters. Local decision makers, people living, working and operating businesses in the SWAP area, and members of the community at large must understand and support efforts to protect the public drinking water supply. Figure 5-1 illustrates the phased approach of educating a community about SWAP by targeting efforts at each of these groups.

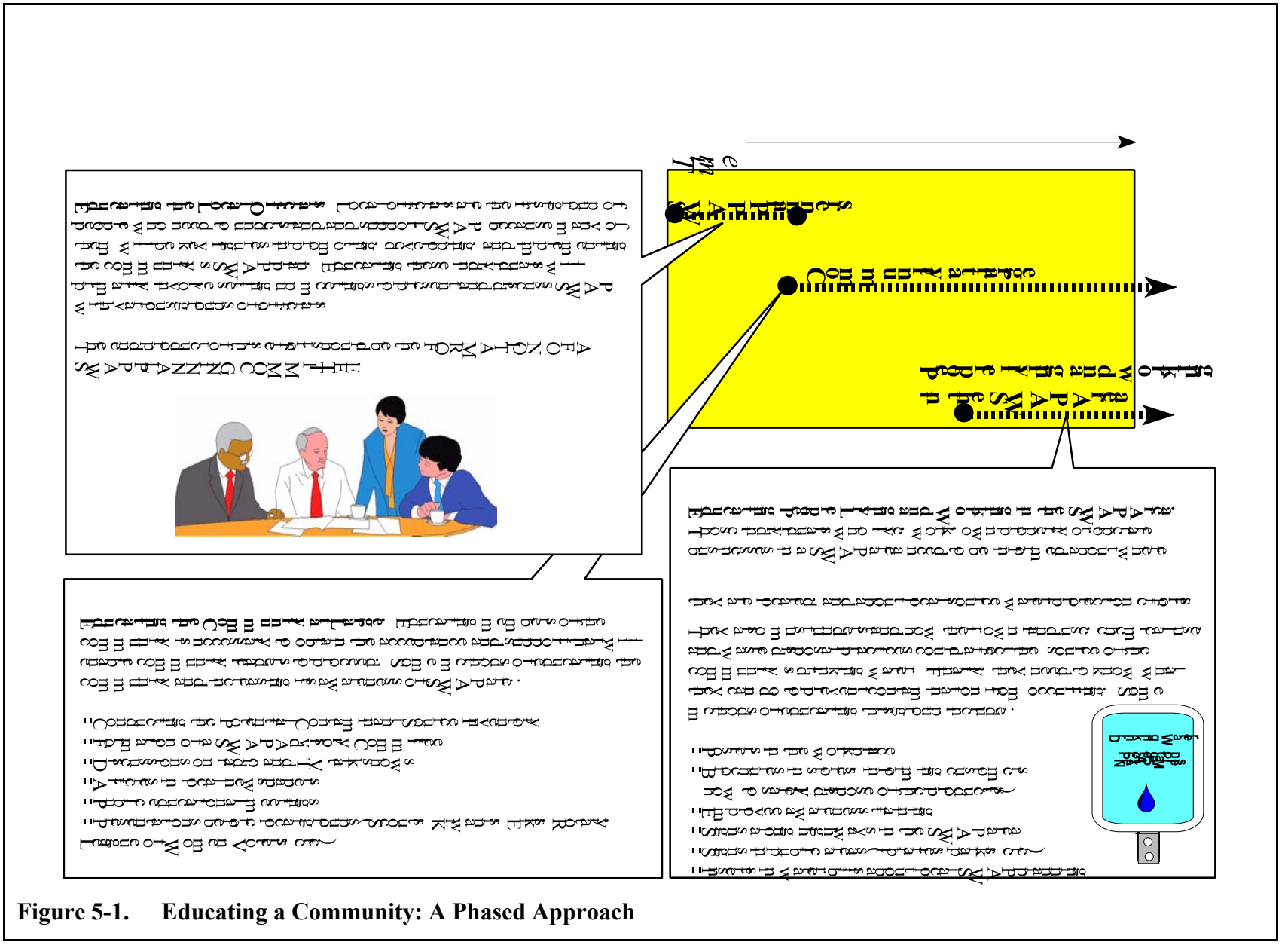


Figure 5-1. Educating a Community: A Phased Approach

The education component of a source water protection plan must not only discuss how members of the community will be informed about SWAP efforts, but also how they will be involved in development of protection strategies. Ohio EPA strongly recommends the establishment of a SWAP committee at the individual SWAP area level to assist in local protection efforts. Individuals that may be involved with implementing protection actions or may be impacted by those measures should be invited to participate. This can be particularly important when the SWAP area incorporates multiple jurisdictions. Cooperation from local officials in those other jurisdictions may be essential for a public water supply owner to implement a source water protection plan. Table 5-5 lists the individuals and organizations Ohio EPA recommends be involved with decision making at the local level.

Emergency Response/Contingency Planning. When a chemical release occurs in a SWAP area, different levels of response are necessary depending on the magnitude of the release and whether it is a surface water or ground water system. To prevent disruption of service, a public water supplier needs to have previously identified both short- and long-term alternative sources of water. For a surface water system, the public water system may have to shut down the intake for a few hours or a few days. For ground water systems, if contamination occurs they could be forced to permanently abandon a well and find an alternative source.

Table 5-5. Potential SWAP Committee Members

- public water suppliers
- municipal, township, and county government
- regional planning commissions
- county Emergency Management Agency Director
- soil and water conservation districts
- local and township fire departments
- health departments
- Natural Resources Conservation Service Agents
- private industry (NPDES dischargers)
- local farmers
- local developers
- community service organizations
- local chamber of commerce
- public interest, environmental and watershed groups
- League of Women Voters
- local teachers and education professionals
- senior citizens groups
- local newspapers and radio stations
- retired local experts
- residents

Public water systems should use the information from the assessments to update existing contingency and emergency plans. The public water system manager should be aware of all of the potential sources of contamination within the SWAP area, but particularly of those which lie within the emergency management zone for surface waters, or inner management zone for ground waters. The assessments will provide pointers to these sources and the susceptibility analysis will also highlight areas of particular concern because of either the number, type or enclosure of potential contaminants.

For a contingency plan to be effective, everyone who works at the public water system should be well informed. Potential sources must have accurate contact names and numbers for the Emergency Management Association and public water system. The public water supplier should coordinate all response activities with the Local Emergency Planning Committee and the Emergency Management Agency.

Contaminant Source Control Strategies. Public water systems can use a wide variety of techniques to reduce the risk of contamination from specific contaminant sources. These can

range from completely voluntary actions by the owners of the contaminant sources to requirements enacted through local ordinances or overlay zoning. Some examples of source controls include:

- ***Chemical Use Reduction.*** Pollution prevention strategies can be developed that focus on reducing chemicals of concern. Ohio EPA's Office of Pollution Prevention and other resource providers can work with source water protection stakeholders including businesses, industry, agriculture, local governments, and municipalities in developing specific pollution prevention strategies..

- ***Design Standards.*** The contaminant sources must meet certain design standards, such as berms, impermeable storage surfaces, overfill protection, leak detection systems, secondary containment systems, etc..

- ***Operating Standards.*** The contaminant source must meet certain operating standards such as periodic inspection, testing and maintenance. This includes better cropping practices to reduce runoff from agriculture fields, and measuring the fuel level in storage tanks daily to determine if leakage is occurring.

- ***Reporting Requirements and Documentation.*** Owners of contaminant sources are required to report the types and quantities of chemicals used, stored and disposed of on the property and document source management efforts.

- ***Source Prohibitions.*** The source (type of facility, land use or specific chemical) is not permitted to exist in the SWAP area. These are usually achieved through zoning ordinances, but may also be implemented through the purchase of land or development rights, or by obtaining an easement, deed restriction, or restrictive covenant.

- ***Source Restrictions.*** The source may exist in the SWAP area in restricted amounts. Or, certain types of land use may be restricted, but not altogether banned. Source restrictions are usually implemented through the same mechanisms as listed for source prohibitions.

Public water systems that serve a government entity have much more power to implement source controls than other systems, because any portion of the SWAP area that lies within the boundaries of the political jurisdiction is subject to the authority of that political jurisdiction. Passing a local ordinance, and then enforcing it, certainly requires an investment by the community, accompanied often by significant political risk. However, it can be a very powerful option for addressing a large number of contaminant sources, and provides the authority and resources for ongoing enforcement at the local level.

Watershed Management Plans. All of the protection strategies discussed above are applicable to all public water systems, whether they use ground water or surface water. However, in some instances, source water protection strategies for public water systems using surface water may be

substantially different from those using ground water. Certain types of contaminants and contaminant sources pose a greater risk to surface water than ground water. For example, surface water systems in agricultural areas tend to detect elevated levels of nitrates and pesticides during certain times of the year. Ground water systems located in the same areas may detect elevated levels of nitrates, but in Ohio pesticides are rarely detected in ground water at *any* time of the year. Consequently, agricultural fields may be a higher priority potential contaminant source for a surface water system than a ground water system, and protective activities are likely to focus on agricultural best management practices. Just as wellhead protection has set the foundation for source water protection for ground water systems, watershed planning efforts in Ohio have set the foundation for source water protection for surface water systems. Table 5-6 discusses watershed action planning in the State of Ohio.

Table 5-6. Watershed Action Planning

A watershed action plan addresses multiple water quality concerns and stakeholder interests within a watershed. Surface water SWAP areas are a type of watershed. An action plan simply identifies the activities to be undertaken either to protect waters from contamination, or to improve waters that are already contaminated.

Over 70 active watershed groups exist throughout Ohio. Each of these groups have initiated efforts to protect surface water resources for a variety of reasons and have formed unique councils, coalitions, partnerships, groups, and committees to implement protection activities. Some of these groups have closely followed Ohio EPA's planning guidelines as suggested in *A Guide to Developing Local Watershed Action Plans in Ohio* (Ohio EPA, 1997c), while others may have sprung up as single issue groups and established their own process for implementing protection activities. While the majority of these groups may not specifically be concerned with drinking water, some may. Those that are not may be interested in incorporating drinking water concerns into their activities and plans as assessments are completed and results are disseminated.

Existing watershed groups naturally provide an opportunity for public water systems and other SWAP stakeholders to learn about their watershed and to collaborate efforts. In some instances where watershed groups exist, the group may be a valuable source of information to the public water supplier, and they may also act as a vehicle for public education and outreach. Ohio EPA encourages public water systems to seek out these groups and collaborate with them in conducting ongoing assessments and protection activities.

Where watershed groups do not exist, public water systems may need to initiate a watershed action planning process. This can be done by following the suggestions in *A Guide to Developing Local Watershed Action Plans in Ohio* (Ohio EPA, 1997c), but begins with public outreach and education. Components of a watershed action plan include similar steps to those involved in the cycle of assessment and protection activities. The Guide provides specific suggestions on how to implement the steps. In essence, surface water source water assessments are a type of watershed inventory. As such, they provide a springboard for moving into watershed action planning. Frequently, conducting the inventory is one of the more time consuming and difficult pieces of watershed action planning. The source water assessments will effectively complete this step for those watersheds or subwatersheds that contribute water to a stream used by a public water system.

Multiple Jurisdictions. Almost every SWAP area for community public water systems will encompass lands under multiple political jurisdictions. Implementing protective measures in areas outside the boundaries of the political jurisdiction which owns, operates, or is served by the

public water system has been a major barrier to implementing protective measures. While Ohio EPA strongly believes that implementing protection measures in areas outside of a community's jurisdiction should be done through cooperation and mutual agreement, this is not always possible. The Ohio Revised Code contains two separate provisions which may provide additional authority to political jurisdictions to go beyond their boundaries to protect their source waters. Specifically Ohio Revised Code 3750.11(G) states:

> "*A political subdivision that owns, operates, or is served by a public water system as defined in Section 6109.01 of the Revised Code may establish and enforce requirements that provide for the protection of ground water resources that serve as a source of drinking water for its public water system and that are located within scientifically derived wellhead protection areas."*

In addition Ohio Revised Code 743.25 states:

> "*No person shall pollute a running stream, the water of which is used for domestic purposes by a municipal corporation, by putting therein a putrid or offensive substance, injurious to health. The director of a public service of a city or board of trustees of public affairs of a village shall enforce this section. The jurisdiction of a municipal corporation to prevent the pollution of its water supply and to provide a penalty therefor shall extend twenty miles beyond the municipal corporation limits."*

These two provisions should be considered only as a last resort for communities seeking to implement source water protection planning activities. To date, they have not been tested within the state courts and therefore the effectiveness of these sections cannot be relied upon. Communities who are unsuccessful at initiating cooperative relationships with neighboring jurisdictions should work closely with Ohio EPA. Local officials such as county commissioners, township trustees, and municipal officials will be encouraged by Ohio EPA and other interested parties to recognize SWAP areas in their planning efforts. A number of cities and villages in southwest Ohio have adopted municipal ordinances that prohibit or restrict certain activities/land uses within a SWAP area. Some counties have adopted ground water protection resolutions.

One impressive example of coordinated drinking water protection efforts by multiple urban water systems is the Hamilton to New Baltimore Ground Water Consortium, which includes representatives from three city systems (Fairfield, Hamilton, and Cincinnati) and several private water companies, all of them deriving their drinking water from the same aquifer. The Consortium delineated and inventoried a joint WHP/SWAP area that extends for miles along the Great Miami River (Figure 5-2). Currently, an ordinance devised for the entire area has been accepted by some members of the consortium and is awaiting acceptance by others.

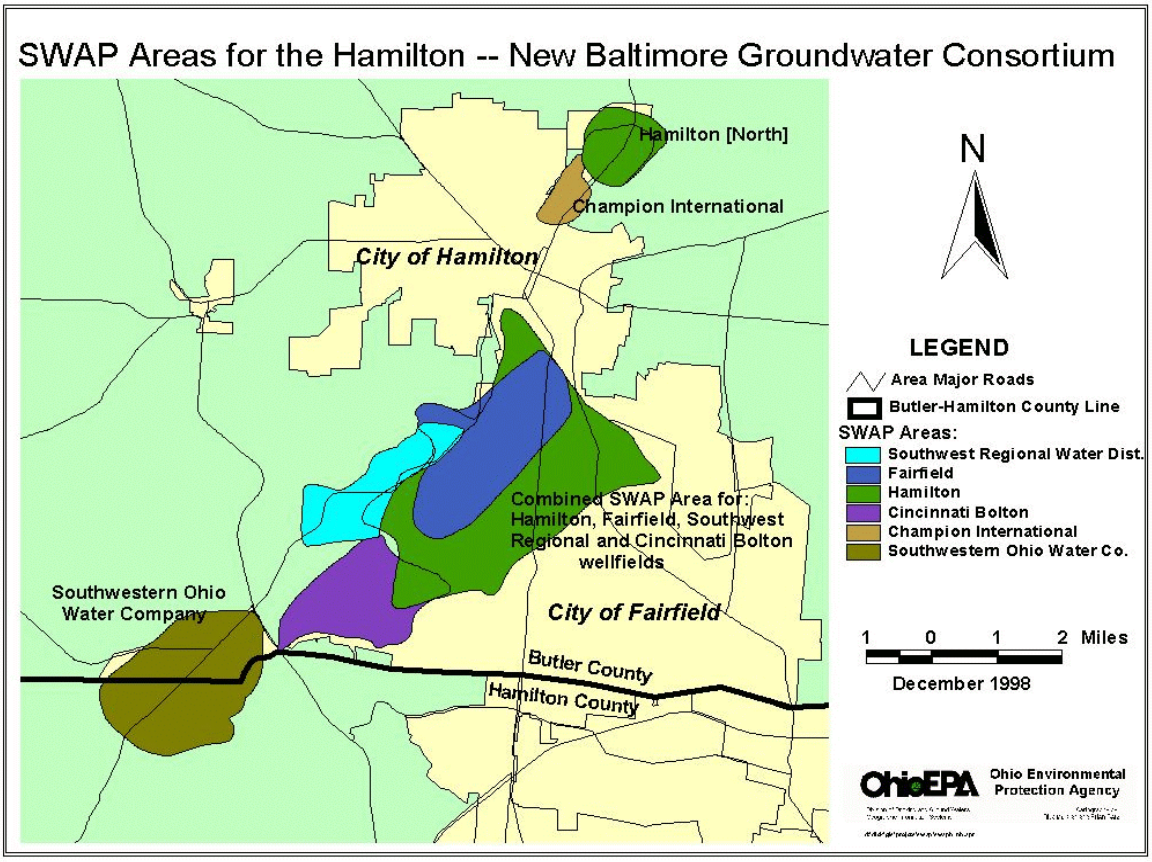


Figure 5-2. The Hamilton to New Baltimore Ground Water Consortium

The Hamilton to New Baltimore Groundwater Consortium consists of six independent public and industrial water suppliers in southern Butler and northern Hamilton Counties, Ohio. Members are the City of Cincinnati, City of Fairfield, City of Hamilton, Southwest Regional Water District, Southwestern Ohio Water Company, and Champion International. Combined, Consortium members produce over 61 million gallons per day for public and industrial water needs in large portions of Butler County, and the northern portions of Hamilton County. This service area encompasses one of the most rapidly developing sections of the greater Cincinnati metropolitan area.

In 1991, the Consortium began working on the development of a joint multi-jurisdictional, multiple wellfield Wellhead Protection Program. By 1998, all components of the Consortium's Wellhead Protection program had been endorsed by Ohio EPA. The Consortium's ongoing Wellhead Protection activities include, but are not limited to, the following:

- Adoption of a locally developed Wellhead Protection ordinance by two municipalities, one county, one village, and four townships;
- Installation of monitoring wells for a new Wellhead Protection monitoring network;
- Implementation of the Consortium's contingency plan;
- Planning for a County-wide children's ground water festival;
- Production of a local video on ground water; and
- Placement of wellhead protection road signs in wellhead protection areas.

The Consortium's Wellhead Protection effort has received state-wide and national attention in recent years. More information on the Consortium's Wellhead Protection Program can be found on its web site at ***www.gwconsortium.org.***

The recent resurgence of interest in municipal and county comprehensive planning offers much promise for assisting public water suppliers in protecting undeveloped portions of the SWAP area from development. The main goal of a comprehensive plan is to direct development to certain areas within the jurisdiction to reduce "urban sprawl" and all the problems associated with it. In addition to identifying development areas, however, comprehensive plans also identify areas that should be among the *last* to be developed. For example, Wayne County's comprehensive plan identifies "natural resource areas" that are to be protected from development (Table 5-7).

5.3.2 Other Community and Non-transient Noncommunity Systems

Included in this break out are community systems that do not serve a political jurisdiction (mostly large mobile home parks and other residential centers such as homeowner associations, retirement villages, etc.) and all the non-transient-noncommunity systems. The latter include hospitals, schools, and factories, and are defined as systems that are not community systems and that regularly serve over 25 *of the same persons* over six months per year. The systems discussed in this section comprise approximately 1,100 of Ohio's 6,100 public water systems.

While the operators of these types of public water systems are certified operators, water supply usually is not their principal job responsibility or concern. Most of these systems use ground water as a source, but amounts pumped vary widely, depending primarily on the number of people served. SWAP areas will correspondingly vary in size. This category of public water systems typically has responsibility for larger numbers of people than transient systems, and often includes sensitive populations such as children and the elderly. However, these public water systems typically have no authority over contaminant sources outside their own property boundaries.

Table 5-7. Wayne County's Comprehensive Plan, "Tomorrow Together" (April, 1997)

"The Wayne County Comprehensive Plan establishes a policy framework to guide public decisions regarding development for the unincorporated area. It also recommends an approach to growth management for all jurisdictions that seeks to redirect development to the cities, villages and hamlets, with the anticipated outcome of preserving agriculture and greenspace. Protecting the County's quality of life while accommodating a reasonable amount of growth is the desired long-term result, with minimal public expenditure of tax dollars and minimal impact on the environment." (Executive Summary)

The portion of the Plan dealing with natural resources lists eight objectives that address woodlands and wetlands, stream corridors, and water quality, among others. Objective Seven proposes to protect ground water resources by (1) Discouraging inappropriate development over or adjacent to groundwater recharge areas and aquifers; (2) Adopting wellhead protection regulations to protect aquifers; and (3) Conducting countywide groundwater supply surveys to delineate resources and identify pollution potential.

Ohio EPA will expect the owner of these types of systems to put their plans for protection strategies into writing, although their plans will be substantially simpler than those of the community systems described in Section 5.3.1. Ohio EPA will be developing a worksheet (or series of worksheets) that will aid the owners of these systems to determine the best options for reducing threats from the contaminant sources identified in their inventories. A generic, fill-in-the-blank type of plan will be provided by Ohio EPA that they can then complete. The worksheet and generic plan will help ensure that these systems address each element of a protection strategy. Ohio EPA staff will be available to help these systems with this effort, and progress will

be tracked by Drinking Water Program district staff.

Education, training and public participation should focus on making certain that residents, employees, and any others who frequent the SWAP area are aware that their activities could affect the quality of the water they are drinking. If the owner/operator handles large amounts of chemicals, the employees should be trained in avoiding spills and responding to them if they occur. Brochures and posters in the work place are two common approaches that have been used before. Again, Ohio EPA is developing educational tools that can be used by these systems.

An emergency preparedness/contingency plan should be in place so that the owner and any employees know how to minimize water quality impacts of any emergencies. This plan should also address how water would be obtained if the ground water became contaminated.

Contaminant source control strategies should strive to reduce the threat of any contaminant sources *on the owner's property*. Some examples include making sure that any chemicals used on site are properly stored, handled and disposed of, or conducting routine maintenance and inspection of on-site septic systems Sometimes better housekeeping on the property is all that can be done; sometimes there will be no contaminant sources at all.

Although a non-community public water system has limited or no legal authority to impose source control strategies beyond its property boundaries, other mechanisms exist to assist public water systems with protection activities at off-property potential contaminant sources. The contingency plan should account for them, and the owner/operator may be willing to try talking to the neighbors (a form of "education"). If the owner/operator lives in a county or township that is promoting source water protection, he or she may be able to have the local government address the contaminant sources under local regulations. These systems may also benefit from protection activities being implemented in a larger SWAP area. For instance, if they are located in a surface water SWAP area, the protection strategies implemented for the watershed may provide additional protection to their source waters.

5.3.3 Transient Public Water Systems

Transient systems are defined as systems that are not community systems and regularly serve over 25 *different* persons over sixty days per year. They include primarily small businesses (such as convenience stores, gas stations, restaurants, hotels, campgrounds, etc.) located in areas that are not serviced by water utility lines. Transient systems make up two-thirds of all of Ohio's 6,130 public water systems. Most owner/operators of transient water systems are private business people, who are obliged to also act as water system operators. In the absence of any known contamination, the operation of their water supply generally is a low priority to them.

Virtually all transient systems use ground water as their source of water, and pump limited amounts. The SWAP area is likely to be quite small, and unless the owner is handling chemicals for a living, the number of contaminant sources within the SWAP area is likely to be very limited. Chances are good that much of the SWAP area will lie within the owner's property boundaries. However, the owner will have no authority to protect his source water from any contaminant sources located beyond the owner's property boundaries.
Ohio EPA will encourage the owner/operator to put the "protective actions" into writing by completing a simple worksheet and checklist that is linked directly to the checklist of

contaminant sources that have been identified during the assessment. Ohio EPA staff will be available to assist the owners in completing these checklists. A copy of each checklist will be maintained in Ohio EPA files and progress will be tracked by the Drinking Water Program district staff. The strategies used to prevent contamination will focus on the property under control of the owner and will be similar to those for the non-transient systems, as described above.

