Washington's Source Water Assessment Program (SWAP)

June 2005 (Revised)

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A. Background

1996 amendments to the federal Safe Drinking Water Act (SDWA) require states to implement Source Water Assessment Programs (SWAP). There are four major components to the federally mandated SWAP program. The state is to ensure the following requirements have been met for each federally regulated public drinking water system:

1) Delineate source water protection area(s) (SWPA) for each source (well, spring, surface water intake).
2) Inventory each SWPA for potential contaminant sources.
3) Conduct a susceptibility assessment for each drinking water source.
4) Make the findings of 1-3 readily available to interested parties.

Washington is in a good position to comply with these requirements. The state Department of Health Office of Drinking Water (ODW) has been assigned primacy for the federal drinking water program in Washington. ODW is responsible for implementing the SWAP requirements, including information dissemination. Under existing state rules (WAC 246-290-135) Washington's federally regulated public water systems (Group A systems) already are conducting wellhead protection programs and/or watershed control programs. All "ground-water-using" Group A systems also are required to submit a susceptibility assessment to ODW as part of their wellhead protection program.

ODW's primary limitation in implementing SWAP requirements is lack of a data management mechanism able to track and disseminate SWAP findings to interested parties. ODW's general approach has been to focus most of its SWAP-related resources on data collection, management and distribution. Because much of the data generated through the Wellhead Protection Program and the Watershed Control Program is spatial in nature (wellhead protection areas, watershed basins), ODW has been developing geographic information system (GIS) capabilities to manage, store and distribute this information. ODW also is developing applications that will allow interested persons to access this information on the Internet.

ODW is utilizing existing programs to implement the majority of the SWAP requirements. Several such programs are key to successful implementation efforts. Key programs include:

- Wellhead Protection Program
- Watershed Control Program
- Wellhead /Critical Aquifer Recharge Area GIS mapping project (Washington State Dept of Transportation (WSDOT))
- Phase II/V monitoring waiver vulnerability assessment program, and the Information Integration Project (Washington State Dept of Ecology (Ecology)).

Each of these programs will be discussed in this document.

B. Public Participation

The SWAP program, especially its component pieces, was developed with public participation.

ODW has a legislatively defined standing advisory committee. This committee, the Water Supply Advisory Committee (WSAC), served as the advisory committee to Washington's SWAP program. The committee met in January and October 1998 and again in January 1999 to discuss, in part, the proposed SWAP Program.

In addition to using the WSAC, ODW worked with the Interagency Ground Water Committee. Staff presented the proposed program to the committee in Yakima on November 10, 1998.

ODW mailed/e-mailed the proposed program to all interested parties and past Wellhead Protection Program Advisory Committee members, and posted a copy of the proposal on its Web site – making it available to anyone with Internet access.

Two public meetings / hearings on ODW's proposed SWAP Program were held. They were advertised in five major newspapers across the state. The first was in Spokane on January 25, 1999 and the second was January 26 in Olympia. No interested parties participated. The general lack of interest in the proposed SWAP program is believed to be due to the use of existing programs, with no new requirements to public water systems, to meet the objective. The use of GIS technology and Internet accessibility of the data are also widely supported. With no controversial elements, there is general support for ODW's proposed approach to implementing the SWAP requirements.

It is important to note that the various existing programs, in particular the Wellhead Protection Program, the Growth Management Act[1] (critical aquifer recharge area protection) and the watershed control program, were developed with public participation as required by Washington state's administrative procedures. The wellhead program also used both a technical and a policy advisory committee. More details can be found in the *Wellhead Protection Program Guidance Document* (DOH PUB 331-018 is online at http://www4.doh.wa.gov/dw/publications/publications.cfm).

C. State Approach

1. Overall Approach

Washington's overall approach is to use data from existing programs, convert it into a format that can be imported into a GIS data system, use the GIS system for the initial inventory, upgrade the inventory over time by integrating data from other sources, such as local governments, and provide the information to interested entities primarily via the Internet.

[1] Washington passed the Growth Management Act in 1990. The act requires all jurisdictions in the state to identify and protect four types of "critical areas." One of the four is "areas having a critical recharging effect on aquifers used for potable supplies"—or Critical Aquifer Recharge Areas.

2. Existing data and programs to support the SWAP process

ODW seeks to maximize efficiency by using data generated from existing programs, and data integration and GIS coverage development efforts to implement the SWAP Program. In addition to specific drinking water programs, such as wellhead protection, watershed control, and the susceptibility assessment portion of Ecology's Phase II/V monitoring waiver program, there are essential ongoing programs and efforts at other agencies. For example, Washington's SWAP Program benefits from the fact that Ecology is a national leader in efforts to integrate disparate environmental databases. Ecology seeks to geo-code much of its information for use in GIS analysis (Information Integration Project-IIP).

Another boon, as SWAP implementation occurs, is that Washington has earned national recognition repeatedly for being "the most digital" state in the nation. ODW is working closely with the Washington State Geographic Information Council to ensure GIS data developed for the SWAP Program can be easily exchanged with other interested entities.

A key measure of success from ODW's perspective is the extent to which local governments have easy access to SWAP-related information for better decision making. Because of the geographical nature of wellhead protection areas and drinking water watersheds, a map-type display format is often most easily understood. Getting SWAP data into a GIS environment allows the data to be analyzed against a wide variety of disparate data sets—such as land use, zoning and potential contaminant source databases. To this end, ODW's SWAP Program has been working with local health jurisdictions and city/county/public utility districts to enable SWAP-related GIS data to be collected at the local level and shared between jurisdictions. A significant portion of the SDWA SRF SWAP set-aside was allocated for grants to local governments for SWAP-related data collection efforts.