5.4 SWAP ONGOING ASSESSMENT ACTIVITIES

It is important to understand that, although the 1996 Safe Drinking Water Act amendments specified that assessments be complete within a specific deadline, assessment is not a one-time effort. Ohio's program recognizes the dynamic nature of the landscape and use of resources. For example, new public water systems come on-line every year. Some ground water systems will increase their pumping rates, or install new wells, which may change the configurations of their SWAP areas. Some surface water systems will relocate or remove their intakes, which will likely affect at least the configurations of the emergency management zones and corridors, if not the entire SWAP area. As urbanization and development expands away from the major cities, many of the noncommunity public water systems will tie in with community water systems and will no longer be public water systems.

Potential significant contaminant sources also come and go. A Susceptibility Analysis based in part on outdated potential significant contaminant source information may inaccurately assess the susceptibility of the public water system. Most importantly, the protective activities being implemented by various stakeholders may prove unsuccessful, or may become unnecessary. Therefore, assessment at the individual SWAP areas will need to be reviewed on a periodic basis. At the same time, assessment on a statewide basis will be ongoing, as the various statewide programs continue to collect and evaluate water quality data and other relevant types of information.

5.4.1 Ongoing Assessment at the Individual SWAP Area

Assessments of *new* public water systems will be conducted as described in Chapters Two and Three of this document, except that Ohio EPA may not play such a central role in the completion of the work; this will depend, in part, on future resource allocations. Assessments of *existing* systems will be updated periodically. It is anticipated that the primary mechanism for these updates will be the sanitary surveys, which are conducted on a regular basis (every one to five years) by the Ohio EPA Division of Drinking and Ground Waters' District staff. Additions to the sanitary survey checklist will remind inspectors to note items that could affect the accuracy of the original source water assessment.

The drinking water inspector will inquire about the status of protective efforts. Where a concerted effort is warranted by the Susceptibility Analysis, failure to initiate or carry through on planned protective strategies may affect the supplier's eligibility for monitoring waivers, low-interest loans, or other incentive programs. Where it appears that the supplier needs encouragement, the inspector will notify the appropriate Ohio EPA staff to offer assistance.

Another mechanism for updating assessments for surface water systems may be watershed action

plans. The watershed group may commit to a routine reassessment of the corridor and priority management areas, set timelines for completion, and assign staff to various tasks. Their efforts will likely focus on reinventorying the priority areas and evaluating the effectiveness of protective strategies that have been put in place.

5.4.2 Ongoing Assessment at the Statewide Level

Ohio EPA will continue gathering and evaluating water quality data through the various water quality programs it is administering. It will also work to integrate data from other state and local agencies into the database that is being created during the Resource Characterization phase of the SWAP Program. Water quality monitoring on a regular cycle will serve to identify emerging problems, and provide information on the effectiveness of current protection efforts. The biennial Water Resource Inventory, which Ohio EPA compiles for U.S. EPA, tracks trends in water quality and can be used to focus on source waters at the level of individual SWAP areas.

5.5 MEASURES OF EFFECTIVENESS

A key component of any successful program is a method for measuring progress. The ultimate goal of Source Water Assessment and Protection is an abundant supply of clean, safe drinking water, but measuring progress towards that goal can be difficult. There are several reasons for the difficulty:

- "Prevention" is a concept that defies this sort of analysis**.** For example, if a public water supplier using ground water implements a vigorous SWAP effort for ten years, and then discovers a contaminant plume, does it mean the efforts are a 'failure'? (The contamination may emanate from a source that originated decades ago, and that was removed and forgotten long before the SWAP efforts were initiated.) Conversely, if the system has no problems, does this mean the SWAP efforts are a 'success'? (The system may not have had any problems anyway.)

- Where water quality is currently degraded, improvements can take many years to manifest. For example, one of the most important indicators of surface water quality is the health of the biological community dwelling in or around the surface water (i.e., fish and bugs). However, there is often a lag between such protective actions as reductions in pollutant loads and measurable improvement in the biological community.

- Cause-and-effect rarely is straightforward with environmental problems. The environment is so complex and so imperfectly understood, it is rarely possible to establish a direct, "scientifically proven" link between one set of actions and an apparent enviromental response.

Any effort to evaluate the effectiveness of the SWAP efforts must acknowledge these kinds of uncertainties.

5.5.1 Indicators of Effectiveness

For discussion purposes, indicators of effectiveness can be broken into two categories: administrative indicators and environmental indicators. Both of these categories are illustrated in Figure 5-3, which shows how they are used jointly by the Division of Surface Water to assess water quality improvements.

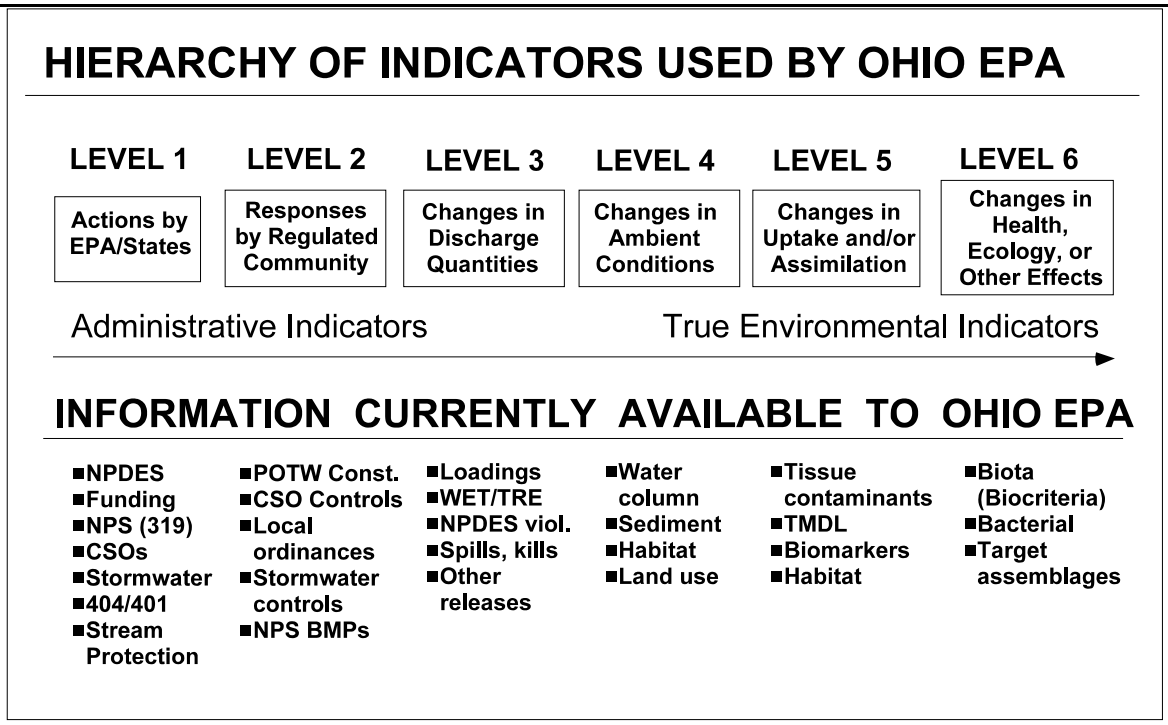


Figure 5-3. An Example of Administrative and Environmental Indicators: The Division of Surface Waters' Environmental Indicator Framework.

The indicators framework shown above includes a hierarchical continuum from administrative through true environmental indicators. The six "levels" of indicators include: (1) actions by regulatory agencies (permits, enforcement, grants); (2) responses by the regulated community (treatment works, management practices); (3) changes in discharged quantities (pollutant loadings); (4) changes in ambient conditions (water quality, habitat); (5) changes in uptake and/or assimilation (tissue contaminants, productivity, biomarkers); and, (6) changes in health, ecology (ecological indicators), or other effects. Thus the administrative activities that have predominated water pollution control efforts since the early 1970s (levels 1, 2, and 3), and which have prompted the expenditure of billions of dollars of treatment upgrades, can now be tracked through to "the results" in the environment as revealed by chemical/physical and ecological indicators.

Administrative indicators typically measure accessible quantities such as the number of actions taken or the amount of money spent. The actions are supposed to result in some improvement of a situation, but the improvement itself is not directly measured. Because administrative indicators are based on an *assumed* cause-and-effect relationship, they are admittedly imperfect measures of effectiveness. Despite this, administrative indicators are widely used because they are so accessible to measurement, with a minimum of cost and effort. During the early phase of a program, when actual data may be sparse or nonexistent, they often are the only kinds of indicators that can be evaluated.

Environmental indicators are measurable aspects of the environmental medium. In the SWAP Program, the obvious environmental indicators would be water quality data, which are expressed in concentrations of chemicals in the water. For surface water bodies, the health of the biological community also is an environmental indicator, although a less direct one for the purposes of water suppliers. Environmental indicators provide a much more satisfying basis for evaluation of effectiveness, but they are not perfect either, since they also are subject to the

uncertainties noted above. Environmental indicators are more likely to be evaluated as a program matures, and more environmental data become available.

5.5.2 Measuring the Effectiveness of the SWAP Program

As priorities from SWAP are integrated into the state's existing programs such as the water quality monitoring, watershed and wellhead programs, new administrative and environmental indicators will need to be developed and integrated with currently available indicators.

In addition to the need for specific indicators that span the life of the program from inception to maturation, indicators must also be developed with the needs of their users considered. For example, indicators for reporting to federal agencies might need to be different from those to be viewed or used by public water systems, local stakeholders, or others involved in source water protection. Table 5-8 identifies a number of different types of administrative indicators that could be used to capture the progress of the statewide SWAP Program.

Table 5-8. Possible Administrative Indicators For Evaluating SWAP Effectiveness

Currently tracked by Ohio EPA on existing database (WHPSTAT)

- Number of systems for which the state has completed delineation and inventory
- Number of systems completing delineating and inventory voluntarily
- Number of systems completing management plans: wellhead or watershed
- Number of systems with public awareness programs in place

Could be obtained from existing databases

- Dollars invested in SWAP by Ohio EPA
- Percentage of program completion time goals met
- Percentage or degree of Federal objectives/directives met

Could be tracked through surveys

- Percentage of public aware of SWAP Program
- Percentage of public accepting SWAP Program as important

Would depend on mechanisms for interagency communication, such as the various coordinating committees

- Number of other programs (in Ohio EPA and other agencies) integrating SWAP priorities into their programs
- Adoption of legislation to codify SWAP objectives and/or enabling management across jurisdictional boundaries

Mechanisms for measuring the effectiveness of SWAP efforts based on environmental indicators also will be developed. The mechanisms will need to be consistent with the procedures developed for ongoing assessments as well as procedures developed for the various water quality monitoring programs. For the approximately 5,800 ground water systems in Ohio, the periodic sampling of finished water that has been required historically by the Safe Drinking

Water Act will remain the core of the data available for measuring effectiveness of protective activities in ground water-based SWAP areas. For some community systems, Ohio EPA's ambient monitoring network will provide additional raw water quality data that can be used. As integration with other divisional and state programs continues, the water quality data from these programs will supplement the core data.

For surface water systems, Ohio EPA will report on environmental indicators of SWAP implementation through its existing monitoring and assessment program. The five-year basin approach to monitoring of surface water in Ohio was initially established to facilitate the renewal of National Pollution Discharge Elimination System (NPDES) permits and to provide a systematic evaluation of changes in water quality over time. This system has evolved over time to include identification of the causes of non-attainment of water quality standards for designated uses, including nonpoint sources, spills, and habitat modifications. The water quality monitoring and assessment program also feed in to the "use designations" in water quality standards. The SWAP Program will allow the review of drinking water use designation on a site specific basis, much as Ohio has done with its aquatic life use designations.

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GLOSSARY

Abandoned Well - A well whose use has been permanently discontinued or that is in a state of disrepair such that it cannot be used for its intended purpose.

Air Stripping - A treatment system that removes volatile organic compounds from contaminated ground water or surface water by forcing an airstream through the water and causing the compounds to evaporate.

Ambient Water Chemistry - The chemical characteristics of water in a surface water body (stream, river, lake) or ground water aquifer.

Anderson Land Use Classification - A land use classification with broad categories which are: Urban, Agricultural, Range Land, Forest Land, Water, Wetlands, and Barren Lands.

Anthropogenic - The impacts of humans on nature.

Aquifer - A rock or sediment formation which is saturated and sufficiently permeable to transmit quantities of water to wells or springs.

Aquifer Media - The geologic material that makes up the aquifer, e.g., sand and gravel, sandstone, limestone.

Baseline Maps - Maps of current water resource and other geographic information which will be used for comparisons with future observations and activities.

Bedrock - A general term for the rock type that underlies soil and other unconsolidated materials.

Brine - A subsurface water containing a high content of dissolved salts, and once separated from crude oil is regulated as a hazardous waste.

Brine Injection - Process of disposing of brine into geologic formations below underground sources of drinking water.

Bureau of Underground Storage Tank Regulations (BUSTR) - The Bureau of Underground Storage Tank Regulation (BUSTR) regulates Ohio's underground storage tank program.

Capacity Development Program - The 1996 Safe Drinking Water Act requires each state to implement a Capacity Development Program to ensure that each community and non-transient non-community public water system has the technical, managerial, and financial capacity to ensure long term compliance with all drinking water regulations.

Carbonate Aquifer - An aquifer consisting chiefly of carbonate rocks, such as limestone and dolomite.

Chemical Monitoring Reform - The U. S. EPA is considering requiring states to screen their public water systems to identify those systems at risk of contamination and establish sampling during the period(s) of greatest vulnerability.

Clean Water Act - The Clean Water Act is a 1977 amendment to the federal Water Pollution Control Act of 1972, which set the basic structure for regulating discharges of pollutants to waters of the United States. The law gave Ohio EPA the authority to set effluent standards on an industry basis (technology-based) and continued the requirements to set water quality standards for all contaminants in surface waters. The Clean Water Act makes it unlawful for any person to discharge any pollutant from a point source into navigable waters unless a permit (National Pollution Discharge Elimination System) is obtained under the Act.

Combined Sewer Overflow - Discharge of a mixture of storm water and domestic waste into ditches, rivers, streams or other water bodies when the flow capacity of a sewer system is exceeded during rainstorms.

Community Public Water Systems - A water system that provides water for human consumption to at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. Examples of community systems are municipalities, mobile home parks, home owner associations and nursing homes.

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) - U.S. EPA's computerized database of information about potential and actual uncontrolled hazardous waste sites. It serves as an informational tool to identify sites that appear to warrant further investigation and possible remediation.

Cone of Depression - A depression in the ground water table or potentiometric surface that has the shape of an inverted cone and develops around a well from which water is being withdrawn. Its trace (perimeter) on the land surface defines the zone of influence of a well. Also called *pumping cone* and *cone of drawdown*.

Confined Aquifer - An aquifer confined by an upper and lower confining layer in which the potentiometric surface of the aquifer lies above the base of the upper confining layer.

Confining Unit - Geological material through which significant quantities of water can not move; located below unconfined aquifers, above and below confined aquifers. Also known as a confining bed or confining layer. Typical confining units include clay or shale layers, and till deposits.

Contaminant Candidate List - A list of contaminants which, at the time of publication, are not subject to any proposed or promulgated National Primary Drinking Water Regulations, that are known or anticipated to occur in public water systems and which may require regulations under the Safe Drinking Water Act (Section 1412 (b) (1)). The Safe Drinking Water Act, as amended, specifies that the U.S. EPA must publish the first list of contaminants by February 1998, and every five years thereafter. The Contaminant Candidate List must be published after consultation with the scientific community, and after notice and opportunity for public comment.

Contaminant - Any physical, chemical, biological or radiological substance or matter in water.

Corridor Management Zone - The area adjacent to streams and tributaries within the delineated SWAP area that extends upstream for a distance of 10 miles from a surface water supply intake. It has a width of 1,000 feet on each bank of the principal stream, and 500 feet on each bank of major tributaries draining into the principal stream.

Delineate - To determine and draw the outline or boundary of the SWAP area. This is the five year time of travel zone for ground water based public water systems and the entire watershed upstream of the surface water intake for public water systems using surface water.

Digital Elevation Models - A digital representation of terrain relief produced from elevation data by map sheets acquired from the National Mapping Division of the United States Geological Survey.

Digital Line Graphs - A specialized geographic information system (GIS) file structure normally termed ".DLG." This is a digital format standard published by United States Geological Survey for use in exchanging cartographic data files in vector format.

Digitize - Manual tracing of map features to digitally record the coordinates of each point.

DRASTIC Index - An index developed by the National Water Well Association for the U.S. EPA to evaluate hydrogeologic characteristics of an aquifer to characterize its sensitivity to contamination. The seven characteristics evaluated are **D**epth to Water, Net **R**echarge, **A**quifer Media, **S**oil Media, **T**opography, **I**mpact of the Vadose Zone Media, and Hydraulic **C**onductivity of the aquifer. The DRASTIC indices are graphically represented on Ground Water Pollution Potential Maps, developed by the Ohio Department of Natural Resources.

Drawdown - A lowering of the water table of an unconfined aquifer or the potentiometric surface of a confined aquifer, caused by pumping ground water from wells.

Ecosystem - A community of abiotic and biotic features such as plants, animals, and soil, functioning as a whole in nature.

Effluent - Wastewater, treated or untreated, that flows out of a treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters.

Eight Digit Hydrologic Cataloging Units - *See Hydrologic Unit*.

Emergency Management Zone - The area in the immediate vicinity of the surface water supply intake in which the public water supplier has little or no time to respond to a spill.

Flow Boundaries - Physical or hydraulic boundaries of ground water flow systems that control the direction of ground water flow. Typical physical boundaries are relativity impermeable units of rock or sediment. Hydraulic boundaries refer to divides in ground water flow that may be natural (related to the topography) or artificial (created by pumping water out of, or injecting water into, an aquifer).

Formation - a body of rock characterized by a degree of lithologic homogeneity and prevailing characteristics. A formation is typically tabular in shape and is mappable on the earth's surface or traceable in the subsurface.

Fracture - A general term for any break in a rock, which includes cracks, joints, and faults.

Geographic Information System (GIS) - A computer system that stores and uses locations and information describing natural or man-made features on the earth.

Geologic Sensitivity - The relative ease with which a contaminant applied at or near the surface can migrate to the aquifer of interest. The characteristics of the geologic materials present control the sensitivity.

Global Positioning System (GPS) - A collection of 24 satellites that are orbiting the earth which are used to pinpoint positions anywhere on earth.

Gradient (Hydraulic Gradient) - The change in total hydraulic head (static water level) over a change in distance in a given direction. The direction is that which yields a maximum rate of decrease in head.

Ground Water - The water contained in inter-connected pores located below the water table in an unconfined aquifer or located in a confined aquifer.

Ground Water Quality - *See Water Quality*.

Ground Water Pollution Potential Maps - Ohio county maps produced by the Ohio Department of Natural Resources, Division of Water, using the DRASTIC mapping process. The system consists of two major elements: 1. The designation of mappable units, termed hydrogeologic settings, and; 2. The superposition of a relative rating system to determine the pollution potential. *See DRASTIC Index.*

Heterogeneous - Characteristic of a medium in which material properties vary from point to point.

Homogeneous - Characteristic of a medium in which material properties are identical throughout.

Hydraulic Conductivity - A measure of the relative ease with which water can move through a permeable medium (aquifer).

Hydraulic Head - Height of the water column at a given point in a ground water system, usually given as feet above mean sea level**.**

Hydrogeologic Data - Data that helps to characterize the hydrogeology of an area, such as porosity, aquifer material, and hydraulic conductivity.

Hydrogeologic Setting - Description of the physical setting or location on the basis of geologic and hydrologic considerations and characteristics.

Hydrogeology - The study of the interrelationships of geologic materials and processes with water, especially ground water.

Hydrologic Setting - Geographic information related to the drainage patterns or use of water in a given area.

Hydrologic Cycle - Movement or exchange of water between the atmosphere and earth.

Hydrologic Unit - The basic unit of an ordered grouping of watersheds and sub-watersheds that make up the entire drainage network of the United States. This drainage network was developed by the United States Geological Survey. Each watershed is assigned a unique identification code based on its location and relationship with surrounding watersheds. The hydrologic unit identification code is a number consisting of between 2 to 17 digits depending on factors specific to each watershed. In Ohio, most major river basins have been assigned one or more 8-digit hydrologic unit codes. Each of these 8-digit hydrologic units has been further divided into smaller watersheds identified by 11, 14, and 17-digit hydrologic unit codes.

Inner Management Zone - The one or two year time of travel boundary that identifies the area closest to a well or wellfield.

Inorganic Contaminants - Mineral-based compounds such as metals, nitrates, and asbestos. These contaminants are naturally-occurring in some water, but can also get into water through farming, chemical manufacturing, and other human activities.

Isotropic - The condition in which hydraulic properties of the aquifer are equal in all directions.

Karst Aquifer - An aquifer (typically consisting of carbonate materials) in which dissolution of the rock enlarges fractures and may create caverns. Ground water moves rapidly through karst aquifers and is typically very susceptible to contamination.

Landsat Thematic Mapper Data - Data collected in seven bands of the electromagnetic spectrum (including visual, infrared, and thermal portions) by landsat satellites. The collected data are used to create satellite images that are used within a geographic information system to identify various land uses and other geopolitical features.

Large Quantity Generator - One of three categories U.S. EPA uses to define hazardous waste generators based upon the quantity of hazardous waste they generate per month. Large quantity generators generate more than 2,200 lbs (1000 kg) per month.

Lithology - The description of rocks on the basis of their physical and chemical characteristics.

Maximum Contaminant Level (MCL) - The maximum amount of a compound allowed in drinking water under the Safe Drinking Water Act. Maximum Contaminant Levels are set by

considering both health effects of the compound and technical feasibility of removing the compound from the water supply.

Microbiology - A branch of biology dealing with microscopic forms of life.

Model (Ground Water Flow Model) - A mathematical model that simulates ground water flow indirectly by means of a governing equation thought to represent the physical processes that occur in the system, together with equations that describe heads or flows along the boundaries of the model (boundary conditions).

National Pollution Discharge Elimination System (NPDES) - Anyone wishing to discharge wastewater from a point source (such as a pipe) into a body of water first must obtain a National Pollutant Discharge Elimination System (NPDES) permit from Ohio EPA. The NPDES permit states how much of any pollutant can be discharged.

Nitrate (NO_3) - The most highly oxidized nitrogen phase in the nitrogen cycle which is an important plant nutrient and fertilizer. Nitrate can be toxic to infants, the elderly, and livestock, and the major sources of nitrates in water are septic tanks, feed lots/animal waste, and fertilizers.

Non-Transient Non-community Water Systems - Public water systems which serve at least 25 of the same non-resident persons per day for more than six months of the year. Non-Transient Non-Community systems are typically schools, offices, hospitals, and factories.

Ohio River Valley Sanitation Water Commission (ORSANCO) - An interstate water pollution control agency that was established as a provision of and to implement the Ohio River Valley Water Sanitation Compact, signed in 1948 by the governors of Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia and West Virginia.

On-Stream Impoundment - A reservoir that is filled by the river or stream flowing through it.

Open Interval - The portion of a bedrock well that is not cased. This is the zone that contributes ground water to the well. Well screens are generally not used in bedrock wells.

Organic Constituents - Carbon-based chemicals, such as solvents and pesticides, which can migrate into water through runoff from cropland or discharge from factories.

Outfall - The place where effluent is discharged into receiving waters. Frequently a facility may have more than one discharge pipe, in which case each pipe is referred to by its associated outfall number.

Partially Penetrating Wells - A well constructed in such a way that it draws water from only part of the total thickness of the aquifer.

Partially Confining Aquifers - An aquifer that consists of an upper low-permeability layer that can provide some recharge to the aquifer.

Particle Tracker - A ground water flow model that calculates the flow path of water to a well or other discharge point.

Pathogen - Micro-organisms (e.g., bacteria, viruses, or parasites) that can cause disease in humans, animals, and plants.

Permeability - The ease with which water, or other fluid, passes through a substance.

Pilot Study - A trial study used to serve as a guide or test case for proceeding studies.

Plume - A concentration of contaminants in air, soil, or water usually extending from a distinct source.

Point Source - A stationary location or fixed facility such as an industry or a municipal sewage treatment plant that discharges pollutants into the air or surface water through pipes, ditches, lagoons, wells, or stacks.

Pollution Prevention - U.S. EPA defines Pollution Prevention (P^2) as source reduction and other practices that reduce or eliminate the creation of pollutants through the increased efficiency in the use of raw materials, energy, water or other resources, or the protection of natural resources by conservation.

Porosity - The ratio of the volume of void spaces in a rock or sediment to the total volume of the rock or sediment.

Potential Significant Contaminant Source - A facility or activity that stores, uses, or produces chemicals or elements, and has the potential to release contaminants in an amount that could significantly impact the source waters used by the public water supply.

Potentiometric Map - A contour map of the static water elevations of a particular hydrogeologic unit. Potentiometric maps can be used to determine ground water flow direction and gradient.

Potentiometric Surface - A surface that represents the level to which water will rise in tightly cased wells. If the head varies significantly with depth in the aquifer, then there may be more than one potentiometric surface. The water table is a particular potentiometric surface for an unconfined aquifer.

Public Water System - A system for the provision to the public of piped water for human consumption. Public water systems are identified as *community*, *non-transient non-community*, or *transient public water system*.

Pumping Rates - That rate at which water is pumped from a well or other raw water source.

Qualitative Habitat Evaluation Index - A multi-metric evaluation tool used by Ohio EPA as a screening tool to assist in assigning the appropriate aquatic life use designation for a river or stream.

Quarries - Surface mines from which building stone such as marble, granite, slate or limestone is extracted.

Radiological - Radioactive substances and high-energy radiation.

Raw Water - Untreated water.

Recharge - The addition of water to ground water or surface water by processes of the hydrologic cycle (precipitation or infiltration from the base of a stream into the aquifer) or human activity (injection wells).

Regional Source Water Assessment and Protection (SWAP) Area - Refers to a SWAP area for ground water systems that is regional in scope. The boundaries are based on regional ground water flow boundaries or aquifer boundaries, and the SWAP area may incorporate the five-year capture areas of numerous public water systems. For example, a regional SWAP area will be delineated where large regions of surface karst exist.

Resource Conservation and Recovery Information System (RCRIS) - A national management and inventory system of hazardous waste handlers defined by the Resource Conservation and Recovery Act (RCRA). Handlers can be characterized as fitting one or more of the following categories: treatment, storage and disposal facilities, large quantity generators, small quantity generators, or Transporters. RCRIS captures identification, location and other data for all handlers regarding permit/closure status, compliance with federal and state regulations, and cleanup activities.

Sanitary Survey - An on-site review of the water source, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of such source, facilities, equipment, operation and maintenance for producing and distributing safe drinking water.

Screened Interval - *See Well Screen*.

Secondary Maximum Contaminant Level - The advisable maximum level of a contaminant in water which is delivered to the free-flowing outlet of the ultimate user of a public water system. Contaminants added to the water under circumstances controlled by the user, except those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition.

Sensitivity - *See Geologic Sensitivity.*

Separate Sewer Overflow - Discharge of domestic waste when the flow capacity of a sewer system is exceeded.

Sinkholes - A circular depression in a karst area resulting from the dissolution and/or collapse of underlying materials.

Small Quantity Generator - Persons or facilities that produce 220 - 2,200 pounds per month of hazardous waste. Small quantity generators are required to keep more records than conditionally exempt generators. Small quantity generators may include automotive shops, dry cleaners, photographic developers, and a host of other small enterprises, and comprise by far the vast majority of hazardous waste generators.

Solvent - A liquid substance capable of dissolving or dispersing one or more other substances.

Source Waters - The aquifer or watershed that is contributing water to the public water system.

Source Water Assessments - The process of delineating a SWAP area, inventorying the area for potentially significant sources, and completing the susceptibility analysis for a wellfield or surface water intake for a public water system.

Specific Yield - The ratio of the volume of water the rock or sediment will yield by gravity drainage to the volume of the rock or soil.

Stakeholders - People with a vested interest in the outcome or result of a program or project. Stakeholders within Ohio's Source Water Assessment and Protection Program include anyone who lives in the SWAP area or has land management responsibilities in it. Stakeholders include (among others) government agencies, businesses, private individuals and special interest groups.

Standard Industrial Codes (SIC)- A method of grouping industries with similar products or services and assigning codes to these groups.

Sub-Watersheds - A drainage area such as a creek, that is part of a larger drainage area or watershed.

Surface Water - All water which is open to the atmosphere and subject to surface water runoff (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.).

Susceptibility - The likelihood for the source water(s) of a public water system to be contaminated at concentrations that would pose a concern.

Synthetic Organic Compounds (SOCs)- Laboratory-derived organic compounds, such as pesticides and herbicides.

Time of Travel - The distance that a contaminant or dissolved species will move through the saturated zone and/or surface water body in a specified time.

Topographic Maps - Maps representing the surface features of a region, including the relief and position of natural features like hills, valleys, rivers, and lakes, and man-made structures such as roads and buildings.

Toxic Release Inventory - An annual report of toxic chemical pollution released into the environment by businesses throughout the country. It is available to U.S. EPA, other levels of government and the public in order to analyze industries' progress toward reducing pollution.

Transient Non-Community - Public water systems, which serve at least 25 different (transient) persons over sixty days per year. Transient non-community systems typically are restaurants, hotels, rest areas, golf courses, churches or stores.

Transmissivity - The rate at which water of a prevailing density and viscosity is transmitted through a unit width of an aquifer or confining bed under a unit hydraulic gradient. It is a function of properties of the liquid, the porous media, and the thickness of the porous media.

Treated Water - Water that has been subjected to one or more physical, chemical, or biological processes to reduce its potential of being a health hazard.

Tributaries - A stream that feeds into a larger sized stream or lake.

Trihalomethane (THM)- are disinfection byproducts formed when chlorine reacts with naturally occurring organic matter in the source water used by a water treatment plant.

U.S. EPA Region 5 - The U.S. EPA has divided the United States into 10 regions. Ohio, Wisconsin, Minnesota, Michigan, Illinois, and Indiana are that states that make up Region 5.

Unconfined Aquifer - An aquifer over which there is no confining layer.

Unsaturated Zone - The zone between the land surface and the watertable.

Underground Injection Well - A dug hole or a bored, drilled, or driven well whose depth is greater than the largest surface dimension and that is used to direct fluids into the subsurface. Class V injection wells are the most common and range in complexity from simple cess pools, through storm drains and septic systems, to sophisticated geothermal reinjection wells.

Upground Reservoir - An off-steam water storage facility that is filled with water pumped from a river or stream.

Use Attainment Assessments - Scientific analysis of the chemical, biological and physical conditions of the surface water resource to determine its ecological health and ability to meet its designated uses.

Vadose Zone - *See Unsaturated Zone*.

Volatile Organic Compounds (VOC) - An organic compound that is characterized by being highly mobile in ground water and which is readily volatilized into the atmosphere (chemicals identified in paragraph (C) of rule 3745-81-12 and paragraph (C) of rule 3745-81-24 of the Administrative Code).

Water Quality - Values for dissolved substances in water based upon their toxicological and ecological impacts. Water quality values are monitored annually throughout Ohio (for both surface waters and ground waters) in order to monitor the ambient water quality conditions throughout the state. This monitoring network helps the State of Ohio stay informed of water quality trends that may be occurring within the different regions of the state.

Watershed - A watershed is an area of land from which surface water drains into a common outlet, such as a river, lake, or wetland.

Water Supply Revolving Loan Account Program - A program that will provide assistance for the planning, design, and construction of improvements to community water systems, and nonprofit noncommunity public water systems for planning, design, and construction through below rate loans to eliminate public health threats and ensure compliance with federal and state drinking water laws and regulations.

Well Log - A record of the lithology of the soil, unconsolidated material, and rock types encountered in a borehole from the surface to the bottom. Also known as a lithologic log.

Well Screen - A tubular device with either slots, holes, gauze, or continuous-wire wrap; used at the end or between sections of well casing to complete a well. Water enters a well through its well screen, which serves as a filtering device to sediments.

Wellfield - An area containing two or more wells that are supplying water to a public water system.

Wellhead - The physical structure, facility, or device at the land surface from or through which ground water flows or is pumped from subsurface, water-bearing formations.

APPENDIX A
Contaminants of Concern, Potential Significant Contaminant Sources, and Checklist

APPENDIX A
Description of Contents

A-1 Contaminants of Concern Associated with Primary Contaminant Type

Creating the list of Contaminants of Concern
According to U.S.EPA guidance, each state must identify what "contaminants of concern" its SWAP Program will address and what "significant potential sources" of those contaminants the State will inventory in assessment efforts. At a minimum, states must identify, to the extent practical, the 'origins' of contaminants regulated by the Safe Drinking Water Act (e.g., chemicals for which monitoring is required) located in SWAP areas. States may also chose to identify the origins of other contaminants determined to present a threat to public health. Through the public participation process it was determined that Ohio should not limit the inventory to only sources of chemicals regulated by the Safe Drinking Water Act.

An expanded list of chemicals that Ohio EPA will include in the inventory process was developed and includes contaminants from the following lists:

1. All chemicals and pathogens with a Maximum Contaminant Level.
2. All chemicals with a Secondary Maximum Contaminant Level.
3. All chemicals that are targeted for regulatory review on the federal Contaminant Candidate List.
4. All chemicals and pathogens that have federal Safe Drinking Water Act or state monitoring requirements.
5. All chemicals that have Ohio water quality standards developed under the Clean Water Act.

The creation of this list does not indicate that Ohio will limit inventories only to the chemicals on the list. It just ensures that *at a minimum* potential significant sources of the listed chemicals will be incorporated into the inventory.

Categorization by Type of Contaminant
The categorization of contaminants of concern into nine contaminant types was done to aid in linking contaminants of concern to potential contaminant sources. The categorization was done by Ohio EPA, using best professional judgement and the following references:

Lewis, Richard J. 1997. Hawleys Condensed Chemical Dictionary - 13th Edition.

Verschueren, Karel. 1996. Handbook of Environmental Data on Organic Chemicals - Third Edition.

A-2 Primary Contaminant Type Associated with Specific Potential Contaminant Sources

The links between potential contaminant sources and types of contaminants are based on Ohio EPA guidance documents for conducting potential pollution source inventories (Ohio EPA, 1997a).

Intended Application of Appendices A-1 and A-2
Upon the completion of a detailed inventory, the potential significant contaminant sources may be linked to a list of potential contaminants of concern associated with those sources through the use of Appendices A-1 and A-2.

Appendix A-1 lists each contaminant of concern and identifies it as being in one of 8 categories of contaminant types. In Appendix A-2, the specific potential contaminant sources are linked to one or more of the categories of contaminants. For example, animal feedlots, a potential contaminant source, is shown in Appendix A-2 to be linked to three contaminant types: microorganisms, pesticides and nutrients. Potential contaminants of concern may then be identified by listing the contaminants of concern in each contaminant category. It is important to note that identifying the specific contaminants of concern associated with a particular potential contaminant source requires a site visit. However, the source water assessment process conducted by Ohio EPA will not include site visits to all potential contaminant sources.

It should also be noted that the links between potential contaminant sources and primary contaminant types are not intended to be comprehensive or exhaustive, but only those most commonly associated with the potential contaminant source. In addition, any specific potential contaminant source may actually have none, some, or more types of contaminants associated with it than indicated through the use of these Appendix A tables.

A-3 Potential Significant Contaminant Source Inventory Checklist (Ground Water)

Appendix A-3 includes a checklist that was developed for use by public water systems that use ground water. The public water supplier will locate sources listed on the form on their protection area map, and indicate the total number of each specific type of source they have on the form. The checklist/form asks for more detailed information about the wellfield property (on-site sources), but does not require as detailed information about off-site sources (although space is available on the form to check off more detailed information if it is known about a specific source). Potential pathogen sources (including *Cryptosporidium*) are identified on the checklist by an asterisk after the name of the potential pollution source.

The draft checklist presented in this appendix was produced based on the results of a pilot study, comments through the public participation process, and Appendix E of the USEPA SWAP Guidance. The draft checklist will be pilot tested before distribution to the remaining public water systems in Ohio. The pilot testing will produce examples that can be sent to public water systems to help them better understand how to complete the forms.

Ohio EPA will provide direct technical assistance to help public water systems complete the

checklist forms. The inventory checklists may be inadequate for larger community public water systems. These systems may be required to complete a more detailed inventory (with the assistance of the Ohio EPA).

Appendix A-1. Contaminants of Concern Associated with Primary Contaminant Type

CHEMICAL	Microorganism	Pesticide	Nutrient	Metal	Lubricants, Fuels & Motor Oil	Solvent	Organic	Other
Acrolein							XXXXXX	
Acrylonitrile		XXXXXXXX						
Alachlor		XXXXXXXX						
Aldicarb		XXXXXXXX						
Aldicarb Sulfone		XXXXXXXX						
Aldicarb Sulfoxide		XXXXXXXX						
Aldrin		XXXXXXXX						
Alpha radioactivity								XXXXXX
Aluminum, total				XXXXXX				
Antimony, total				XXXXXX				
Arsenic, total		XXXXXXXX						
Asbestos								XXXXXX
Atrazine		XXXXXXXX						
Atrazine-desethyl		XXXXXXXX						
Azobenzene (Diphenylhydrazine, 1,2-)							XXXXXX	
Barium, total				XXXXXX				
Barium-140								XXXXXX
Benzene						XXXXXX		
Benzidine							XXXXXX	
Beryllium				XXXXXX				
Beta radioactivity								XXXXXX
Boron								XXXXXX
Bromobenzene						XXXXXX		

Appendix A-1. Contaminants of Concern Associated with Primary Contaminant Type

CHEMICAL	Microorganism	Pesticide	Nutrient	Metal	Lubricants, Fuels & Motor Oil	Solvent	Organic	Other
Bromochloromethane							XXXXXX	
Butachlor		XXXXXXXX						
Butylbenzene, n-		XXXXXXXX						
Butylbenzene, sec-						XXXXXX		
Butylbenzene, tert-						XXXXXX		
Cadmium				XXXXXX				
Calcium								XXXXXX
Carbaryl		XXXXXXXX						
Carbofuran		XXXXXXXX						
Carbon tetrachloride						XXXXXX		
Chlordane		XXXXXXXX						
Chloride								XXXXXX
Chlorobenzene						XXXXXX		
Chlorophenol, 2-							XXXXXX	
Chlorotoluene, 2-						XXXXXX		
Chlorotoluene, 4-						XXXXXX		
Chromium				XXXXXX				
Color (Tannins and other organics)								XXXXXX
Copper				XXXXXX				
Cyanazine		XXXXXXXX						
Cyanide								XXXXXX
Cymene (Isopropyltoluene, 4-)						XXXXXX		
Dalapon		XXXXXXXX						

Appendix A-1. Contaminants of Concern Associated with Primary Contaminant Type

CHEMICAL	Microorganism	Pesticide	Nutrient	Metal	Lubricants, Fuels & Motor Oil	Solvent	Organic	Other
DDT		XXXXXXXX						
Di(2-ethylhexyl)adipate							XXXXXX	
Di(2-ethylhexyl)phthalate							XXXXXX	
Di-n-butyl phthalate							XXXXXX	
Dibromo-3-chloropropane, 1,2-		XXXXXXXX						
Dicamba		XXXXXXXX						
Dichlorophenoxyacetic Acid, 2,4- (2,4-D)		XXXXXXXX						
Dichlorobenzene, 1,2-						XXXXXX		
Dichlorobenzene, 1,3-		XXXXXXXX						
Dichlorobenzene, 1,4-		XXXXXXXX						
Dichlorobenzidine, 3,3'-							XXXXXX	
Dichlorodifluoromethane							XXXXXX	
Dichloroethene, 1,1-						XXXXXX		
Dichloroethene, cis-1,2-						XXXXXX		
Dichloroethene, trans-1,2-						XXXXXX		
Dichlorophenol, 2,4-							XXXXXX	
Dichloropropane, 1,2-						XXXXXX		
Dichloropropane, 1,3-						XXXXXX		
Dichloropropane, 2,2-						XXXXXX		
Dichloropropene, 1,1-		XXXXXXXX						
Dichloropropene, 1,3-		XXXXXXXX						
Dieldrin		XXXXXXXX						
Diethyl phthalate						XXXXXX		

Appendix A-1. Contaminants of Concern Associated with Primary Contaminant Type

CHEMICAL	Microorganism	Pesticide	Nutrient	Metal	Lubricants, Fuels & Motor Oil	Solvent	Organic	Other
Dimethyl phthalate							XXXXXX	
Di-n-butyl phthalate							XXXXXX	
Dinitro-2-methylphenol, 4,6-		XXXXXXXX						
Dinitrophenol, 2,4-							XXXXXX	
Dinitrotoluene, 2,4-							XXXXXX	
Dinoseb		XXXXXXXX						
Diquat		XXXXXXXX						
Dissolved Solids, total								XXXXXX
Endosulfan		XXXXXXXX						
Endothall		XXXXXXXX						
Endrin		XXXXXXXX						
Ethylbenzene						XXXXXX		
Ethyl Chloride (Chloroethane)						XXXXXX		
Ethylene Dibromide (Dibromoethane, 1,2-)		XXXXXXXX						
Ethylene Dichloride (Dichloroethane, 1,2-)						XXXXXX		
Ethylidine Chloride (Dichloroethane, 1,1-)							XXXXXX	
Fluoride								XXXXXX
Fluorotrichloromethane (Trichlorofluoromethane)							XXXXXX	
Glyphosate		XXXXXXXX						
Halomethanes, total (HMs)							XXXXXX	
Methyl Bromide (Bromomethane)		XXXXXXXX						
Methyl Chloride (Chloromethane)						XXXXXX		
Methylene Chloride (Dichloromethane)						XXXXXX		

Appendix A-1. Contaminants of Concern Associated with Primary Contaminant Type

CHEMICAL	Microorganism	Pesticide	Nutrient	Metal	Lubricants, Fuels & Motor Oil	Solvent	Organic	Other
Hardness, Total (CaCO3)								XXXXXX
Heptachlor		XXXXXXXX						
Hexachlorobenzene							XXXXXX	
Hexachlorobutadiene						XXXXXX		
Hexachlorocyclohexane (Heptachlor Epoxide; BHC)		XXXXXXXX						
Hexachlorocyclohexane, alpha		XXXXXXXX						
Hexachlorocyclohexane, beta		XXXXXXXX						
Hexachloroethane							XXXXXX	
Hexachlorocyclopentadiene							XXXXXX	
Hydroxycarbofuran, 3-							XXXXXX	
Iodine-131								XXXXXX
Iron				XXXXXX				
Isophorone						XXXXXX		
Isopropylbenzene					XXXXXXXXXXXXX			
Lead				XXXXXX				
Lindane (Hexachlorocyclohexane, gama)				XXXXXX				
Magnesium				XXXXXX				
Manganese				XXXXXX				
MBAS (Foaming agents)								XXXXXX
Mercury				XXXXXX				
Methomyl		XXXXXXXX						
Methoxychlor		XXXXXXXX						

Appendix A-1. Contaminants of Concern Associated with Primary Contaminant Type

CHEMICAL	Microorganism	Pesticide	Nutrient	Metal	Lubricants, Fuels & Motor Oil	Solvent	Organic	Other
Methylene Bromide (Dibromomethane)						XXXXXX		
Metolachlor		XXXXXXXX						
Metribuzin		XXXXXXXX						
Mirex		XXXXXXXX						
Molybdenum				XXXXXX				
Naphthalene					XXXXXXXXXXXXX			
Nickel				XXXXXX				
Nitrate			XXXXXXX					
Nitrate-Nitrite			XXXXXXX					
Nitrite			XXXXXXX					
Nitrobenzene							XXXXXX	
N-Nitrosodimethylamine						XXXXXX		
N-Nitrosodi-n-propylamine		XXXXXXXX						
N-Nitrosodiphenylamine							XXXXXX	
Organotins							XXXXXX	
Oxamyl		XXXXXXXX						
Pathogens	XXXXXXXXXXX							
Coliform, E Coli (Bacteria)	XXXXXXXXXXX							
Coliform, fecal (Bacteria)	XXXXXXXXXXX							
Coliform, total (Bacteria)	XXXXXXXXXXX							
Cryptosporidia	XXXXXXXXXXX							
Giardia	XXXXXXXXXXX							
Pentachlorobenzene							XXXXXX	

Appendix A-1. Contaminants of Concern Associated with Primary Contaminant Type

CHEMICAL	Microorganism	Pesticide	Nutrient	Metal	Lubricants, Fuels & Motor Oil	Solvent	Organic	Other
Pentachlorophenol		XXXXXXXX						
Phenol							XXXXXX	
Phenol, total							XXXXXX	
Phenolics							XXXXXX	
Phosphamidon		XXXXXXXX						
Phosphate			XXXXXXX					
Phosphorus			XXXXXXX					
Picloram		XXXXXXXX						
Polychlorinated biphenyls (PCBs)							XXXXXX	
Aroclor 1016							XXXXXX	
Aroclor 1221							XXXXXX	
Aroclor 1232							XXXXXX	
Aroclor 1242							XXXXXX	
Aroclor 1248							XXXXXX	
Aroclor 1254							XXXXXX	
Aroclor 1260							XXXXXX	
Polynuclear aromatic hydrocarbons (PAHs)							XXXXXX	
Acenaphthene							XXXXXX	
Anthracene							XXXXXX	
Benzo(a)pyrene							XXXXXX	
Fluoranthene							XXXXXX	
Fluorene							XXXXXX	
Pyrene							XXXXXX	

Appendix A-1. Contaminants of Concern Associated with Primary Contaminant Type

CHEMICAL	Microorganism	Pesticide	Nutrient	Metal	Lubricants, Fuels & Motor Oil	Solvent	Organic	Other
Propachlor		XXXXXXXX						
Propylbenzene, n-						XXXXXX		
Radium, total								XXXXXX
Radium-226								XXXXXX
Radium-228								XXXXXX
Radon-222								XXXXXX
Residue, total filtered (Solids)								XXXXXX
Selenium								XXXXXX
Silver				XXXXXX				
Silvex (2,4,5-TP)		XXXXXXXX						
Simazine		XXXXXXXX						
Sodium				XXXXXX				
Strontium				XXXXXX				
Strontium-89								XXXXXX
Strontium-90								XXXXXX
Styrene							XXXXXX	
Sulfate								XXXXXX
Tetrachlorodibenzo-p-dioxin, 2,3,7,8- (2,3,7,8-TCDD; Dioxin)							XXXXXX	
Tetrachloroethane, 1,1,1,2-						XXXXXX		
Tetrachloroethane, 1,1,2,2-						XXXXXX		
Tetrachloroethene						XXXXXX		
Thallium				XXXXXX				

Appendix A-1. Contaminants of Concern Associated with Primary Contaminant Type

CHEMICAL	Microorganism	Pesticide	Nutrient	Metal	Lubricants, Fuels & Motor Oil	Solvent	Organic	Other
Tin				XXXXXX				
Titanium				XXXXXX				
Toluene						XXXXXX		
Toxaphene		XXXXXXXX						
Triazines		XXXXXXXX						
Trichlorobenzene, 1,2,3-						XXXXXX		
Trichlorobenzene, 1,2,4-						XXXXXX		
Trichloroethane, 1,1,1-						XXXXXX		
Trichloroethane, 1,1,2-						XXXXXX		
Trichloroethene							XXXXXX	
Trichlorophenol, 2,4,6-		XXXXXXXX						
Trichlorophenoxypropionic acid, 2,4,5- (2,4,5-T)		XXXXXXXX						
Trichloropropane, 1,2,3-						XXXXXX		
Trimethylbenzene, 1,2,4-							XXXXXX	
Trimethylbenzene, 1,3,5- (Mesitylene)							XXXXXX	
Tritium								XXXXXX
Turbidity (Suspended Solids)								XXXXXX
Uranium, total								XXXXXX
Uranium-234								XXXXXX
Uranium-235								XXXXXX
Uranium-238								XXXXXX
Vanadium				XXXXXX				
Vinyl chloride							XXXXXX	

Appendix A-1. Contaminants of Concern Associated with Primary Contaminant Type

CHEMICAL	Microorganism	Pesticide	Nutrient	Metal	Lubricants, Fuels & Motor Oil	Solvent	Organic	Other
Water treatment parameters								
Alkalinity, phenolphthalein (CaCO3)								XXXXXX
Alkalinity, stability (CaCO3)								XXXXXX
Alkalinity, total (CaCO3)								XXXXXX
Fluoride								XXXXXX
Bromate							XXXXXX	
Chlorite								XXXXXX
Chlorine dioxide								XXXXXX
Chlorine dioxide residual								XXXXXX
pH, lab (Hydrogen)								XXXXXX
Trihalomethanes							XXXXXX	
Bromoform							XXXXXX	
Bromodichloromethane							XXXXXX	
Chloroform						XXXXXX		
Dibromochlorometha							XXXXXX	
Halo acetic acids								XXXXXX
Monochloroacetic Acid								XXXXXX
Dichloroacetic Acid								XXXXXX
Trichloroacetic Acid								XXXXXX
Monobromoacetic Acid								XXXXXX
Dibromoacetic Acid								XXXXXX
Xylenes					XXXXXXXXXXXX			
Zinc				XXXXXX				

Appendix A-2. Primary Contaminant Type Associated with Specific Potential Contaminant Sources

Source	Microorganisms	Pesticides	Nutrients	Metals	Lubricants, Fuels & Motor Oil	Solvents	Organics	Site Specific
AGRICULTURAL SOURCES								
Animal Feedlots	XXXXXXXXXXXX	XXXXXXXX	XXXXXXX					
Animal Burial Areas	XXXXXXXXXXXX		XXXXXXX					
Animal Waste Storage / Treatment	XXXXXXXXXXXX		XXXXXXX					
Auction Lots	XXXXXXXXXXXX	XXXXXXXX	XXXXXXX					
Confined Animal Feeding Operations (CAFOs)	XXXXXXXXXXXX	XXXXXXXX	X XXXXXX					
Crop Irrigation		XXXXXXXX	XXXXXXX		XXXXXXXXXXXXX			
Crops: Corn, Soybean, Wheat		XXXXXXXX	XXXXXXX		XXXXXXXXXXXXX			
Crops: Orchards		XXXXXXXX	XXXXXXX		XXXXXXXXXXXXX			
Crops: Other		XXXXXXXX	XXXXXXX		XXXXXXXXXXXXX			
Dairy Facility	XXXXXXXXXXXX	XXXXXXXX	XXXXXXX					
Drainage Canals (Agricultural)	XXXXXXXXXXXX	XXXXXXXX	XXXXXXX					
Drainage Tile (Agricultural)		XXXXXXXX	XXXXXXX					
Drainage Wells (Agricultural)	XXXXXXXXXXXX	XXXXXXXX	XXXXXXX					
Farm Chemical Distributor		XXXXXXXX	XXXXXXX		XXXXXXXXXXXXX			
Farm Machinery Repair Areas				XXXXXX	XXXXXXXXXXXXX	XXXXXX		
Fertilizer Application			XXXXXXX					
Greenhouses / Nurseries		XXXXXXXX	XXXXXXX					
Manure Spreading	XXXXXXXXXXXX		XXXXXXX					
Other Animal Facilities	XXXXXXXXXXXX	XXXXXXXX	XXXXXXX					
Pasture	XXXXXXXXXXXX		XXXXXXX					
Pesticide / Fertilizer / Petroleum Storage & Transfer Areas		XXXXXXXX	XXXXXXX		XXXXXXXXXXXXX			
Silage Storage (Bulk)			XXXXXXX					
Silviculture (Logging)			XXXXXXX					

Appendix A-2. Primary Contaminant Type Associated with Specific Potential Contaminant Sources

Source	Microorganisms	Pesticides	Nutrients	Metals	Lubricants, Fuels & Motor Oil	Solvents	Organics	Site Specific
RESIDENTIAL SOURCES								
Pesticide Application		XXXXXXXX						
Residential (Multi-Units)		XXXXXXXX	X XXXXXX	XXXXXX	XXXXXXXXXXXX		XXXXXXX	
Residential (Single Family Homes)		XXXXXXXX	XXXXXXX	XXXXXX	XXXXXXXXXXXX		XXXXXXX	
Septic Systems (Discharging to Stream or Surface Water)	XXXXXXXXXXX		XXXXXXX					
Septic Systems (Leach Field)	XXXXXXXXXXX		XXXXXXX					
MUNICIPAL SOURCES								
Artificial Ground Water Recharge Areas	XXXXXXXXXXX		XXXXXXX	XXXXXX	XXXXXXXXXXXX		XXXXXXX	
Combined Sewer Overflows (CSOs)	XXXXXXXXXXX		XXXXXXX	XXXXXX	XXXXXXXXXXXX		XXXXXXX	
Composting Facility / Yard Wastes			XXXXXXX				XXXXXXX	
Demolition Debris Landfills							XXXXXXX	
Drinking Water Treatment Plants								XXXXXX
Fire Stations					XXXXXXXXXXX			
Highway		XXXXXXXX		XXXXXX	XXXXXXXXXXX		XXXXXXX	
Historic Railroad Right-of-Ways		XXXXXXXX		XXXXXX	XXXXXXXXXXX		XXXXXXX	
Historic Waste Dumps / Landfills								XXXXXX
Illegal Dump								XXXXXX
Incinerator: Municipal				XXXXXX			XXXXXXX	
Landfill: Municipal								XXXXXX
Managed Forests		XXXXXXXX	XXXXXXX					
Military Base								XXXXXX
Park Land		XXXXXXXX	XXXXXXX					
Radioactive Waste Disposal Sites								XXXXXX
Railroad Tracks (Right-of-Way)		XXXXXXXX		XXXXX X	XXXXXXXXXXX			
				XXXXXX	XXXXXXXXXXX	XXXXXX	XXXXXXX	
Recycling / Reduction Facilities								XXXXXX

Appendix A-2. Primary Contaminant Type Associated with Specific Potential Contaminant Sources

Source	Microorganisms	Pesticides	Nutrients	Metals	Lubricants, Fuels & Motor Oil	Solvents	Organics	Site Specific
Right-of-Ways (Herbicide Use Areas)		XXXXXXXX						
Road Maintenance Depots / Deicing Operations		XXXXXXXX		XXXXXX	XXXXXXXXXXXXX	XXXXXX	XXXXXXX	
Schools		XXXXXXXX	XXXXXXX	XXXXXX	XXXXXXXXXXXXX		XXXXXXX	
Sewage Sludge / Biosolid Application			XXXXXXX	XXXXXX				
Sewer Lines	XXXXXXXXXXXX		XXXXXXX	XXXXXX				
Storm Drains	XXXXXXXXXXXX	XXXXXXXX	XXXXXXX	XXXXXX	XXXXXXXXXXXXX		XXXXXXX	
Storm Water Basins	XXXXXXXXXXXX	XXXXXXXX	XXXXXXX	XXXXXX	XXXXXXXXXXXXX		XXXXXXX	
Waste Transfer / Recycling Stations								XXXXXX
Wastewater Treatment Plant	XXXXXXXXXXXX		XXXXXXX	XXXXXX			XXXXXXX	
Wastewater Application Sites	XXXXXXXXXXXX		XXXXXXX	XXXXXX			XXXXXXX	
Wells: Abandoned								XXXXXX
Wells: Water Supply								XXXXXX
COMMERCIAL SOURCES								
Abandoned Airfields				XXXXXX	XXXXXXXXXXXX	XXXXXX	XXXXXXX	
Above Ground Storage Tanks		XXXXXXXX	XXXXXXX		XXXXXXXXXXXX		XXXXXXX	
Airport				XXXXXX	XXXXXXXXXXXX	XXXXXX	XXXXXXX	
Auto Repair Shops				XXXXXX	XXXXXXXXXXXX	XXXXXX	XXXXXXX	
Barber and Beauty Shops							XXXXXXX	
Barging facilities					XXXXXXXXXXXX			XXXXXX
Boat Services / Repair / Refinishing				XXXXXX	XXXXXXXXXXXX	XXXXXX	XXXXXXX	
Body Shops				XXXXXX	XXXXXXXXXXXX	XXXXXX	XXXXXXX	
Camp Grounds	XXXXXXXXXXXX	XXXXXXXX	XXXXXXX		XXXXXXXXXXXX			
Car Dealerships					XXXXXXXXXXXX	XXXXXX	XXXXXXX	
Car Washes			XXXXXXX		XXXXXXXXXXXX	XXXXXX	XXXXXXX	
Carpet Stores							XXXXXXX	
Cemeteries	XXXXXXXXXXXX							

Appendix A-2. Primary Contaminant Type Associated with Specific Potential Contaminant Sources

Source	Microorganisms	Pesticides	Nutrients	Metals	Lubricants, Fuels & Motor Oil	Solvents	Organics	Site Specific
Construction Areas					XXXXXXXXXXXXX	XXXXXX		
Demolition Areas								XXXXXX
Dry Cleaners						XXXXXX	XXXXXXX	
Equipment Rental / Repair Shop								XXXXXX
Fleet / Truck / Bus Terminals				XXXXXX	XXXXXXXXXXXXX	XXXXXX		
Food Processor								XXXXXX
Funeral Services and Crematories	XXXXXXXXXXXX	XXXXXXXX				XXXXXX	XXXXXXX	
Furniture and Fixtures Manufacturers						XXXXXX	XXXXXXX	
Furniture Repair and Finishing Shops						XXXXXX	XXXXXXX	
Gas Stations				XXXXXX	XXXXXXXXXXXXX	XXXXXX	XXXXXXX	
Golf Courses		XXXXXXXX	XXXXXXX		XXXXXXXXXXXXX			
Hardware / Lumber / Parts Stores					XXXXXXXXXXXXX		XXXXXXX	
Heating Oil Companies					XXXXXXXXXXXXX	XXXXXX		
Historic Gas Stations				XXXXXX	XXXXXXXXXXXXX	XXXXXX	XXXXXXX	
Hospitals				XXXXXX	XXXXXXXXXXXXX	XXXXXX	XXXXXXX	
Junk Yards: Scrap and Auto				XXXXXX	XXXXXXXXXXXXX	XXXXXX	XXXXXXX	
Landscaping Firms			XXXXXXX					
Laundromats			XXXXXXX					
Lawn / Farm Stores		XXXXXXXX	XXXXXXX		XXXXXXXXXXXXX			
Marina / Boat Docks				XXXXXX	XXXXXXXXXXXXX	XXXXXX	XXXXXXX	
Medical / Dental Offices / Clinics				XXXXXX		XXXXXX	XXXXXXX	
Office Buildings / Complexes		XXXXXXXX	XXXXXXX		XXXXXXXXXXXXX			
Paint Stores						XXXXXX	XXXXXXX	
Parking Lots / Malls					XXXXXXXXXXXXX			
Pest Control Company		XXXXXXXX						
Pharmacies							XXXXXXX	
Photo Processing / Printing				XXXXXX		XXXXXX	XXXXXXX	

Appendix A-2. Primary Contaminant Type Associated with Specific Potential Contaminant Sources

Source	Microorganisms	Pesticides	Nutrients	Metals	Lubricants, Fuels & Motor Oil	Solvents	Organics	Site Specific
Print Shops						XXXXXX	XXXXXXX	
Printer / Publisher						XXXXXX	XXXXXXX	
Recreational Vehicle / Mini-Storage					XXXXXXXXXXXXX	XXXXXX	XXXXXXX	
Research Laboratories				XXXXXX		XXXXXX	XXXXXXX	
Sawmills and Planers						XXXXXX		
Sports and Hobby Shops					XXXXXXXXXXXXX	XXXXXX	XXXXXXX	
Underground Storage Tanks					XXXXXXXXXXXXX			
Veterinary Offices	XXXXXXXXXXXX	XXXXXXXX				XXXXXX	XXXXXXX	
Welding Shops				XXXXXX		XXXXXX	XXXXXXX	
INDUSTRIAL SOURCES								
Asphalt Plants							XXXXXXX	
Cement / Concrete Plants								XXXXXX
Chemical Drums / Storage					XXXXXXXXXXXXX	XXXXXX	XXXXXXX	
Chemical Plant								XXXXXX
Chemical Spills								XXXXXX
Chemical / Petroleum Pipelines					XXXXXXXXXXXXX	XXXXXX	XXXXXXX	
Electrical / Electronic Manufacturing				XXXXXX		XXXXXX		
Foundries and Metal Fabricators				XXXXXX	XXXXXXXXXXXXX	XXXXXX	XXXXXXX	
Gas Lines								XXXXXX
Gravel Pits								XXXXXX
Historic hazardous materials sites				XXXXXX	XXXXXXXXXXXXX	XXXXXX	XXXXXXX	XXXXXX
Industrial Pipelines								XXXXXX
Lagoon / Pond / Pit								XXXXXX
Landfills: Industrial Nonhazardous								XXXXXX
Landfills: Hazardous Wastes								XXXXXX
Machine and Metalworking Shops				XXXXXX	XXXXXXXXXXXX	XXXXXX	XXXXXXX	

Appendix A-2. Primary Contaminant Type Associated with Specific Potential Contaminant Sources

Source	Microorganisms	Pesticides	Nutrients	Metals	Lubricants, Fuels & Motor Oil	Solvents	Organics	Site Specific
Material Stockpiles								XXXXXX
Metal Finishing / Plating				XXXXXX		XXXXXX	XXXXXXX	
Mine Tailings Ponds				XXXXXX				
Mine Wastes (Gob Piles, Tailings, etc.)				XXXXXX				
Mines: Abandoned				XXXXXX				
Mining: Surface				XXXXXX				
Mining: Underground				XXXXXX				
Permitted Discharge Pipe (Outfall)								XXXXXX
Petroleum Production and Storage Companies					XXXXXXXXXXXX		XXXXXXX	
Plastics / Synthetics Producers						XXXXXX	XXXXXXX	
Quarry								XXXXXX
Stone, Clay and Glass Manufacturers						XXXXXX	XXXXXXX	
Surface Impoundments								XXXXXX
Wells: Injection								XXXXXX
Wells: Brine Injection				XXXXXX			XXXXXXX	
Wells: Oil and Gas				XXXXXX	XXXXXXXXXXXX	XXXXXX	XXXXX XX	
Wood / Pulp / Paper Mills				XXXXXX			XXXXXXX	

Appendix A-3 Potential Significant Contaminant Source Inventory Checklist

POTENTIAL SOURCES OF CONTAMINATION CHECKLIST

SYSTEM NAME:	PWS ID#:
ADDRESS:	CONTACT PERSON:
COUNTY:	PHONE NUMBER:
TOWNSHIP:	DATE OF INVENTORY:

Please note the number of each type of source located in the 1-year Time of Travel (TOT) and 5-year TOT. List any specific information regarding the potential pollution source under the "comments" section.

ON-SITE SOURCES

Potential Contaminant Source	MAP CODE	Sources in 1-year TOT	Sources in 5-year TOT	**COMMENTS** -Substances present, amount, type of storage, emergency response plans, maintenance, etc..
Above Ground Storage Tanks	O-1			
Chemical Drums/ Storage	O-2			
Chemical Spills	O-3			
Chemical/petroleum pipelines	O-4			
Combined Sewer overflows*	O-5			
Fertilizer Application	O-6			
Gas Lines	O-7			
Industrial pipelines	O-8			
Lagoon/Pond/Pit	O-9			
Material stockpiles	O-10			
Pesticide Application	O-11			
Salt/Deicing Storage Piles	O-12			
Septic Systems (discharging)*	O-13			
Septic Systems (leachfield)*	O-14			
Sewer Lines*	O-15			
Storm Drains	O-16			
Surface Impoundments	O-17			
Underground Storage Tanks	O-18			
Wells: water supply	O-19			
Wells: oil and gas	O-20			
Wells: brine injection	O-21			
Wells: injection	O-22			
Wells: not in use	O-23			
Other _____	O-24			

Practices to reduce spills or releases employed on-site:

OFF-SITE SOURCES (In Your Protection Area)								
Potential Contaminant Sources	**MAP CODE**	**Sources in 1-year TOT**	**Sources in 5-year TOT**	**Floor Drain**	**UST**	**Chemical Storage**	**Source of Info**	**COMMENTS- Substance present, amount, responsible party, etc.**
COMMERCIAL SOURCES								
Abandoned airfields	C-1							
Airport	C-2							
Auto repair shops	C-3							
Barber and beauty shops	C-4							
Barging facilities	C-5							
Boat services/repair/refinishing	C-6							
Body shops	C-7							
Camp grounds	C-8							
Car dealerships	C-9							
Car washes	C-10							
Carpet stores	C-11							
Cemeteries*	C-12							
Construction areas	C-13							
Demolition areas	C-14							
Dry cleaners	C-15							
Equipment rental/repair shops	C-16							
Fleet/truck/bus terminals	C-17							
Food Processor	C-18							
Funeral services and crematories	C-19							
Furniture and fixtures manufacturers	C-20							
Furniture repair/finishing shops	C-21							
Gas stations	C-22							
Golf courses	C-23							
Hardware/lumber/parts stores	C-24							
Heating oil companies	C-25							
Historic gas stations	C-26							
Hospitals*	C-27							
Junk yards, scrap and auto	C-28							
Landscaping firms	C-29							
Laundromats	C-30							
Lawn/farm stores	C-31							

OFF-SITE SOURCES (In Your Protection Area)								
Potential Contaminant Sources	**MAP CODE**	**Sources in 1-year TOT**	**Sources in 5-year TOT**	**Floor Drain**	**UST**	**Chemical Storage**	**Source of Info**	**COMMENTS- Substance present, amount, responsible party, etc.**
COMMERCIAL SOURCES (continued)								
Marina/boat docks	C-32							
Medical/dental offices/clinics*	C-33							
Office buildings/complexes	C-34							
Paint stores	C-35							
Parking lots/malls	C-36							
Pest control company	C-37							
Pharmacies	C-38							
Photo processing/printing	C-39							
Print Shops	C-40							
Printer/publisher	C-41							
Recreational vehicle/mini	C-42							
Research laboratories	C-43							
Sawmills and planers	C-44							
Sports and hobby shops	C-45							
Veterinary offices*	C-46							
Welding shops	C-47							
Other (list under comments)	C-48							
INDUSTRIAL SOURCES								
Asphalt plants	I-1							
Cement/concrete plants	I-2							
Chemical Plant	I-3							
Electrical/electronic	I-4							
Foundries and metal fabricators	I-5							
Gravel pits	I-6							
Historic hazardous material site	I-7							
Landfills: hazardous wastes	I-8							
Landfills: Industrial	I-9							
Machine/metalworking shops	I-10							
Metal finishing/plating	I-11							
Mine tailings ponds	I-12							
Mine wastes (gob piles,tailings)	I-13							
Mines: abandoned	I-14							

OFF-SITE SOURCES (In Your Protection Area)

Potential Contaminant Sources	MAP CODE	Sources in 1-year TOT	Sources in 5-year TOT	Floor Drain	UST	Chemical Storage	Source of Info	COMMENTS- Substance present, amount, responsible party, etc.
INDUSTRIAL SOURCES (Continued)								
Mining: surface	I-15							
Mining: underground	I-16							
Petroleum production and storage companies	I-17							
Plastics/synthetics producers	I-18							
Quarry	I-19							
Stone, clay and glass	I-20							
Wood preserving/treating	I-21							
Wood/pulp/paper mills	I-22							
Other (list under comments)	I-23							
AGRICULTURAL SOURCES								
Animal burial areas*	A-1							
Animal feedlots*	A-2							
Animal waste storage/	A-3							
Auction lots*	A-4							
Confined Animal Feeding	A-5							
Crops : corn, soybean, wheat	A-6							
Crops: orchards	A-7							
Crops: other	A-8							
Dairy Facility*	A-9							
Drainage canals (agricultural)	A-10							
Farm chemical distributor	A-11							
Farm machinery repair areas	A-12							
Greenhouses/Nurseries	A-13							
Other animal facilities*	A-14							
Pasture*	A-15							
Pesticide/fertilizer/petroleum	A-16							
Silage storage (bulk)	A-17							
Silviculture (logging)	A-18							
Other (list under comments)	A-19							

OFF-SITE SOURCES (In Your Protection Area)

Potential Contaminant Sources	MAP CODE	Sources in 1-year TOT	Sources in 5-year TOT	Floor Drain	UST	Chemical Storage	Source of Info	COMMENTS- Substance present, amount, responsible party, etc.
MUNICIPAL SOURCES								
Artificial ground water	M-1							
Composting facility/yard	M-2							
Demolition Debris Landfills	M-3							
Drinking water treatment plants	M-4							
Fire stations	M-5							
Highway	M-6							
Historic railroad right-of-ways	M-7							
Historic waste dumps/landfills	M-8							
Illegal Dump	M-9							
Incinerators (municipal)	M-10							
Landfills (municipal)	M-11							
Managed forests	M-12							
Military Base	M-13							
Park lands	M-14							
Radioactive waste disposal sites	M-15							
Railroad Tracks (right of way)	M-16							
Railroad yards/	M-17							
Recycling/reduction facilities*	M-18							
Right-of-ways (herbicide use	M-19							
Road maintenance	M-20							
Schools	M-21							
Storm water basins	M-22							
Waste transfer/recycling	M-23							
Wastewater treatment plant*	M-24							
Wastewater application sites	M-25							
Other (list under comments)	M-26							

Does any portion of your protection area have **Zoning**? ___ YES ___ NO.
Is your entire protection area **Sewered**? ___ YES ___ NO. If you answered "NO", is your entire protection area unsewered (on septic tanks, or package plants, etc.) ___ YES ___ NO. If you answered "NO" please mark on your protection area map all areas that are unsewered.
Does any portion of your protection area utilize home fuel oil tanks? __ YES __ NO (may be indicated by areas that do not have gas lines) If you answered "yes" please mark these areas on your protection area map.

APPENDIX B
Source Water Assessment Strategy for the Ohio River

Draft

The Ohio River Valley Water Sanitation Commission

October 1998

INTRODUCTION

The Safe Drinking Water Act (SDWA) Amendments of 1996 included a requirement that states establish a source water assessment program (SWAP) to protect all public drinking water supplies. As part of this requirement states need to set forth their strategic approach to conducting the assessments, delineate source water areas for public water systems (PWSs), identify the origins of regulated and certain unregulated contaminants in the delineated area, and determine the PWS's susceptibility to contamination by the sources inventoried. States are also required to describe how they will make the maximum practical effort to coordinate with other states, tribes, or nations in completing assessments on an interstate basis.

ORSANCO's role in SWAP activities has been defined as providing a mechanism for interstate cooperation and communication within the Ohio River Basin. In 1997, ORSANCO initiated a work group, comprised of representatives of state drinking water agencies and members of ORSANCO's Water Users Advisory Committee, to discuss interstate aspects of SWAP activities for the Ohio River. As a result of this meeting, ORSANCO agreed to develop an approach for states to delineate and inventory Ohio River source water. This approach would be incorporated into a report that could be appended to states' individual SWAP plans and used as a minimum guideline for interstate assessments. Therefore, the goal of this document is to provide states with a consistent approach to conduct Ohio River source water assessments.

The Commission

The Ohio River Valley Water Sanitation Commission (ORSANCO) is an interstate water pollution control agency that was established as a provision of and to implement the Ohio River Valley Water Sanitation Compact, signed in 1948 by the governors of Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia, and West Virginia. The Commission consists of three representatives from each state, appointed by their respective governors, and three members from the federal government who are appointed by the President. A guiding principle of the Compact is that pollution originating in one state shall not injuriously affect the waters of another state. Therefore, ORSANCO manages and operates programs for water quality monitoring and assessment, assists in emergency response management, has established pollution control standards for the Ohio River, and facilitates interstate cooperation and coordination through an extensive committee structure (see Figure 1). Due to the nature of Source Water Assessment activities on the Ohio River, the Commission is uniquely positioned to facilitate interstate cooperation and participation to implement this document.

The Basin

The Ohio River Basin encompasses portions of 14 states in an area of more than 200,000 square miles, which constitutes over five percent of the total United States land mass. The Ohio River itself, formed in Pittsburgh at the confluence of the Allegheny and Monongahela Rivers, is 981 miles long and flows through or borders six states - Illinois, Indiana, Kentucky, Ohio, Pennsylvania, and West Virginia (see Figure 2). Over 25 million people reside in the Ohio River Basin, or approximately 10 percent of the total U.S. population. Of these, nearly three million people use the Ohio River as a source of drinking water from 32 public water supply intakes (see Table 1).

Figure 1. Ohio River Valley Water Sanitation Commission Committee Organizational Structure

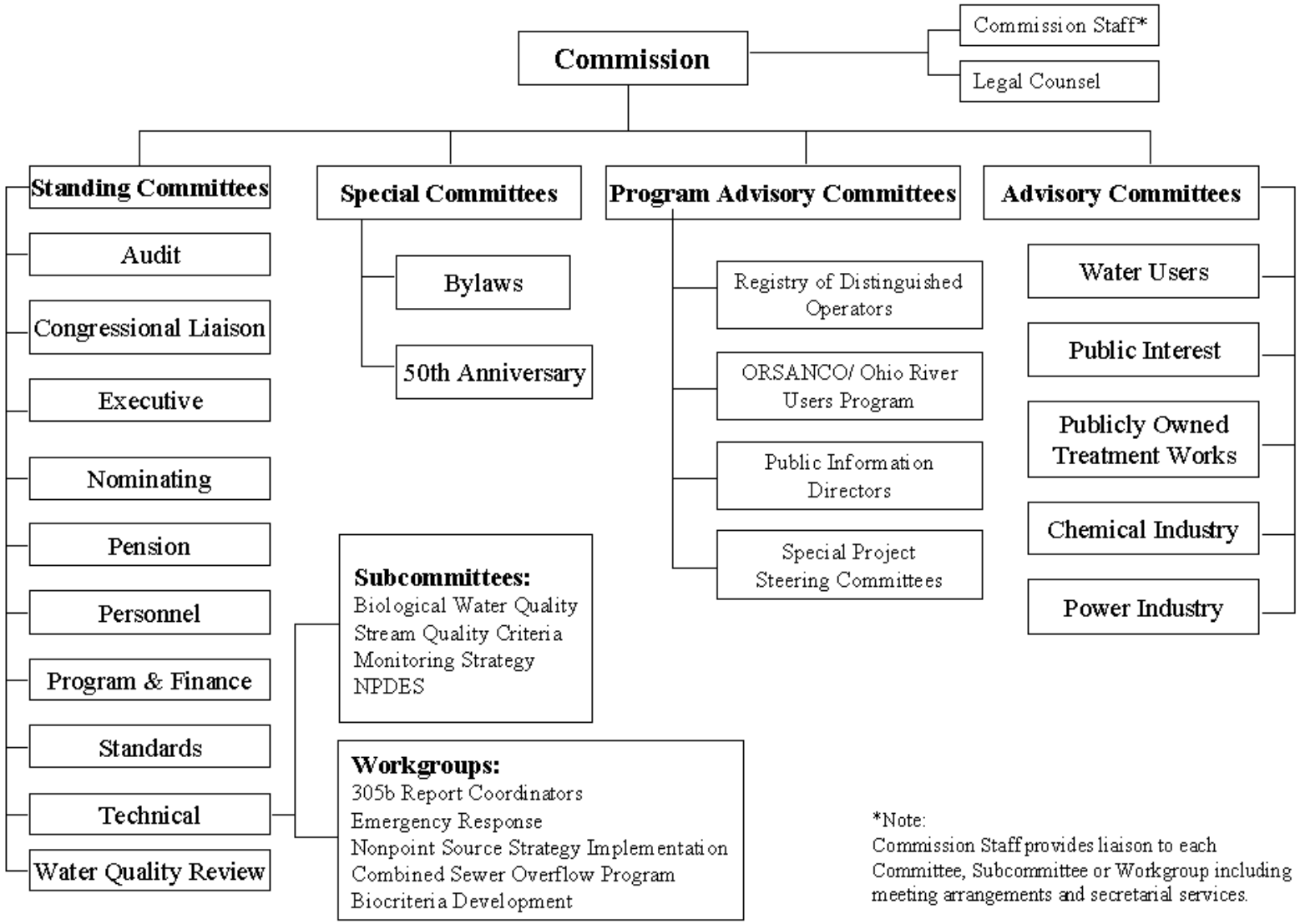

Figure 2. The Ohio River Basin

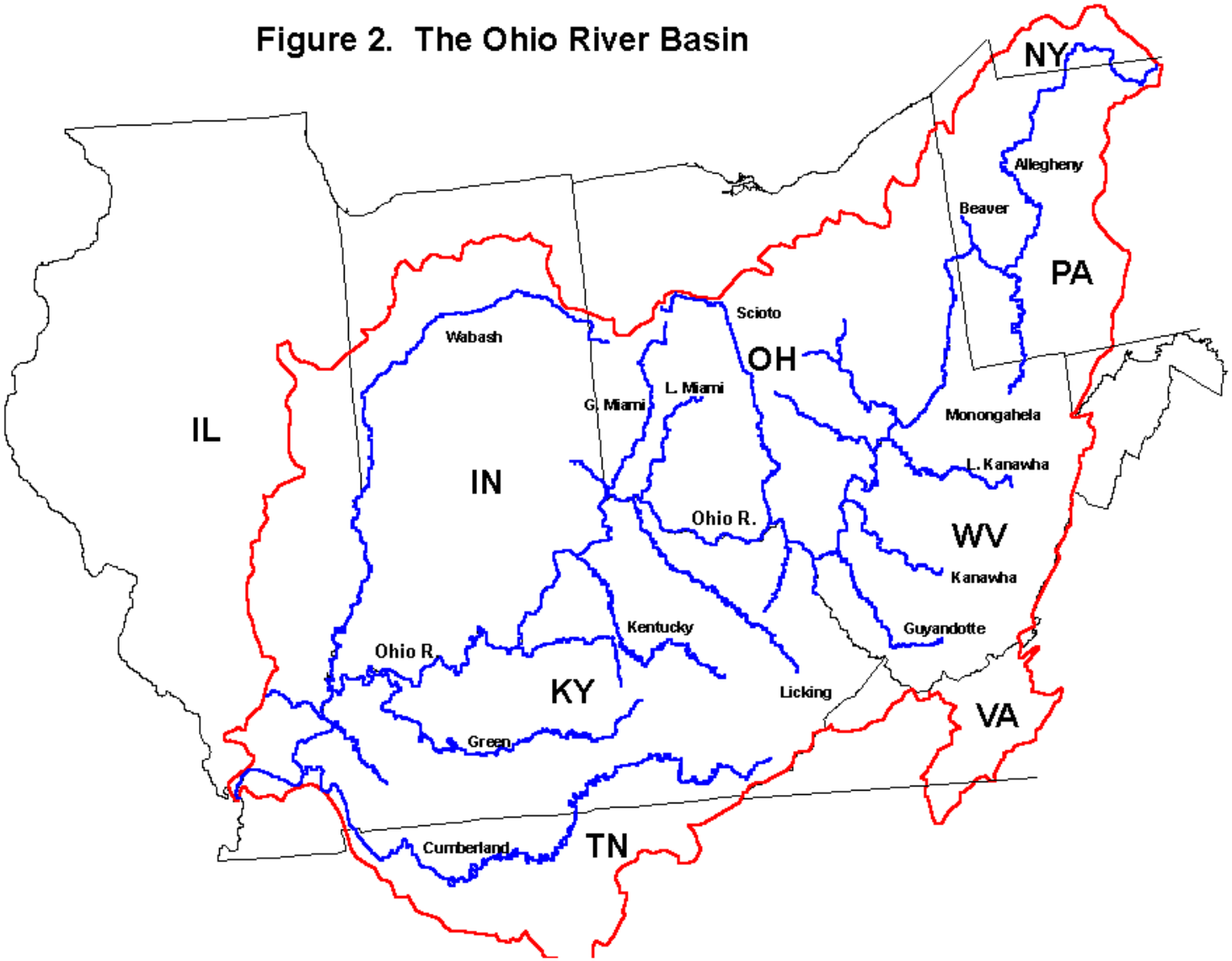

Table 1. Ohio River Public Drinking Water Intakes.

Mile	State	Intake	Pumping Rate (MGD)	Intake Depth (Feet*)	Population Served
4.5	PA	West View	20.0	15	200,000
8.6	PA	Robinson Township	3.0	15	10,800
29.0	PA	NOVA Chemical Corp.	0.12		
36.0	PA	Midland	3.5	15	1,200
40.2	OH	East Liverpool	3.6	10	13,500
59.1	OH	Toronto	0.3	19	6,800
65.2	WV	Weirton	3.2	24	22,000
65.2	OH	Steubenville	6.5	18	40,000
70.8	WV	Hooverson Heights	0.4	8-10	5,000
86.8	WV	Wheeling	8.0	7	60,000
137.1	WV	Sistersville	0.2	8	2,000
304.2	WV	Huntington	13.0	15-21	90,000
306.9	WV	Huntington		17.5	
319.7	KY	Ashland	8.5	23	35,900
327.0	OH	Ironton	2.0	18	12,700
327.5	KY	Russell	2.0	15	14,500
350.8	OH	Portsmouth	7.0	18	50,000
407.8	KY	Maysville	2.5	12	13,000
462.8	OH	Cincinnati	124.0	27	800,000
462.9	KY	Kenton Co. (Ft. Thomas)	40.0	30	180,000
463.2	KY	Newport	12.0	22	25,000
594.2	KY	Louisville	115.0	20	720,000
600.6	KY	Louisville		10-30	
609.0	IN	Indiana Cities (New Albany)	5.0	15	35,000
791.5	IN	Evansville	30.0	4	161,000
803.2	KY	Henderson	6.6	30	42,000
829.3	IN	Mt Vernon	2.0	35	8,300
839.9	KY	Morganfield	2.2	28.3	10,000
842.5	KY	Uniontown	0.1	5	1,000
871.4	KY	Sturgis	0.35	18	4,200
935.5	KY	Paducah	6.6	15	47,000
977.0	IL	Cairo	1.2	8	5,800
978.0	IL	Cairo		26	

*Below normal pool stage.

ROLES AND RESPONSIBILITIES

The development of a strategy for Ohio River source water assessments involves participation from state water agencies, ORSANCO, and ORSANCO's Water Users Advisory Committee (WUAC), which made up of representatives of Ohio River drinking water utilities. ORSANCO's main role in SWAP is interstate coordination not implementation. State water agencies are responsible for conducting SWAPs on interstate water systems. Following are the roles of each of these entities.

ORSANCO

1. Develop a source water assessment strategy containing minimum procedures for a consistent approach to assessments on the Ohio River.
2. Generate GIS coverages of delineation areas along the Ohio River.
3. Provide technical/public information workshops for groups conducting Ohio River source water assessments.
4. Provide technical guidance and facilitate an exchange of information/data among state water agencies for source water assessment activities.
5. Incorporate general education on source water assessment activities into ORSANCO's public information work.

SWAP Work Group

1. Provide guidance, technical assistance, and direction for the development of a Source Water Assessment Strategy for the Ohio River.
2. Review and adopt/revise the submitted document.
3. Coordinate ORSANCO's Ohio River activities with individual state SWAPs.

ORSANCO Water Users Advisory Committee

1. Provide technical guidance for ORSANCO and state water agencies in development of an Ohio River Source Water Assessment plan.
2. Review the submitted Ohio River Source Water Assessment plan.

State Drinking Water Agencies

1. Provide guidance, direction, and technical assistance in development of a source water assessment strategy for the Ohio River.
2. Conduct public reviews and address comments regarding requirements and progress of Ohio River source water assessments.
3. Implement Ohio River Source Water Assessments using ORSANCO's document as a minimum guideline.
4. Conduct susceptibility determinations for portions of the river within their border.
5. Communicate and exchange information with adjacent state water agencies regarding interstate concerns.

DELINEATION OF PROTECTION AREAS

The focus of this document is on Ohio River surface water intakes. Therefore, ground water wells adjacent to the Ohio River will not be incorporated in Ohio River delineations. In addition, tributaries are only included to the extent that they affect Ohio River source water. Delineations of tributary intakes will not be conducted in this approach.

Due to the size and complex nature of the Ohio River, ORSANCO recommends using a tiered-delineation system consisting of three protection zones (see Figure 3 – to be added). The purpose of this tiered-approach is to define the level of source inventory within the Ohio River Basin. The following recommendations are intended to serve as minimum guidelines for state water agencies.

Zone I - Zone of Critical Concern
Extends ¼ mile below a water intake to 25 miles upstream in the Ohio River and major tributaries identified in U.S. EPA Reach File 1. The lateral extent includes ¼ mile on both sides of the river bank and major tributaries.

Zone II - Zone of High Concern
Extends ¼ mile below a surface water intake, upstream, to ¼ mile below the next Ohio River intake. Major tributaries are incorporated within a 25 mile distance upstream from the intake. The lateral extent includes all 14-digit hydrologic units adjacent to the banks of the Ohio River and major tributaries.

Zone III - Source Water Area
The entire portion of the Ohio River Basin upstream from a surface water intake.

The 25 mile distance used for Zone I is based upon a 5 hour time-of-travel estimate using maximum Ohio River velocities near surface water intakes from February, 1995 to February, 1998. At a minimum, by using this approach, the entire watershed area upstream from an intake is classified as Zone III. However, within this area Zone I is the "zone of critical concern", or the area within which a contamination event will quickly affect the water supply. This corresponds to any source directly adjacent to the Ohio River and major tributaries within a 25 mile upstream distance from the surface water intake. In addition, Zone II is a "zone of high concern" which includes a wider buffer consisting of all 14-digit HUCs adjacent to the Ohio River and incorporating major tributaries within 25 miles upstream from an intake. While protection responsibility of an intake ends ¼ mile below the next upstream intake, communication channels should be established to warn lower intakes of an upstream contamination event.

CONTAMINATION INVENTORY

Each Ohio River state is responsible for performing potential contaminant source inventories for drinking water intakes within their respective boundaries. ORSANCO will then coordinate an information exchange between neighboring states so that the interstate aspects of SWAP activities can be addressed. To facilitate a data transfer between states, a minimum information level was established (see Table 2). These requirements serve as minimum guidelines for states where information on point sources are available. State agencies may chose to provide additional data beyond these minimum requirements.

Table 2. Required inventory information for point sources.

Facility Name
Facility Address
Facility Contact/Telephone Number
Facility ID Number
Facility NPDES Permit Number
Latitude/Longitude
Chemical/Chemicals
Quantity Information
Standard Industrial Classification

In addition, for Ohio River public water intakes potential contaminate sources should be inventoried in a tiered-approach. In Zone I, all potential contaminant sources to a surface water supply identified in Table 3 should be inventoried. Potential sources can be found using existing national, regional, and state databases and through field verification. In Zone II, inventories should focus mainly on existing databases and "localized" in-state information resources to identify sources in Table 3. Due to the size of this zone a field component to identify sources of potential contamination would be impractical. However, since this area may require future management activities, a high level of source detail is required. In Zone III, only critical areas of major activity need to be located. At a minimum, sources contained in U.S. EPA's Envirofacts Warehouse web home page (www.epa.gov/enviro/) should be identified.

SUSCEPTIBILITY

It is the responsibility of each state to use available information in determining the susceptibility of their surface water intakes to contamination. ORSANCO recognizes that states have their own unique methods to determine susceptibility and developing a similar approach for this analysis on the Ohio River would be complex. Therefore, by ORSANCO coordinating an interstate exchange of information, each state will be equipped to determine susceptibility in their own style.

Table 3. Potential Sources of Surface Water Contamination

Non-point Sources
- **Agriculture**
- **Forestry**
- **Urban runoff**
- **Mining**
- **Construction**

Solid Waste Facilities
- **Landfills (active, closed, abandoned)**
- **Open dumps**
- **Direct septic discharges**

Underground Storage Tanks
- **Hazardous substance tanks**
- **Petroleum tanks**

Hazardous Waste Sites
- **Generators**
- **Transporters**
- **TSD facilities (landfills, surface impoundments, waste lagoons)**

Superfund Sites
- **NPL sites**
- **State Superfund sites**

Permitted Dischargers

Water Treatment Plants

Barge Transfer Facilities

River Terminals
- **Cargo**
- **Fuel**

Combined Sewer Overflows (CSOs)

Miscellaneous Sites
- **Bridges**
- **Pipelines**
- **Railroads**

APPENDIX C
Proposed Assessment Protocol for Great Lakes Sources

Proposed Assessment Protocol for Great Lakes Sources

Introduction

Recently there has been concern over the protection of the nation's drinking water sources. This issue has been debated nationally and eventually was addressed in federal legislation. In 1996 when the federal Safe Drinking Water Act was reauthorized, legislation was added that requires source water assessments be performed on all sources of public drinking water supplies. The assessments must consider the vulnerability of these public drinking water sources. Assessments of intakes that extend into the Great Lakes present a unique challenge in determining the scope and magnitude of these assessments with limited resources. The intakes for some of these sources extend far enough into a lake to receive no effects from specific shoreline contaminant sources (except possibly air borne contaminants) while others closer to shore do. To provide guidance on how source water assessments should be performed, it will be necessary to address this very basic premise. The United States Environmental Protection Agency (U.S. EPA) may be able to give some assistance by providing access to databases, developing screening methods and area wide monitoring for general contaminants, general lake responses to airborne contaminants, and other area wide general assistance.

Initial Survey

An initial survey should be preformed at each Great Lakes source to assess local source water impacts. Any criteria or studies that were performed to locate the intake should be reviewed. Senior operators and the plant superintendent at the treatment plant should be interviewed to gain knowledge of raw water quality fluctuations. Past water quality records would need to be reviewed. Bacteriological quality and turbidity levels are good indicators of localized impacts. If this review indicates that only minor fluctuations occur in the raw water quality, the source is probably not impacted from localized contaminants and the assessment would parallel a general water quality assessment of the total lake with some consideration for potential emergency spills.

A numerical factor or coefficient could be set to provide continuity between sources. For example, if the maximum coliform levels and turbidity levels were not greater than a certain percentage above the average levels and these average levels were low, the source quality could be assessed as being stable and not impacted by localized contaminants. The initial inventory could be completed by a combination of a simple survey form followed by either an on site interview or a telephone interview.

A work group from the Great Lakes states should develop these parameters. This workgroup should be representative of the Great Lakes states, water utilities with intakes on the Great Lakes, and U.S. EPA Region 5. There should be consensus among the states and U.S. EPA on the makeup of the group.

Completing the Assessment

If the assessment indicates the intake is not impacted by potential shoreline contaminants, the assessment should reference general Great Lakes water quality and trends within the source water assessment area. This information has been compiled by several sources such as the U.S. EPA Great Lakes National Program Office and the Great Lakes Mass Balance Studies done by the U.S. EPA, the states, and United States Geological Survey (U.S. Geological Survey). Another source could be the Remedial Action Plans for Great Lake Areas of Concern and the Lakewide Management Plans.

For systems where the initial survey indicates a potential for shoreline impacts, the assessment becomes more difficult and site specific. The next step would be to provide a delineation of the area that contributes potential impacts. It would then be necessary to assess the impacts in the area and their relative impact on the quality and treatability of the raw water. If a river or stream that dis-charges into the lake near the intake causes a significant impact, a watershed assessment of the river or stream may be necessary. These impacts may not be continual, but may arise only as a result of when certain events occur, such as a specific wind direction and intensity, or a river or stream discharge into the lake at a certain level. There may also be impacts from certain thermal or seasonal conditions. Again, the workgroup should develop criteria to determine "significant impact and level of impact." The level of impact could be assigned a numerical score based on comparative values between the river water, the intake water and the lake water for certain water quality constituents such as alkalinity, chloride, coliform, turbidity, etc. This will require extensive review of the water quality records and in depth interviews with plant personnel. Some monitoring modifications could be requested to enhance the assessment to fill data gaps.

If the water quality impact is due more to a general lake condition, such as proximity to a shallow bay or wind direction, the degree of these impacts must be assessed. Interviews with the plant personnel with extensive experience at the plant would be essential. Once the impacts are categorized, assessments must be made for each impact. For example, if a shallow bay causes water quality impacts, these impacts should noted along with the change in water quality anticipated and the degree and frequency of change. If the quality change results from an algae bloom, the conditions that promote the bloom should be listed, along with the resulting water quality changes and the degree and frequency of the changes. Each impact should be listed in the narrative portion of the assessment. These analyses and effective operational responses to the impacts could then be incorporated into a contingency plan.

If the impact results from a discharge on the shoreline, runoff from the shoreline, or location of a facility near the intake, these potential impacts should listed and assessed. It will be necessary to delineate an "area of concern," determine the impacts in this area and then assess these impacts. This could become complex depending upon the shoreline assessment. If the impact were from runoff, it would first have to be assessed to determine the degree of impact due to the volume and concentration of contaminants in the runoff. Is the runoff significant? If it is, the potential makeup of the runoff would need to be assessed. For example, is the runoff from farmland? If so, the time of the year would be critical. If it is urban runoff, the types if commercial and industrial establishments in the area would be important. These assessments will be complex and must be designed so they can be altered and expanded, as more information becomes

available. The assessment must be dynamic in nature and be designed to be expanded in the future.

Many bays and tributary mouths in urban or industrialized areas hold deposits of sediment contaminated by metals and organic toxicants. Records of state environmental protection agencies and state environmental management agencies, as well as the U.S. Army Corps of Engineers Harbor Dredging Programs should evaluated to determine whether an increase in turbidity due to material suspended in such sites might pose a risk.

Wind direction affects many intakes. This may be due to a shallow bay, or proximity to a shallow bay, where the bottom sediments are stirred into the intake water column or it may direct shoreline runoff over the intake. These impacts can be surveyed by delineating the area that contributes water to the general area and checking the potential contaminants in the area. Extensive interviews with plant personnel and review of historical records will be necessary. Once the impact has been determined, the assessment of the impact must be made. The list of contaminants associated with each impact must be listed.

Remote sensing, including aerial photograph and satellite imagery, can be extremely revealing both in analyzing a history of events and near real time tracking of tributary and near shore phenomena.

A numerical system would be difficult to establish for this type of an assessment. The best method may be to develop a general map of the area, delineating the contributing areas, and listing the locations of the various impacts along with a narrative that explains these impacts. Three-dimensional hydraulic models can be valuable tools for use in areas where they have been developed.

Spill Assessments

Large volumes of materials are transported on the Great Lakes by shipping. Some of these materials are toxic in nature and subject to accidental spillage during transit and loading. Ships also pose potential risks to intakes through accidental spills of fuel and lubricants. When doing vulnerability assessments of the intakes, this traffic should be considered. If ships pass in close proximity to an intake or if there is a nearby commercial loading facility or harbor, procedures should be established to respond to spills from these ships. It would not be possible to predict many specific contaminants from general shipping, but proximity of a particular industry serviced at a local harbor would indicate heightened risk potentials for specific products or supplies. Procedures could be developed for reaction to families of contaminants, such as volatile organic chemicals, pesticides, etc. Previous spills in the vicinity, if any, should be reviewed and assessed. The source should have a spill response plan for guidance in an emergency.

Spills along lakeshores or connecting river shorelines should also be assessed along with potential spills from pipelines, docking facilities, railroad lines, etc. For example, there are numerous chemical plants along the St. Clair River, which connects Lake Huron to Lake St. Clair. These potential sites should first be identified and located on a map if the initial survey indicates there may be impacts from these areas. Procedures then should be developed for

assessing and reacting to these types of emergencies. Where possible on the connecting rivers, modeling of the river flows could be used to assess potential impacts on intakes. In these cases, the specific contaminant would normally be known and this information could be used in the assessment.

For intakes located closed to the lake shore lines, again the areas that could significantly impact the intake should be delineated. Potential spill sources in these areas such as industries, disposal facilities, highways, railroads, pipelines, etc. should be located, mapped and assessed. Depending upon the type of potential risk, the specific contaminant may be identifiable, but this may not always be the case. These spills should be considered differently from the routine discharges that may exist. A spill is a unique event, and emergency reaction would be necessary to deal with the potential impact.

Surveys of fixed facilities, pipelines, highway and rail corridors and shipping routes have generally been completed and can be obtained by contacting the local emergency planning committee or the area planning committee. These two groups should have inventories of oil and hazardous materials fixed facilities and transportation routes.

Potential Treatment Impacts

The impacts from treatments at the intake should also be included in the assessments. Continual treatment for zebra mussels may cause development of other impacts on the finished water quality. Short-term treatments or impacts such as intake cleaning, dredging, construction, etc. should also be included in the assessment.

Summary

An outline of the general methodology to be used for Great Lakes intakes should be a main part of the source water assessment program for states in the Great Lakes Region. Due to the unique nature of each intake, each assessment will be site specific. Assessments of the Great Lakes water quality in general have been done by various agencies and these efforts, should be referenced and not duplicated. The site-specific assessments, if done in close cooperation with the treatment plants and local surface water protection agencies, become valuable tools to future operations and planning.

APPENDIX D
Key Stakeholders in Ohio's Source Water Assessment and Protection Program

Key Stakeholders in Ohio's Source Water Assessment and Protection Program

I. Public Water System Owners and Operators

A. Municipal, County, and Township Governments
B. Non-governmental Owners and Operators (businesses, industry, home associations, etc.)

II. Local Governments and Decision Makers

A. Municipalities
    -Mayor
    -City Council Members
    -Utility Directors
    -Drinking Water Supply Systems
    -Local Disaster Relief Agencies/Health, Safety, Emergency Response Directors
    -Local Watershed Groups
B. Counties
    -County Commissioner
C. Townships
    -Township Trustee

III. Special Districts

A. Conservancy Districts-Miami Conservancy District
B. General and City Health Districts
C. Soil and Water Conservation Districts

IV. Multi-Jurisdictional Mechanisms

A. Regional Councils of Governments, such as:
    -Miami Valley Regional Planning Commission(MVRPC)
    -Northeast Ohio Four County Regional Planning and Development Org. (NEFCO)
    -Northeast Ohio Areawide Coordinating Agency (NOACA)
    -Ohio, Kentucky, Indiana (OKI) Regional Council of Govts.
    -Toledo Metropolitan Area Council of Governments (TMACOG)
B. Regional and County Planning Commissions
C. Interstate Regional Planning Commissions, such as:
    -Ohio River Valley Water and Sanitation Commission (ORSANCO)
    -Eastgate Development and Transportation Agency (EDATA)

V. State Agencies

A. Ohio Environmental Protection Agency
    -Division of Drinking and Ground Waters
    -Division of Surface Water
    -Division of Emergency and Remedial Response
    -Division of Solid and Infectious Waste Management
    -Division of Hazardous Waste Management
    -Office of Pollution Prevention
    -Small Business Assistance Office

B. Ohio Department of Natural Resources
- -Division of Water
- -Division of Geological Survey
- -Division of Mines and Reclamation
- -Division of Oil and Gas
- -Division of Real Estate and Land Management
- -Division of Soil and Water Conservation.

C. Ohio Department of Agriculture
D. Ohio Department of Commerce, State Fire Marshal
E. Ohio Department of Development
F. Ohio Department of Health
G. Ohio Department of Transportation
H. Ohio Water Development Authority
I. Public Utilities Commission of Ohio

VI. Federal Agencies

A. United States Environmental Protection Agency (USEPA)
B. US Department of Agriculture (USDA)
- -Natural Resources Conservation Service
- -Rural Development

C. US Department of Interior (DOI)
- -USGS
- -Nuclear Regulatory Commission

VII. Associations and Organizations

A. Environmental Organizations
- -Local Watershed Groups
- -Ohio Environmental Council
- -Ohio Public Interest Campaign
- -Ohio Citizen Action
- -Sierra Club
- -Rivers Unlimited
- -Rural Action
- -The Nature Conservancy

B. Professional Associations
- -American Water Works Association
- -American Association of Retired Persons
- -Ohio Electric Utilities Institute
- -Ohio Manufactured Homes Association
- -Ohio Water Resources Council
- -Ohio Corporation for Health Information
- -Rural Community Assistance Program
- -Ohio Rural Water Association
- -Ohio Farm Bureau
- -Ohio Oil and Gas Association
- -Ohio Aggregates Association
- -Ohio Municipal League
- -Ohio AgriBusiness Association
- -Water Management Association of Ohio

-League of Women Voters -Red Cross
-United Way

VIII. Private Citizens

A. Ohio Water Consumers
B. People who live or work in SWAP areas.

IX. Owners of Contaminant Sources

A. Chamber of Commerce and Industry Associations
B. Businesses located in SWAP areas

State of Ohio

Source Water Assessment and Protection Program

ATTACHMENT 1

Development Process for the Ohio Source Water Assessment and Protection Program

MAY 1999

The Ohio Environmental Protection Agency
Division of Drinking and Ground Waters
Division of Surface Water

ATTACHMENT TO OHIO'S SWAP PROGRAM
Development Process for Ohio's Source Water Assessment and Protection Program

1.0 INTRODUCTION

The Safe Drinking Water Act Amendments of 1996 require that public input be sought during the development of a state's source water assessment and protection (SWAP) program. This requirement is based on the recognition that environmental programs reflecting the concerns and desires of the public are most likely to be successful. They are more likely to be successful because they are accepted by those who are affected by them, and more likely to be fully implemented. Moreover, those individuals who participate in the planning process gain an in-depth understanding of the program enabling them to promote the program effectively. Public participation is thus a component of a more widespread public education effort, and ultimately helps to build public support and responsibility for local water supplies.

Ohio's efforts to disseminate information and promote public discussion of SWAP began formally in April 1997, with a joint United States Environmental Protection Agency (U.S. EPA) and Ohio Environmental Protection Agency (Ohio EPA) Stakeholder's Meeting (held in Columbus) that attracted over 200 participants from around the state. This was one of the largest such stakeholder's meetings in the United States. Immediately after the issuance of U.S. EPA's SWAP guidance in August 1997, Ohio EPA convened a meeting of about 30 technical people to solicit suggestions on how to develop the State's SWAP program. This group recommended formation of both a technical advisory committee (TAC) and a public advisory group (PAG). It was envisioned that the technical advisory committee would be a smaller working group whereas the public advisory group would be larger, allowing for broader representation. They also recommended Ohio EPA staff develop a skeleton outline of the program prior to convening advisory groups.

Development of Ohio's SWAP Program started intensively in December, 1997 through monthly meetings of a Technical Advisory Committee and five public advisory groups (a central Ohio group and one in each of Ohio EPA's four outlying district offices). The work of these two groups is discussed in detail in the next three sections of this attachment. After meeting with the TAC and PAG for seven months, Ohio EPA began to write the draft Program in July, 1998. The advisory groups were reconvened in August and September to provide their comments on the draft Program and recommendations on how to move from assessments to protection activities. The draft was revised during September and October. In November it was released for public review and comment by all interested Ohioans. News releases, public advisories and mailings were used to announce the availability of the draft and the schedule for public meetings. Copies of the draft document were automatically sent to all members of the technical and public advisory groups.

To help facilitate broad public input on the draft document, Ohio EPA conducted ten public information meetings and comment sessions. Meetings were held in the afternoon and evening

in each of Ohio EPA's district offices. The purpose of multiple meeting locations and times was to make the meetings more accessible. The formal comment period closed at the end of December, at which point Ohio EPA compiled and responded to all comments (see Section 1.5, "Responsiveness Summary"). The Program was then revised for submittal to U.S. EPA by February 8, 1999.

Ohio EPA used a wide variety of tools and techniques to promote public awareness and participation in the development of the SWAP program. In addition to running the various public meetings, Ohio EPA staff in the Central and District offices gave presentations to numerous interest groups around the state, explaining SWAP and the development of Ohio's program. Ohio's SWAP Program development was publicized in several statewide news releases, articles in a variety of publications, and in the Agency's web page.

1.1 TECHNICAL ADVISORY COMMITTEE

In December 1997, Ohio EPA convened a Technical Advisory Committee consisting of approximately 30 individuals. The purpose of this committee was to provide Ohio EPA with viewpoints on technical feasibility and effectiveness of the proposals being put forth for the Program.

The Committee members were selected based on their roles as managers, key technical staff, or public leaders for various water-related programs and protection efforts around the state. Eighteen of the participants were associated with State agencies. Half of these represented various programs of Ohio EPA, and the other half represented various programs within the Ohio Department of Natural Resources. One reason for including so many State Agency staff was to enable discussions of the state environmental databases--where data gaps existed, and how linkages among the databases could be forged. It was also anticipated that these departments would be instrumental in implementing the SWAP Program.

The other 12 Technical Advisory Committee members represented academia, public water supply managers, regional planning agencies, environmental action groups, the Ohio Rural Water Association, and environmental consultants. Although the committee membership adjusted slightly over the year, the total number of participants was kept at no more than 30 to facilitate discussion and decision-making.

Figure 1 shows the general composition of the committee by the constituencies represented and Table 1 lists all of the individuals that participated in the Technical Advisory Committee.

1.1.1 Technical Advisory Committee Meetings

The first meeting of Ohio's TAC was held on December 9, 1997. During that meeting, the committee agreed to meet on a monthly basis. Subsequent TAC meetings took place on January 21, February 18, March 18, April 22, May 20, and June 17. In addition, two joint meetings were held with the Central Office Public Advisory Group on August 25, and September 16, 1998. Thus a total of nine Technical Advisory Committee meetings were held prior to release of the draft document for public comment.

OEPA-DDAGW = Ohio EPA Div. of Drinking and Ground Waters*

OEPA-DSW = Ohio EPA Div. of Surface Water*

ODNR-DOW = Ohio Dept. of Natural Resources Division of Water

ODNR-SWC = Ohio Dept. of Natural Resources Division of Soil and Water Conservation

ODNR-GS = Ohio Dept. of Natural Resources Division of Geologic Survey

ORWA = Ohio Rural Water Association

PUCO = Public Utilities Commission of Ohio

USDA-NRCS = U.S. Dept. of Agriculture, Natural Resource Conservation Service

*Does not include staff from these Divisions who assisted in running the meetings

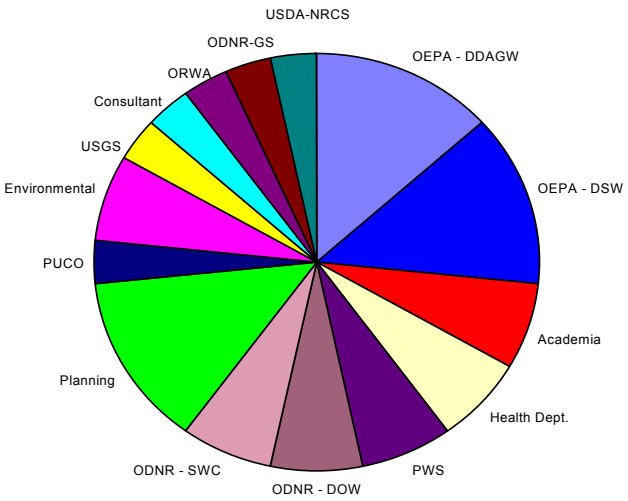

Figure 1. Composition of Technical Advisory Committee for Development of Ohio's SWAP

held with the Central Office Public Advisory Group on August 25, and September 16, 1998. Thus a total of nine Technical Advisory Committee meetings were held prior to release of the draft document for public comment.

Most of these meetings were divided into a Ground Water session (held in the mornings) and a Surface Water session (held in the afternoons). Before each meeting, Ohio EPA staff sent out an agenda and, often, "issue papers" that presented the subjects to be discussed in the next meeting. After each meeting, Ohio EPA staff wrote detailed meeting summaries that were sent to the Committee members, U.S. EPA Region V representatives, and to other Ohio EPA managers and staff in the District Offices. The meeting summaries also were put on the Agency's web page within days of their completion.

Table 1. SWAP Technical Advisory Committee

Name	Affiliation
Susan Applegate	Ohio EPA - Central District Office, Drinking Water
Dave Baker	Heidelberg College, Water Quality Lab
Brian Benick	Medina County Health Department
Dan Binder	City of Columbus, Water Quality Assurance Lab
Leonard Black	Ohio Department of Natural Resources, Water
Tammie Brown	Ohio Department of Natural Resources, Soil & Water
Mike Caprella	City of Lima, Utilities Division
Claude Custer	Northeast Four County Regional Planning Agency
Sue Daly	Public Utilities Commission of Ohio
Jeff Davidson	Ohio EPA - Southwest District Office, Drinking Water
Joe deNovo	Rivers Unlimited
Mike Ekberg	Ohio EPA - Southwest District Office, Ground Water
Jane Forrest	Ohio Citizen Action
Ralph Haefner	U.S. Geological Survey
Mike Hallfrisch	Ohio Department of Natural Resources, Water
Scott Hammond	Miami Valley Regional Planning Commission
Tim Holdeman	Panterra Corporation
Todd Kelleher	Ohio EPA - Central Office, Drinking Water
Bill McCarthy	Ohio EPA - Central District Office, Surface Water
Charles McFarland	Ohio Rural Water Association
Eric Norland	Ohio State University, School of Natural Resources
Debbie Olszowka	Ohio River Sanitation Commission
Ned Pennock	Miami Conservancy District
Rebecca Petty	Ohio Department of Health
Robert Van Horn	Ohio Depart. of Natural Resources,Geological Survey
Jerry Wager	Ohio Department of Natural Resources, Soil & Water
Doug Zehner	Natural Resources Conservation Service

1.2 PUBLIC ADVISORY GROUPS

In January 1998, Ohio EPA convened the first meeting of the Central Office Public Advisory Group. The purpose of this group was to provide a wider representation of interests than those represented by the technically-oriented Technical Advisory Committee, with its preponderance of State agency staff. Originally it was envisioned that the Public Advisory Group would mostly offer feedback on the proposals generated by the Ohio EPA and the Technical Advisory Committee. In practice, the Public Advisory Group often advanced the discussions beyond the point reached in the Technical Advisory Committee meetings and consistently provided excellent comments and suggestions.

Prior to the formation of the public advisory group, there was much discussion on how to best reconcile the desire to reach out to anyone interested in the process, with the need to have a group of reasonable size and balanced representation. Also, the Ohio EPA needed to know in advance how many people would be attending the meetings in order to schedule suitable meeting sites. There was some concern that the public water supply managers needed to be represented in much greater numbers, because they would carry responsibility for at least some of the SWAP

efforts. Also, there was a concern for geographic balance; interested parties in the farthest corners of the state might be discouraged from participating in meetings held in Central Ohio. To address concerns about geographic balance and reaching out to the public water suppliers, Ohio EPA's District staff were requested to set up Public Advisory Groups in their districts.

Although initially 53 people were invited to sit on the Central Office Public Advisory Group, anyone who subsequently called up and expressed interest in participating was added to the mailing list (Table 2). This group included representatives of public water systems, environmental groups, environmental consultants, drillers, business interests, planning agencies, agricultural interests, and housing interests. Figure 2 displays the makeup of the Central Office Public Advisory Group by the constituency represented.

In accordance with U.S. EPA guidance, an effort was made to reach out to "vulnerable populations", i.e., children, the elderly, transplant patients, dialysis patients, chemotherapy patients, and people living with HIV/AIDS. However, it proved difficult to locate those specific individuals who not only represented such groups, but were also very interested in drinking water protection and had the time to attend regular meetings on the subject. Six invitational letters and numerous phone calls produced only one individual who regularly attended the Public Advisory Group meetings. Ohio EPA continued to send meeting announcements, background materials and meeting summaries to everyone originally invited whether they chose to attend meetings or not.

1.2.1 Central Office Public Advisory Group Meeting Schedules

During the first Public Advisory Group meeting held in January, the group agreed to monthly meetings, on the fourth Thursday of each month--one week after that month's Technical Advisory Committee meeting. Meetings were held on January 26, February 26, March 26, April 30, May 28, and June 25. In addition, a joint meeting with the Technical Advisory Committee was held on August 25, and September 16, 1998. A total of eight Public Advisory Group meetings were held before the start of the public comment period. At the request of the participants, most of the these were half-day (morning only) meetings.

Before each meeting an agenda and background materials were sent to the Public Advisory Group members. After each meeting, meeting summaries were written and distributed to the Technical Advisory Committee, and public advisory group members, and were added to the Agency's web page.

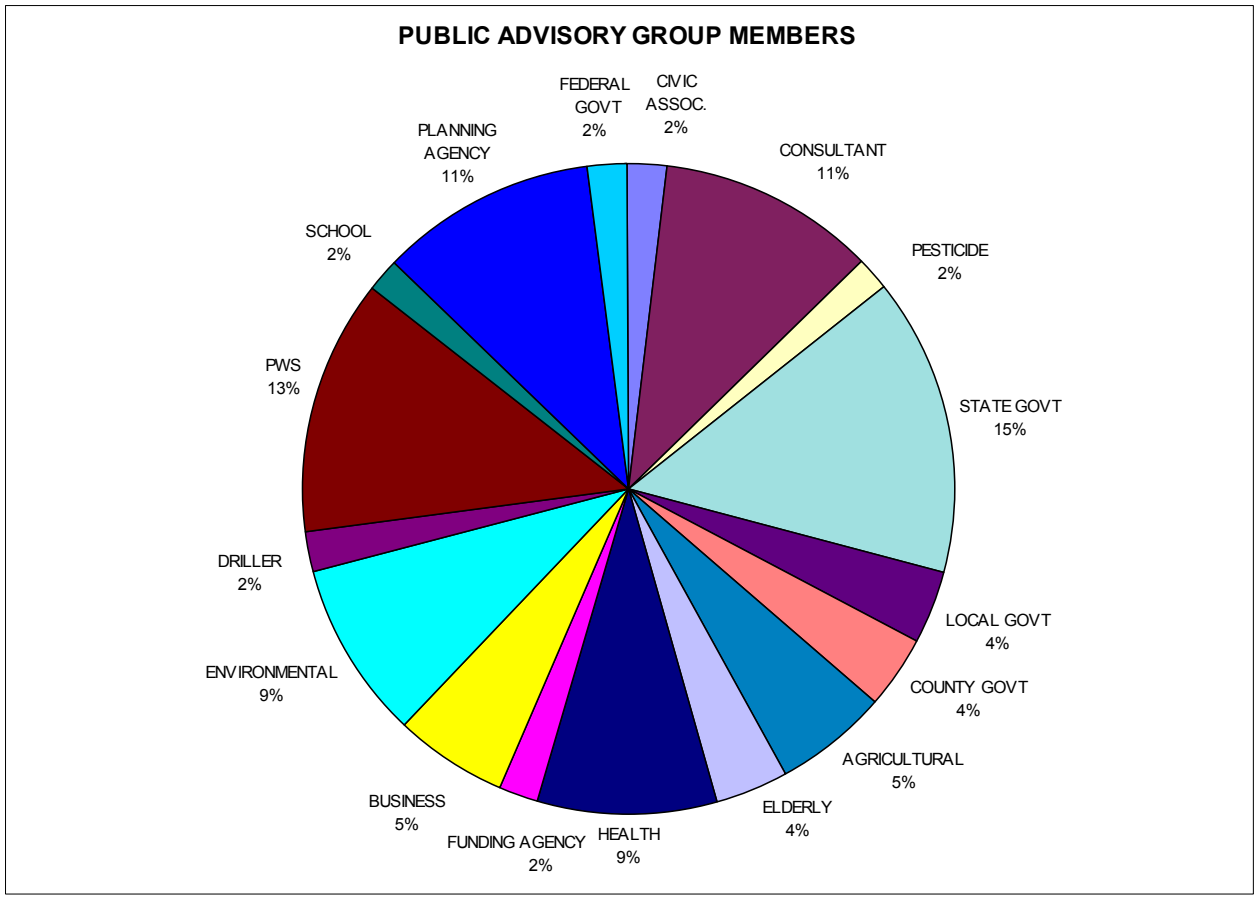

Figure 2. Constituencies Invited to Participate in the Central Office Public Advisory Group

1.2.2 District Public Advisory Groups

District staff organized their public advisory groups by selecting individuals from various mailing lists, and sending letters of invitation. The number of individuals invited varied from district to district, and ranged from 50 to 300. An effort was made to focus on public water suppliers within each District; however, most Districts also invited representatives of academia, environmental consultants, environmental activists, and other interest groups (Figure 3). The number of public
advisory group meetings held in each district varied from 2 to 6 and the duration of each meeting varied from 2 hours to 6 hours. Before each meeting an agenda and background materials were sent to the public advisory group members. After each meeting, meeting summaries were written and distributed to the group members, and were sent to the Central Office for inclusion in the Agency's web page.

Table 2. Central Ohio Public Advisory Group Members

Name	Affiliation
Linda Aller	Bennett & Williams, ECI
John Armentano	Natural Resources Conservation Service
Larry Berger	Ohio Department of Agriculture
Jim Betts	Betts Associates
Dick Bible	Muskingum Conservancy District
Chris Boyd	Ohio RSVP
Ron Bridges	American Association of Retired People
Elizabeth Burch	Ohio Manufactured Homes Association
Michael Burns	Consumers Ohio Water Company
Bruce Cornett	Green Environmental Coalition
Kim Cotrill	Environmentalist
Kim Coy	City of Akron
Debbie Crawford	United Way
Darla Crum	City of Hamilton
Scott Davis	The Nature Conservancy
Rick Donahoe	Environmentalist
Kurt Erichsen	TMACOG
Jane Federer	Red Cross Disaster Services
Steve Grossman	Ohio Water Development Authority
Joseph Hadley	NEFCO
Susan Hampton	Ohio EPA - Central District Office, Drinking Water
David Hanselmann	Ohio Department of Natural Resources, Soil & Water Conservation
Joel Hastings	Ohio Farm Bureau
Larry Hoffman	Ohio Department of Transportation
John Hollback	American Electric Power
Don Hollister	Village of Yellow Springs Council Member
Belinda Jones	The Scotts Company
Linda Knight	State and Local Government Commission of Ohio
Larry Long	County Commissioners Association of Ohio
Lonnie McGhee	Treatment Plant Operator
Charles Morris	Northmor Local Schools
Robert Munch	Village of Waynesville
Richard Noss	Fuller Mossberger Scott & May Engineers
Brian Peach	Ohio AgriBusiness Association
Bill Petrarca	Ohio Corporation for Health Information
Kathy Pinto	Ohio EPA - Central Office, Drinking Water
Paul Plummer	Consultant
Jim Prior	Englefield Oil Company
Jim Rozelle	Ohio Water Resource Council
Judith Scott	City of Mt. Vernon, Water and Wastewater
Richard Shamblen	Malcolm Pirnie, Inc.
Kent Skarrett	Ohio Municipal League
Gloria J.T. Smith	Columbus AIDS Task Force
Gary Sprowls	Sprowls Drilling
Roger Steinhelfer	Ohio Department of Transportation
Rick Thomas	Rona Homes
P.K. Tudor	Del-Co Water Co.
William Veroski	Consultant
Julie Ward	Ohio Rural Community Assistance Program
Julie Weatherington-Rice	Bennett & Williams, ECI
Lara Whitely Binder	Hamilton-New Baltimore Ground Water Consortium
Jane Wittke	Ohio-Kentucky-Indiana Regional Council of Govts.

Table 3. District Office Public Advisory Group Members

SWDO (Coordinator: Mike Ekberg)

Name	Affiliation
John Blessing	Northmont City Schools
Paul Braasch	Clermont County
Patti Davy	Buckeye Trails Girl Scout Camp
Jack DeMarco	City of Cincinnati
Roy Gillespie	Beaver Valley Resort
Don Freisthler	City of Sidney
Tom Fyffe	Wright State University
David Hartman	City of Cincinnati
Eric Heiser	Clermont County
Dale King	West Liberty Salem School
Don Kirker	Village of Williamsburg
Wayne Kopp	City of Piqua
Debbie Metz	City of Cincinnati
Jerry Swanton	City of Springfield
John Van Harlingen	Lake Waynoka
Dan Young	Young's Dairy

NWDO (Coordinator: Pat Heider)

Name	Affiliation
Jenny Carter	Lucas County
Phil Cochran	Bonded Chemical
Mary Dennis	Wood County Health Department
Mark A. Fritz	Wapakoneta City Schools
Judy Junga	Toledo resident
Bill Kreinbrinker	Miller City Schools
Deb Martin	Great Lakes Rural Community Assistance Program
Dan May	University of Findlay
Don Mead	Ohio-American Water Company
Jason Meyer	Bonded Chemical
Ziad Musallam	Fulton County
Andy Struble	Bryan Light & Water
Mike Sweet	Mapleton School
Bob Swinehart	City of Ashland
John Williams	Village of Ottawa
Richard Young	Mohican Youth Center

NEDO (Coordinator: Kathy Metropulos)

Name	Affiliation
Tom Allen	City of North Canton
Joan Brasaemle	EMG, Inc.
Cara Broemsen	West Park Estates
Edith Chase	Portage County Environmental Round Table
Michael Cipolla	Middlefield Village
Bill Cortwright	RSC Properties, Ltd.
Andy D'Apolito	Mahoning County Sanitary
Rick Douglas	Lake County Utilities
George Espy	Seventh Generation
Nancy Farrell	City of Hudson

Table 3. District Office Public Advisory Groups, continued.

NEDO (cont'd)

Name	Affiliation
Carl Ganocy	City of Ravenna
Dan Gonzy	West Park Estates
James Gregory	Warren Water
William Hammer	South Amherst Water
Paul Howard	Ohio Department of Natural Resources
Alan Jacobs	Youngstown State University
Jim Kamps	Cleveland Metroparks
Tom LaPlante	NEFCO
Ron Lawrentz	Troy Oaks Homes
Kevin Lewis	The Holden Arboretum
Terry Lipstreu	Warren Water
Kyle Loudin	Atwater Township
Tom Malunas	Middlefield Village
Susan McCauslin	Davey Resource Group
James McElry	CVNRA
Cary Metcalf	City of Rittman
Manuel Michelakis	Warren Water
Bill Moats	Village of Lodi
Brian Mosko	Multi-Park Services
Jim Princic	Lawhon & Associates
Maggie Rodgers	Cleveland Division of Water
Duane Roka	Ohio Department of Transportation, Rest Areas
R.A. Schultz	Fairlane Water Company
D. Michael Suniser	City of North Canton
Craig Supay	CT Consultants
Christy Thompson	RSC Properties Ltd.
Ray Ushousc	Multi-Park Services
Joe Warino	Mahoning County Sanitary
Larry Wehr	Ohio Water
Gordon Welser	Atwater Township
John Wood	Ohio Department of Natural Resources
Ken Young	Newton Falls Water Plant

SEDO (Coordinator: Stephanie Mosher)

Name	Affiliation
Kim Cutlip	ILLGARD
Wendell Jenkins	Lockheed Martin
John McCort	Village of Barnesville
Scott Miller	Lockheed Martin
Dennis Rezabek	Warren Water
Ed Robinette	Village of Warsaw
Candy Robinson	Longaberger Company
Zebb Taylor	House of Jacob
Troxil Trembly	Warren Water
William Wood	House of Jacob

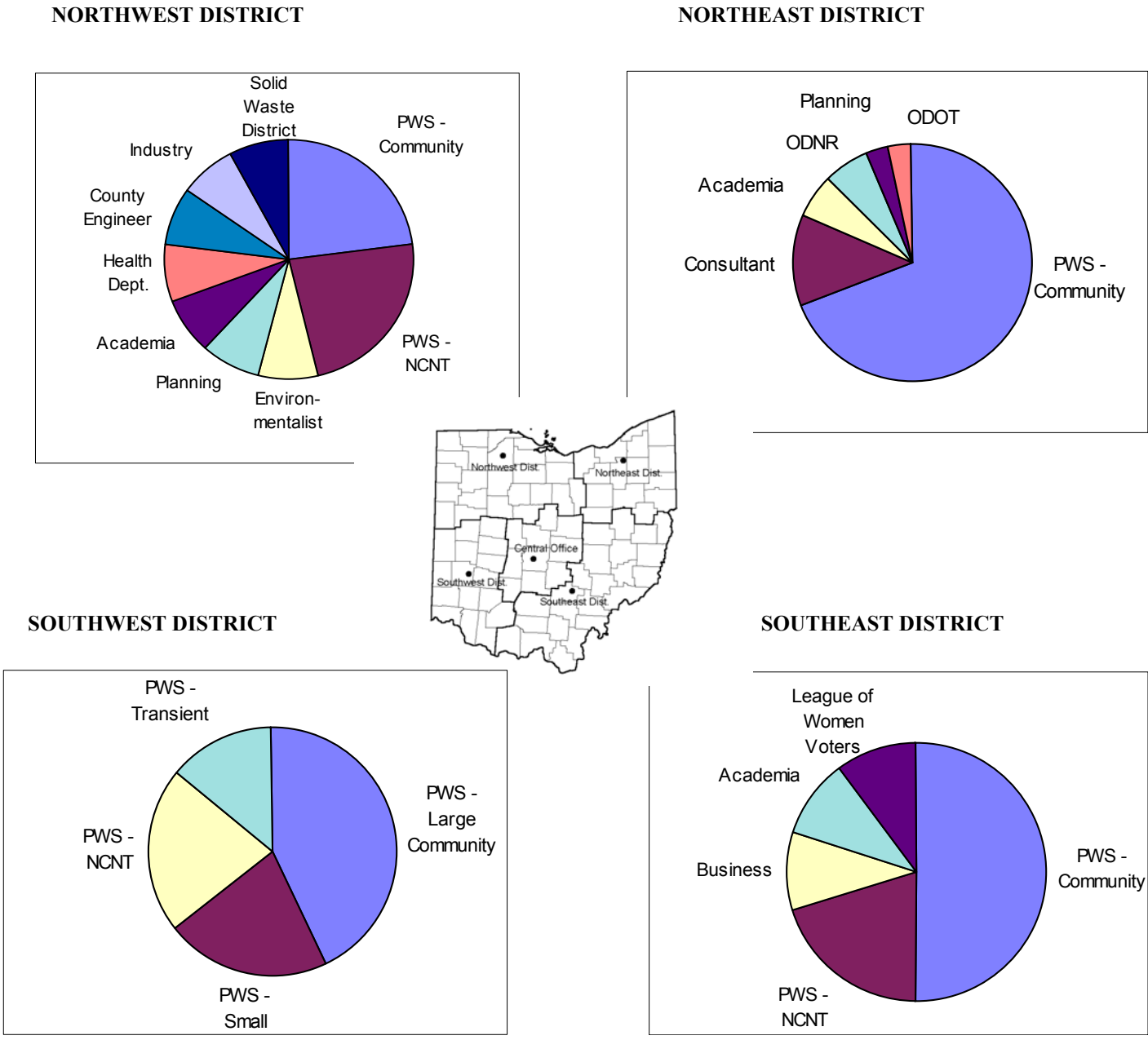

Figure 3. Composition of District Public Advisory Groups

1.3 MAJOR ISSUES DISCUSSED BY THE TECHNICAL ADVISORY COMMITTEE AND PUBLIC ADVISORY GROUPS

The Technical Advisory Committee and Public Advisory Groups were involved in discussions of all aspects of the SWAP Program. The main topics that were discussed and a sampling of the questions that were addressed are listed below. Detailed meeting summaries are on Ohio EPA's web page (www.epa.state.oh.us/ddagw) or are available upon request.

Delineations of Ground Water Systems

- Should the sophistication of delineation method be based on size of system? If so, should it be based on population, pumpage, or a combination of both?--and what are the cutoffs?
- Should the sophistication of delineation method be based on hydrogeologic setting?
- Should the SWAP boundary be the five-year time-of-travel area, as for Wellhead Protection areas?

"Initial delineations" of Surface Water Systems on inland rivers

- How should the "lower boundary" of the watershed be delineated?
- Should we base these initial delineations on the USGS hydrologic units, or a slightly different list of watersheds devised by Ohio EPA?

Delineations of Emergency Response management areas and river corridor areas for surface water SWAP areas

- How far upstream should the river corridor extend? On what basis?
- How far laterally from the stream should the river corridor boundary lie? On what basis?
- To what extent should tributaries be included?

Delineations of areas identified for "priority management" within a watershed (for surface water systems)

- How do we identify such areas? More specifically, how useful is the stream chemistry data in identifying an area of contamination? The biological data?

Inventorying potential sources of contamination within ground water and surface water SWAP areas

- Should we inventory "everything" or can we focus on a group of "significant sources"? If so, which sources are "significant" and why?
- Should we conduct a more intensive inventory in designated critical areas? If so, which areas? And what constitutes a more "intensive" inventory?
- Must we identify the actual contaminants at each identified site, or can we assume certain chemicals are there?
- Can a site be exempted from being listed as a 'source' if the chemicals on site are below some *de minimis* amount (e.g., household chemical products)?

Doing a "susceptibility analysis"

- For surface water systems, should a system be designated 'less susceptible' if it is an off-stream reservoir? Or if it has an enormous storage capacity?
- For ground water systems, should an initial broad-brush susceptibility analysis be done to prioritize systems for more sophisticated delineations?
- How can we use DRASTIC maps for susceptibility analysis? How can we use water quality data? How do we incorporate the hydrogeologic sensitivity data from the delineation and the information about contaminant sources from the inventory?
- Should the susceptibility analysis be based on some kind of numeric ranking system? Should it be a number, a one-word descriptor, a descriptive paragraph?
- How can the susceptibility analysis be designed to lead directly to management?

Figure 4. Members of the Technical Advisory Committee compile a comprehensive list of the various stakeholders who should receive information on SWAP.

Dissemination of information (Figure 4)

- Who has an interest in SWAP?
- Will anyone have a negative reaction to SWAP?
- Who will be critical in implementing source water protection activities?
- What type of information should be disseminated to the various stakeholders, and how will it be disseminated?

Protection Activities

- What are appropriate strategies for implementing protection activities?

- What are the expectations for public water suppliers once assessments are complete, and will these expectations vary based on type of public water system?
- How will Ohio EPA and other agencies help with protection activities?

Additional Issues Discussed by Public Advisory Groups

In the initial district public advisory group meetings, public water suppliers frequently voiced concern over how Ohio EPA would require them to protect areas that they had no jurisdiction over, and the level of management that would be required; some worried that Ohio EPA would expect the same level of effort from small systems as was required for large systems. Ohio EPA staff explained that SWAP was essentially a data collection effort that would enable informed decisions about protection strategies. It was also explained that the Safe Drinking Water Act Amendments did not confer authority to the State of Ohio to require any protection efforts. Land use decisions to protect the drinking water source would remain local decisions.

Once this misconception was addressed, most Public Advisory Group members were primarily concerned with such as issues as: who would implement the data collection; how much assistance the Ohio EPA would provide to public water suppliers in that effort; how--and to what level of detail--the information would be made available to the public; and how vigorously Ohio EPA would engage in public education. In March, Public Advisory Groups in Central Office and the Southeast District "scored" a list of approaches to implementing SWAP. The approaches that scored the highest overall were funding early volunteer efforts; incorporating SWAP into the Sanitary Survey program; and conducting area-wide assessments either by Ohio EPA itself or by its contractors. The approach that scored lowest was legislation requiring all systems to complete a SWAP plan. Input such as this from the various Public Advisory Groups was instrumental in shaping Ohio's program.

1.4 PUBLIC INFORMATION MEETINGS

Ohio EPA issued a news release and citizen advisory announcing the proposed Ohio Source Water Assessment and Protection Program (See attached "News Release") on November 24, 1998. Ten meetings were held throughout the state during the first two weeks of December in each of the five Ohio district offices located in Dayton, Twinsburg, Bowling Green, Logan and Columbus.

To better accommodate various schedules of the working public, two meetings were held in each district office, one at 3:00 p.m. and one at 7:00 p.m.. Each meeting consisted of two components: an information session followed by a comment session. The information session consisted of a fifteen minute presentation about the proposed SWAP program followed by a question and answer period. In most districts, the information sessions were completed within an hour.

In all of the districts, attendance at the afternoon meetings was far greater than in the evenings. Attendance at the 3:00 p.m. meetings ranged from 13 to 47, whereas attendance at the 7:00 p.m. meetings ranged from 4 to 11. Representatives from public water systems, environmental groups, industry, agriculture, campgrounds, resource agencies, citizens and others attended. The photographs in Figures 5 through 8 illustrate participation at the Central, Northeast, Northwest,

and Southwest district office meetings (photos were taken at the Southeast District meeting but did not develop properly). In a couple of districts, the questions raised simply required better explanation of the proposed program; in others, questions centered on the cost of the program to individual water supply operators, involvement of local stakeholders, and feasibility and funding of the program. Questions received during the information session portion of the public meetings were summarized . See "Public Meeting Summaries" at http://www.epa.ohio.gov/ddagw/pdu/swap.html).

Following a break, comments were tape recorded and later transcribed. A total of ten individuals presented oral comments. Most comment sessions lasted well under an hour. Additional comments were received by mail or by phone through the close of the comment period, December 31, 1998.

1.5 RESPONSIVENESS SUMMARY

The attached responsiveness summary addresses all comments received during the public comment period including:

- oral comments recorded at the public meetings held in the district offices on December 1, 2, 3 and December 8th and 10th;
- written comments received via U. S. mail; and
- oral comments received via telephone.

Written comments were received from 3 citizens, 3 representatives from 2 environmental groups, representatives of 2 political jurisdictions, and one state agency. Oral comments were received from 6 individuals representing 5 environmental groups, 1 political jurisdiction, and 3 citizens. Two comments from agencies were taken via telephone.

A variety of comments were received. While some focused on the administration of the program, others were centered on finer technical points. A number of comments were concerned with the feasibility of Ohio EPA conducting over 6,000 assessments using existing or proposed resources. Several comments addressed the need for obtaining adequate funding for the program. A number of comments specifically addressed the need for coordination of programs within Ohio EPA as well as between Ohio EPA and other resource agencies.

Overall, public participation in the review process was moderate. Many of the participants were not only supportive of the program, but were complimentary about the process Ohio EPA used in developing the proposal. They were also generally pleased with the final product, albeit with modifications in some instances. Comments in the following responsiveness summary have been combined, summarized, and condensed wherever possible.

Figure 5.
Public meeting held on December 2, 1998 at Ohio EPA's Central District Office, Columbus, Ohio.

Figure 6.
Public meeting held on December 3, 1998 at Ohio EPA's Northeast District Office, Twinsburg, Ohio.

Figure 7.
Public meeting held on December 8, 1998 at Ohio EPA's Northwest District Office, Bowling Green Ohio.

Figure 8. Public meeting held on December 10, 1998 at Ohio EPA's Southwest District Office, Dayton, Ohio.

State of Ohio

Source Water Assessment and Protection Program

ATTACHMENT 2

Key Players in the Ohio Source Water Assessment and Protection Program

MAY 1999

The Ohio Environmental Protection Agency
Division of Drinking and Ground Waters
Division of Surface Water

ATTACHMENT TO OHIO'S SWAP PROGRAM
Key Players in the Ohio Source Water Assessment and Protection Program

1.0 INTRODUCTION

Ground water protection in Ohio is accomplished through a complex array of rules, regulations and responsibilities. A number of local, state and federal agencies have regulatory responsibilities and/or carry out activities that affect ground water. Most of these agencies also have a role in Ohio's Source Water Assessment and Protection Program (SWAP).

While the Ohio EPA is the leading state agency charged with the development of Ohio's Source Water Assessment and Protection Program, many other agencies and programs, at all levels of government, are essential to the implementation and success of the program. For example, numerous local, state and federal agencies are responsible for providing technical information and assistance needed to delineate SWAP areas and complete a detailed inventory of potentially significant contaminant sources. In addition, many potential sources of surface and ground water contamination fall under the regulatory authority of state agencies, and in some instances federal agencies. A SWAP plan must build on these existing authorities to ensure protection of the public water supply.

1.0.1 PUBLIC WATER SYSTEM OWNERS AND OPERATORS

A. Municipal, County, and Township Governments. Public water supplies are owned and operated by municipalities, counties, homeowner associations, and private companies. These different types of owner/operators have varying authority to implement SWAP protective strategies. For example, Ohio's counties, townships, and municipalities have significant authority to implement source water protection by exercising their powers to protect public health, safety and welfare; adopt land use controls; enforce building standards; and provide drinking water, sewage and solid waste treatment and disposal services. Privately owned systems, however, may have limited authority to implement certain protection options beyond their property boundary, and will have to work cooperatively with the local political jurisdiction to ensure adequate protection of their source waters.

1.0.2 LOCAL GOVERNMENTS AND DECISION MAKERS

A. Municipalities. In Ohio, municipalities provide services generally associated with local government, including fire and police protection; sanitation; utilities including water supply; zoning regulation; and traffic control to protect the health, safety, and general welfare of the public. The powers and duties of Ohio's municipalities are outlined in Article XVIII of the Constitution of the State of Ohio, (also known as the "Home Rule" Amendments) and Title 7 of the Ohio Revised Code. Municipal corporations in

Ohio have the constitutional option of adopting a home rule charter whereby the "municipality may operate, within constitutional limits, independently of the legislative authority of the state in the areas of organization, powers and processes." The municipal code is the law for those that have not adopted a home rule charter.

The authority to control land use is a municipality's greatest power to protect its community's source waters. The legislative authority of a village or city may divide all or any portion of the municipal corporation into zones or districts "...in the interest of the public health, safety, convenience, comfort, prosperity, or general welfare..." Having established such districts, "regulations may be imposed for each of such districts, designating the kinds of classes of trades, industries, residences, or other purposes for which buildings or other structures or premises may be permitted to be erected, altered, or used subject to special regulations" (ORC Chapter 713.06).

In addition to zoning, municipalities also have authority to review site plans and subdivisions; control traffic; and adopt local ordinances or resolutions. Many local agencies are instrumental in providing services or enforcing state laws that protect source waters. These include municipal fire departments, emergency response and planning agencies as well as health departments. Local officials that are instrumental at the municipal level include the mayor, city council members, and utility director.

B. Counties. The county is the major local subdivision of the state, and was created to serve as an agency for the administration of state laws and policies. The powers and duties of counties are outlined in Article X of the Constitution of the State of Ohio and Title 3 of the Ohio Revised Code. A three-member board of county commissioners is provided by statute, while a petition by voters may raise this to five, seven or nine. The board shares responsibility for the administration of state laws with eight other independent county officers: auditor, clerk of courts, coroner, engineer, prosecuting attorney, recorder, sheriff and treasurer.

County commissioners have the power to divide all or any part of the unincorporated territory of a county into zones for the purpose of regulating, among other things, the location and uses of buildings and other structures, and the uses of land for trade, industry, residence, recreation or other purposes (ORC Chapter 303.02). By statute, the county commissioner must appoint a five-member county rural zoning commission to administer the zoning laws. The county commissioner also may establish and maintain garbage and refuse disposal districts.

C. Townships. A civil township is a political subdivision of the state established to administer local government, and is recognized by the Ohio Constitution as both a unit of government and as an agency of the state. The powers and duties of townships are outlined in Article X of the Constitution of the State of Ohio and Title 5 of the Ohio Revised Code. A township's rights and privileges are limited to those functions specified by law and do not include all of the general powers of a corporation. Townships are governed by an elected three-member board of township trustees.

Township trustees may regulate building and land use in unincorporated territory to promote public health and safety provided the regulations are in accordance with a comprehensive plan (ORC Chapter 519.02). If a township adopts zoning regulations prior to adoption of county zoning regulations, the township regulations take precedence unless a majority of affected voters elect to have the township plan replaced by the county plan. Township zoning regulations do not apply within municipal corporations, and cannot prohibit the use of land or buildings for agricultural purposes.

1.0.3 SPECIAL DISTRICTS

Special districts such as conservancy districts, health districts, park districts, sanitary districts, solid waste management districts and regional water and/or sewer districts also have special functional authorities that can be utilized within SWAP areas.

A. Conservancy Districts. A conservancy district is a political subdivision and a public corporation of the state as enacted in ORC Section 6101.03 (F). One of the purposes for which conservancy districts may be organized is to "provide a water supply for domestic, industrial and public use." In Ohio, the Miami Conservancy District has been monitoring and conducting ground water studies in the Great Miami Buried Valley Aquifer for a number of years and as a result has a tremendous amount of hydrogeologic information and can be expected to play a lead role in SWAP implementation.

B. General and City Health Districts. The authority to regulate on-site sewage disposal systems in the State of Ohio lies with Ohio EPA, the Ohio Department of Health and local boards of health. Local boards of health may formulate, adopt and enforce regulations that are more stringent than the State Sanitary Code (ORC 6115). Ohio EPA is responsible for regulating on-site disposal systems serving more than three dwelling units in a single residential structure; having common leach fields serving more than one residential structure; or serving a commercial or industrial land use. The health district, however, may be responsible for inspecting and reporting on the safe operations of those systems. The board of health of a general or city health district also is charged with "...the inspection, licensing, and enforcement of sanitary standards of solid waste facilities...." (ORC 3734.02[C]).

C. Soil and Water Conservation Districts. Soil and water conservation districts primarily study, plan and implement projects that prevent soil erosion and flood damage. They also deal with "the

conservation, development, utilization and disposal of water" within the areas they serve. To accomplish that, soil and water conservation districts have a broad range of administrative, legal, research, plan development and project implementation powers, either by themselves or through the boards of commissioners of their respective counties.

Unlike the other local units of government, however, soil and water conservation districts are not empowered to make and enforce rules and regulations in accomplishing their purposes. Rather they function in an advisory capacity and provide technical assistance to landowners and local officials. It is through their land management practices, therefore, that soil and water conservation districts contribute to source water protection. There are several principal areas in which this occurs. District personnel exert influence by providing information, training, technical assistance, preparation of plans for best management practices, and in some cases, cost sharing of improvements through available funding programs.

Most basic to soil and water conservation district programs are soil conservation and erosion/sediment control, where efforts are directed to reduce soil loss through conservation tillage and other means. This is linked closely to programs geared to encourage proper use of fertilizers, herbicides and insecticides which may reach source waters, either through runoff to surface streams or via direct infiltration through permeable soils.

In addition to these two areas, soil and water conservation districts work with operators of feedlots and poultry farms to develop and encourage animal waste controls that protect surface and ground waters. District staff also are available to assist communities with storm water runoff control plans. Animal production facilities having more than 1,000 animal units are regulated by Ohio EPA's Division of Surface Water.

1.0.4 MULTI-JURISDICTIONAL MECHANISMS

Difficulties in developing protection strategies arise when the designated SWAP area extends into political jurisdictions other than that of the water supply owner/operator. Frequently, community wellfields are situated in areas near corporation limits surrounded by open lands that have afforded some degree of isolation from potential significant contaminant sources as well as provided well sites for expansion. In such instances, delineated protection zones often extend into incorporated and unincorporated lands under another jurisdiction such as a township, county or

possibly another state.

Developing protection strategies for potential significant contaminant sources within a public water supply owner's jurisdiction usually is accomplished through traditional municipal government mechanisms such as zoning ordinances; subdivision regulations; construction or extension of sewer and water service; adoption of operating performance standards; or other local government ordinances to protect the residents' health and welfare. To apply similar land use restrictions outside that political boundary, however, requires the full cooperation, and agreement and legislative actions by other jurisdictions that control land within the designated SWAP area boundary.

The Ohio Revised Code provides for several forms of multi-jurisdictional mechanisms (e.g., Regional Councils of Government, Regional and County Planning Commissions, Interstate Regional Planning Commissions) which make possible intergovernmental planning, protection and coordination. These existing mechanisms may be used to enhance coordination among jurisdictions and to promote SWAP protection activities.

A. Regional Councils of Government. The Ohio Revised Code authorizes the establishment of regional councils of government by its political subdivisions. Agreements may be entered into by counties, municipalities, townships, special districts, school districts or others within Ohio to form a council of government. Through agreement with similar political subdivisions in adjoining states, such an organization may cross state lines.

A council of government has the power to study area governmental problems, encourage cooperative arrangements, and coordinate actions among members. A council of government may, as authorized to do so by its members, carry out the same functions and duties as the members themselves. This provision gives councils of government in Ohio capabilities which extend beyond planning and management into the implementation of plans and programs. Further, political subdivisions may contract with a council to perform any function or service which they themselves can perform. They also can contract with the council to provide services to it.

In Ohio, programs for regional aquifer analysis and ground water education are conducted by the Miami Valley Regional Planning Commission; the Northeast Ohio Four County Regional Planning and Development Organization; the Northeast Ohio Areawide Coordinating Agency; the Toledo Metropolitan Area Council of

Governments; and the Ohio-Kentucky-Indiana Regional Council of Governments; and other regional and local planning organizations.

B. Regional and County Planning Commissions. Regional planning commissions may be created in Ohio by cooperating municipal planning commissions, boards of township trustees and boards of county commissioners. Regional planning commissions have the power to carry out planning functions related to the physical, environmental, social, economic and governmental characteristics of their areas, and of outside areas to the extent that aspects of these characteristics affect their regions. Regional planning commissions are more restricted in their activities than are councils of government. Their role generally is limited to advising, planning and coordinating rather than providing direct services or plan implementation.

C. Interstate Regional Planning Commissions. Boards of county commissioners and municipalities may cooperate with their counterparts in Ohio and in adjoining states to create, by agreement or by compact, interstate regional planning commissions when the political subdivisions make up an area where intergovernmental cooperative planning would be of benefit. The membership of such a regional planning commission is determined by the counties and municipalities creating it. Its powers and duties are similar to those of regional planning commissions as described above.

Ohio governments at all levels have worked with the Ohio River Valley Water and Sanitation Commission (ORSANCO) an interstate water pollution control agency that was established as a provision of the Ohio River Valley Water Sanitation Compact, in order to implement the Compact, which was signed in 1948 by the governors of Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia and West Virginia.

1.0.5 STATE AGENCIES

The Ohio Environmental Protection Agency and the Ohio Department of Natural Resources have the largest role, among all the state agencies, through their respective missions to protect environmental quality and to manage natural resources. Other state departments with significant authority to protect water resources include the Ohio Departments of Health, Agriculture and Transportation, the State Fire Marshal within the Department of Commerce and the Public Utilities Commission.

A. Ohio Environmental Protection Agency. The Ohio Environmental Protection Agency was created under Ohio Revised Code Sections

121.02 and 3745.01, and is the primary state agency charged with protecting the environment. It also is the designated lead agency for developing Ohio's SWAP Program.

(1) The Division of Drinking and Ground Waters (DDAGW). The Ohio EPA's DDAGW was created in November 1991, by merging the former Division of Public Drinking Water with the former Division of Ground Water. Primary responsibilities of the Division include: administering Ohio's public water supply program (ORC 6109); overseeing implementation of Ohio's Ground Water Protection and Management Strategy; as well as developing and implementing Ohio's Wellhead Protection Program and the new SWAP Program. Other responsibilities include: administering the Underground Injection Control program in Ohio for Class I, IV and V injection wells (ORC 3734); providing technical support to other divisions within the Agency; and maintaining a network of water quality monitoring wells.

Principal wellhead protection duties of the Division, include developing policies and guidance documents to help local officials and private purveyors implement local WHP plans; conducting wellhead protection demonstration projects; and promoting WHP planning through presentations and workshops. The Division also provides one-on-one technical assistance to community officials and purveyors developing local WHP plans. Division staff are responsible for overseeing and tracking wellhead protection data and plan submittals, and taking the lead in the WHP plan review process. These duties will continue under the SWAP program.

As the narrative portion of this document outlines, the 1996 amendment to the Safe Drinking Water Act significantly changes Ohio EPA's DDAGW role in protecting Ohio's source waters. As the leading agency responsible for the development and implementation of Ohio's SWAP Program, division staff will be directly involved with the development of SWAP area delineations and potential contaminant source inventories as well as identifying the geologic sensitivity of Ohio's source waters for the more than 6,100 existing public water systems located throughout Ohio. Division staff will also be involved with promoting and assisting communities with the implementation of SWAP area protective strategies.

Other divisions with lead roles in regulating or managing various existing pollution threats in and around designated SWAP areas include the Divisions of Surface Water,

Emergency and Remedial Response, Solid and Infectious Waste Management, Hazardous Waste Management, Office of Pollution Prevention, and Small Business Assistance Office. These divisions also are principal repositories of inventory information for certain types of potential significant contaminant sources.

(2) The Division of Surface Water (DSW). The Ohio EPA's DSW regulates the discharge of wastewaters to surface waters in Ohio through the issuance of permits and through the review of engineering plans for installation of wastewater treatment facilities (ORC 6111 and ORC 6112). The Division also is responsible for enforcing many requirements of the Clean Water Act, and is involved in developing and implementing a water quality management plan. Significant source water protection activities occur through the review and modification of facility site plans.

The DSW also develops and implements agency guidelines, policies and strategies to evaluate surface water quality pollution and abatement needs (ORC 3745). This includes monitoring surface waters to identify water quality problems due to point and nonpoint sources of pollution; developing Ohio's water quality standards; recommending pollution control measures and quantifying expected improvements; preparing watershed planning profiles designed to reduce nonpoint source pollution; and executing nonpoint source demonstration projects. The Division also plays an important role in source water protection when a public wellfield induces significant recharge from surface water.

(3) Division of Emergency and Remedial Response (DERR). Ohio EPA's DERR investigates, cleans up and remediates sites contaminated with hazardous waste (ORC 3734). This includes: responding to chemical and petroleum releases, spills and waste dumping incidents; investigating alleged or suspected environmental violations that involve hazardous waste, solid waste, infectious waste, air pollution or water pollution; and, discovering, prioritizing, investigating and remediating unregulated hazardous waste sites. The Division is responsible for managing Ohio's Voluntary Action Program to remediate industrial brownsfields, and for Ohio's involvement in the federal Superfund program. Division staff maintain a Master Sites List database that tracks sites in Ohio where hazardous waste releases are known or suspected of causing contamination. Those sites located near a public water well receive priority status for investigative work.

(4) The Division of Solid and Infectious Waste Management (DSIWM). Ohio EPA's DSIWM implements and oversees Ohio's solid waste, infectious waste and methane gas programs (ORC 3734). The Division reviews plans for new disposal facilities and issues permits to install; works with communities on long-range solid waste planning; and oversees and registers certain generators and transporters of infectious waste. Ohio's solid waste rules prohibit the siting of new landfills within a five-year time-of-travel boundary of a public water supply well.

(5) The Division of Hazardous Waste Management (DHWM). Ohio EPA's DHWM provides cradle to grave management of hazardous waste in Ohio (ORC 3734). The Division reviews plans for facilities regulated under the Resource Conservation and Recovery Act, and is responsible for issuing permits for treatment, storage and disposal facilities. The Division also works with industry on pollution prevention activities (a critical component for development of SWAP protective strategies).

(6) Office of Pollution Prevention. Ohio EPA's Office of Pollution Prevention (OPP) was established on July 1, 1993. OPP works with companies and other Ohio EPA divisions on a voluntary, non-regulatory basis to help them modify their processes, materials and practices to generate less pollution in a cost-effective and technically feasible manner. The Office primarily serves Ohio's manufacturing community (approximately 55,000 facilities).

However, OPP also provides services for non-manufacturing entities (i.e., the general public, state agencies, various state and local organizations, commercial facilities, etc.).

(7) Small Business Assistance Office. The Ohio EPA's Small Business Assistance Office (SBAO) opened in December of 1995 with the goal of helping small businesses understand and comply with the environmental regulations that apply to them. Currently, the office is available to small businesses with fewer than 100 employees in the ten counties that make up Ohio EPA's Central District Office. The benefits small businesses gain in working with the SBAO to achieve compliance with their environmental regulations include; helping to protect worker health and safety, preserving the environment for future generations, reducing future liability and the potential for noncompliance penalties, as well as recognizing cost savings through pollution prevention and waste minimization.

B. Ohio Department of Natural Resources (ODNR). Several divisions within the Ohio Department of Natural Resources also have lead roles in regulating or managing various existing pollution threats and are the principal repositories of inventory information for those facilities as well as regional geologic and hydrogeologic data.

(1) Division of Water. ODNR's Division of Water is responsible for the quantitative evaluation of Ohio's ground water resources. The Ground Water Resources Section within this Division is instrumental in providing valuable hydrogeologic information for use in delineating SWAP areas. Specific functions include ground water mapping, administering Ohio's well log and drilling-report law, conducting quantitative problem assessments, as well as providing special hydrogeologic assistance to the Ohio EPA during SWAP delineation and resource characterization efforts regarding local geology, well drilling and development. Statutory authority for these activities is contained in ORC Section 1521.

(2) Division of Geological Survey. ODNR's Division of Geological Survey is responsible for collecting and disseminating information related to the bedrock and surficial geology of the state and is also instrumental in providing valuable hydrogeologic information for use in delineating SWAP areas. Through its mapping programs, core drilling program and seismic interpretation programs, the Geological Survey compiles maps, conducts inventories of bedrock and surficial materials, and advises on mining-related issues (ORC Section 1505).

(3) Division of Mines and Reclamation. ODNR's Division of Mines and Reclamation regulates the environmental and safety aspects of coal and mineral mining, and administers a state and federally-funded abandoned mine land program for the restoration of previously-mined lands that are a hazard, or degrading the environment. The sources of revenue for the Division are coal and mineral severance taxes, federal grants, and general revenue funds.

(4) Division of Oil and Gas. ODNR's Division of Oil and Gas receives its regulatory authority from Section 1509 of the ORC to administer rules and regulations that require optimum management of oil and gas reserves as well as the optimum control of pollution from activities associated with production. Major functions which directly relate to ground water protection include controls over oil well drilling, well casing

and well abandonment techniques, as well as regulating storage and disposal practices for associated waste fluids. The Division also administers the state's underground injection control program for Class II and III injection wells.

(5) Division of Real Estate and Land Management. The Division of Real Estate and Land Management (REALM) provides department-wide planning, environmental review coordination, all real estate functions, and the administration of the Federal Land & Water Conservation Fund Program. It is responsible for capital improvements planning, comprehensive planning, canal lands management, administration of the Lake Erie Access grant program, and the organization and management of the coastal zone management program in Ohio. The Division also provides geographic information system and remote sensing data of Ohio to federal, state and local government agencies.

(6) Division of Soil and Water Conservation. ODNR's Division of Soil and Water Conservation functions under ORC Section 1511, which makes it responsible for abating soil erosion and degradation of the waters of the state by sediments, substances attached to it and by animal wastes. The Division also has a variety of investigative responsibilities in order to determine soil characteristics; inventory critical natural resource areas; and to administer the Ohio Capabilities Analysis Program (OCAP), which provides mapping and analysis concerning Ohio's geology, soils and ground water.

C. Ohio Department of Agriculture. The Ohio Department of Agriculture regulates the production, handling and distribution of agricultural products, including pesticides and fertilizers, and promotes agricultural development (ORC Section 121.092 and ORC Chapter 901). The Department's source water-related authority is its power to regulate the distribution, transportation, storage and application of soil additives, fertilizers and pesticides (ORC Chapter 921). Within the Department, the Division of Plant Industry administers these requirements.

D. Ohio Department of Commerce, State Fire Marshal. The Ohio Department of Commerce was created under ORC Section 121.02. Within the Department of Commerce, the Division of the State Fire Marshal investigates the causes of fires; adopts and enforces the State Fire Code; conducts research on the cause and prevention of fires; operates the State Fire Training and Arson Training Academy; issues permits; and conducts numerous other functions related to fire safety, prevention and training (ORC Section 3737.22).

The State Fire Marshal's major source water responsibilities concern the storage of materials which present a fire or explosive hazard and on-site guidance to other officials when emergency conditions involve a fire or explosion. Through assuring that flammable or explosive materials are stored in a manner to prevent fires and explosions, and by directly providing on-site guidance during emergencies, the actions of the Fire Marshal may influence whether or not hazardous substances are discharged to source waters. In addition, the State Fire Marshal's office has state statutory responsibility to administer U.S. EPA's underground storage tank requirements adopted pursuant to the 1984 amendments to the Resource Conservation and Recovery Act (42 U.S.C. 6921).

E. Ohio Department of Development. The Ohio Department of Development (ODOD) is responsible for the creation, retention and expansion of job opportunities for the State of Ohio. The Department, made up of eight divisions, administers both short-and long-term economic development programs. These programs make Ohio an industrial and technological leader throughout the United States. Department of Development programs help retain companies already located in Ohio, as well as attract national and international companies to locate their operations in Ohio and provide assistance to Ohio companies looking to export their products to new markets. Other programs assist entrepreneurial and minority business growth, help build healthy communities and keep the state's businesses competitive in world markets.

Serving as a catalyst, the Department promotes partnerships involving local communities, the private sector and state government. It frequently calls upon public-private sector advisory groups to assess the ODOD programs and Ohio's business climate. Such groups include: the Ohio Job Creation Tax Credit Authority, the Ohio Economic Development Council, the Minority Development Financing Commission, the Ohio Housing Finance Agency, the Development Financing Advisory Board, the Ohio Coal Development Technical Advisory Committee and the Industrial Technology Enterprise Advisory Board.

F. The Ohio Department of Health. The Ohio Department of Health is responsible for the general supervision and control of matters relating to the preservation and protection of public health (ORC Sections 3701.03 and 3701.13). Department functions include programs to regulate the siting, design, operation and maintenance of private residential water supply systems and sewage disposal systems, both of which may directly impact local source water

quality and drinking water safety.

The Department has developed rules governing residential well construction practices and a well permit system, which are administered in cooperation with local health departments. Other source water-related activities include a registration program for private water system contractors and a local inspection and sampling program for private water supplies.

G. Ohio Department of Transportation. The Ohio Department of Transportation manages, constructs and maintains public transportation facilities, including developing plans and state policies concerning such facilities (ORC Section 121.02 and ORC Chapter 5501). Departmental efforts can affect source waters through construction of surface water drainage projects (road construction); operation of sewage disposal and water supply systems at roadside rests; and removal of snow and ice from state highways. In removing snow and de-icing roads, Ohio Department of Transportation stores, transports, and applies nearly one million tons of salt per year. A portion of this salt, together with that used by the public and other governmental units, may reach and contaminate source waters. The Division of Highways administers a program to minimize the effect of road salt on source waters.

H. Ohio Water Development Authority. The Ohio Water Development Authority, established under ORC Section 6121.02, promotes and protects the state's water resources for the benefit of the state, its people and its economy (ORC Section 6121.03). Under ORC 6123, it also has similar responsibilities and goals concerning solid waste disposal and energy resources.

I. Public Utilities Commission of Ohio. The Public Utilities Commission of Ohio regulates the operation of certain public utilities and railroads. A public utility can include any entity that supplies electric, natural gas, sewer, water, telephone or telegraph service within the state, or any motor carrier within the state (ORC Section 4905.02). The Commission's principal authority related to SWAP is the regulation of sewer and water utility companies. It has minor authority to affect ground water protection through its ability to regulate motor carriers and railroads, which transport substances that can be spilled or leaked to the environment.

1.0.6 FEDERAL AGENCIES

A. United States Environmental Protection Agency. The U.S. EPA is the principal federal agency with responsibility for protecting the nation's air, water and land resources from pollution, including

toxic and hazardous wastes. Its authority to address source water management stems from six major national pollution control laws: Safe Drinking Water Act; Resource Conservation and Recovery Act of 1976; Comprehensive Environmental Response Compensation and Liability Act of 1980, Clean Water Act; Federal Insecticide, Fungicide and Rodenticide Act; and the Toxic Substances Control Act of 1976. The State of Ohio has been authorized by U.S. EPA to enforce those laws, and has adopted its own rules and regulations.

B. U.S. Department of Agriculture

(1) Natural Resources Conservation Service gives technical and financial assistance to farmers, ranchers, and state and local governments to reduce soil erosion and sedimentation; prevent flood damages; reduce damages; conserve water and improve water quality; reduce energy requirements; and assure continued agricultural productivity. The Service helps individuals and groups plan and carry out conservation, mainly through local Soil and Water Conservation Districts organized under state laws. The Service also provides technical and financial assistance to sponsoring groups in planning and installing small watershed protection projects. The Natural Resources Conservation Service also administers the Conservation Reserve Program, which pays farmers to seed certain crop lands to grass or trees. Those croplands within 2,000 feet of a public water well or within an endorsed Wellhead Protection Area receive high priority for consideration under this program.

(2) Rural Development was created to help improve the economy and quality of life in rural America. Rural Development offers financial programs to support essential public facilities (e.g., water and sewer systems, housing, health clinics, emergency service facilities as well as electric and telephone services). It also promotes economic development by supporting loans to business through banks and community-managed lending pools. Finally, it offers technical assistance and information to help communities undertake community empowerment programs as well as to help agricultural and other cooperatives to get started and/or improve the effectiveness of their member services.

C. U.S. Department of Interior

(1) The **USGS** prepares maps; collects and interprets data on mineral and water resources; conducts fundamental and applied research in science and technology; and publishes and disseminates the results of its investigations in maps and

reports.

(2) Nuclear Regulatory Commission. The general mission of the Nuclear Regulatory Commission is to assure that civilian uses of nuclear materials and facilities comply with public health and safety, environmental quality, national security, and antitrust laws. In carrying out its general authority, the Nuclear Regulatory Commission plays the key role in protecting source waters from radiological contamination.

1.0.7 ASSOCIATIONS AND ORGANIZATIONS

A number of non-governmental organizations and associations have an interest in the regulation of Ohio's source waters and have played an important advisory role in the development of various water resource programs in Ohio. These groups include:

A. Environmental Organizations:

-Local Watershed Groups
-Ohio Environmental Council
-Ohio Public Interest Campaign
-Ohio Citizen Action
-Sierra Club
-Rivers Unlimited
-Rural Action
-The Nature Conservancy

B. Professional Associations:

-American Water Works Association
-American Association of Retired Persons
-Ohio Electric Utilities Institute
-Ohio Manufactured Homes Association
-Ohio Water Resources Council
-Ohio Corporation for Health Information
-Rural Community Assistance Program
-League of Women Voters
-United Way
-Ohio Rural Water Association
-Ohio Farm Bureau
-Ohio Oil and Gas Association
-Ohio Aggregates Association
-Ohio Municipal League
-Ohio AgriBusiness Association
-Water Management Association of Ohio
-Red Cross

1.0.8 PRIVATE CITIZENS

A. Ohio Water Consumers. The residents of Ohio depend on the federal, state, and local government agencies and officials to do their jobs

in an effective manner so that water consumers throughout the state receive a clean water supply. However, it is equally important that local water consumers become educated about their local SWAP area and more importantly to become actively involved with the development of SWAP management strategies within their community. Water consumers who become educated and involved with their community's SWAP management planning will gain a better understanding of where their water supply is coming from and also will be able to educate others about issues that could threaten the community's source waters. Consumers who become involved with their local SWAP management planning will have a better understanding of the management strategies (ordinances, etc.) their local government chooses to implement.

B. People who live or work in SWAP areas. People who live or work in a community's SWAP area need to be informed about the local SWAP area and also about how their disposal practices or other daily activities may have an adverse impact on the entire community's water supply. People who live or work within a delineated SWAP area should also become involved with local SWAP management planning so that they can have a voice in the decision making and management steps involved with protecting their community's source waters.

1.0.9 OWNERS OF POTENTIAL CONTAMINANT SOURCES

A. Chamber of Commerce and Industry Associations. The local chamber of commerce and industry associations can use the information disseminated by the Ohio EPA about their local SWAP area to inform businesses located within the delineated SWAP area about what it means to be located within a community's protected area and what measures businesses can take in order to ensure or help them to become as much of a low risk potential contaminant source as possible.

B. Businesses located in SWAP areas. Businesses located within a community's SWAP area need to be informed about what it means to be located within a community's protected area. Once informed about the community's SWAP area, businesses should become involved with local SWAP management planning activities. This involvement will allow businesses to become educated about the importance of SWAP and also to have a voice in the management strategies that are implemented by the local government. Businesses located within a communities SWAP area should also educate their employees about what it means to work within a community's SWAP area. Businesses should also implement pollution prevention measures that will make them as much of a low risk potential contaminant source as possible.