3. Delineation approaches

Ground Water Systems

State rule (WAC 246-290-135) requires all Group A[2] systems (including community, non-transient non-community and transient non-community types) using ground water or springs as their source of drinking water to:

- Delineate the 1, 5, and 10-year time-of-travel wellhead protection areas for each source.
- Conduct an inventory for potential contaminant sources.
- Collect and submit information to ODW for a source water susceptibility assessment.

This constitutes part of state wellhead protection requirements. EPA approved Washington's Wellhead Protection Program in 1994.

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[2] "Group A" is the Washington specific designation for public water systems regulated by the federal SDWA. Washington also defines Group B systems. These are public water systems smaller than the minimum cut-off defined by the SDWA.

The state wellhead program establishes a minimum delineation standard. Most systems can use a calculated fixed radius (CFR) approach, but are encouraged to evaluate the overall findings of the analysis and decide if a more sophisticated delineation approach is prudent. For some large, highly susceptible sources, a more sophisticated delineation method is most appropriate (e.g., hydrogeologic mapping, analytical and/or numerical models).

Two complementary programs address non-contiguous recharge areas. First, Washington's Wellhead Protection Program allows water system purveyors to define non-contiguous wellhead protection buffer areas. Second, Washington's Growth Management Act requires all jurisdictions to define Critical Aquifer Recharge Areas (CARAs) and then pass ordinances to protect them. As CARA data is incorporated into a local GIS, the WSDOT has been assembling CARA data from around Washington into a statewide GIS.

i. Rationale for Using a Different Assessment Approach on Transient Non-Community Systems

Transient non-community systems (TNCs) deviate from Washington's Wellhead Protection Program. While TNCs are required to implement the Wellhead Protection Program, they have been among the slowest to comply. For purposes of the SWAP assessment, where site and source-specific data is lacking, TNCs will have arbitrary fixed radius delineations of 600 feet[3] and will be assigned a default susceptibility rating of "high." As part of the SWAP Program, all TNCs were visited, had their location determined with a Global Positioning System (GPS) device and had a water sample analyzed for nitrates as an ambient water quality screening tool.

ii: A major challenge is ensuring compliance by remaining non-compliant Public Water Systems

Excluding TNCs, approximately 95 percent of Washington' Group A systems have submitted their source-specific susceptibility assessment / CFR data to ODW for review. Getting the remaining 5 percent of systems to comply is the single largest compliance challenge facing Washington's SWAP Program. The approach to achieving compliance with the wellhead protection/susceptibility assessment requirements is to incorporate compliance efforts into other priority compliance efforts targeted at those systems out of compliance with SDWA monitoring requirements. In the absence of site-specific data, ODW will assign a susceptibility rating of "high" and a wellhead protection area with an arbitrary fixed radius of 1,000 feet.

iii: Transboundary issues

For purposes of complying with the SWAP requirements of the SDWA, Washington's assessment efforts stop at the state boundary. Interstate and international source water protection efforts will continue to be addressed using site-specific forums. By way of illustration, consider the following:

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[3] 600 foot radius for arbitrary fixed radius delineation is also the default ODW uses for new Group B systems. It was felt to be sufficient to protect the source water for the typical very small system. Most TNCs are also very small systems (e.g., highway rest stops, camp grounds) so a similar default value fits and helps maintain regulatory consistency.

ODW and local purveyors participate on the Abbotsford-Sumas Aquifer International Task Force with Canadian counterparts; ODW works closely with Idaho agencies on ground water and drinking water issues on the Spokane-Rathdrum Prairie Aquifer system; and ODW works with Oregon agencies to deal with nitrate contamination of ground water.

iv: Tracking and Disseminating Wellhead Protection Information

ODW tracks source-specific wellhead protection/susceptibility information. It updates GIS coverages as susceptibility assessments are completed and CFR results are submitted. Local governments, under contract to ODW, digitized non-CFR delineations.

As wellhead protection area GIS coverages are updated, ODW makes them available to interested parties upon request.

Surface Water Sources

Fewer than 200 of the approximately 4,200 federally defined public water systems in Washington use surface water as the source of their drinking water. Several of these remain unfiltered based on the quality of their watershed control programs. The rest filter or are in the process of building filtration facilities, but remain vulnerable to increased turbidity of the source water due to upstream disturbances.

Existing drinking water system planning requirements (WAC 246-290-135 (5)) require all Group A systems using surface water as a source of supply to develop watershed control programs. Watershed control programs require purveyors to delineate the watershed contributing to their source water and inventory potential threats to source water quality within the watershed.

There is no existing state requirement for "surface-water-using" Group A systems to collect and submit information to ODW so it can conduct a susceptibility assessment. Therefore, ODW will collect the information it needs for susceptibility assessments of surface water systems based on the process defined by the EPA-approved Phase II/V Monitoring Waiver Program. By default, surface water sources are assigned a susceptibility rating of "high" for all classes of contaminants.

Delineation Approach for Surface Water Supplies

State watershed delineation requirements do not specify any particular method or approach. The accepted approach is to define the entire watershed up-gradient of the intake point. This includes the initial watershed plus any open conveyance mechanism and/or storage reservoirs.

ODW has been augmenting purveyor-generated watershed delineations by modeling the watersheds using GIS technology and Digital Elevation Models (DEM) developed for the state of Washington.

Many of the watersheds comprise hundreds, or even thousands, of square miles. To maximize effectiveness of inventory efforts, GIS technology is used to help identify potential contaminant sources. Using a "buffer" approach along defined water bodies enables the identification of

geocoded facilities and activities that are potential sources of contamination to the drinking water supply.

Conjunctive Delineations

When it is determined that a well has ground water under the direct influence of surface water (GWI), a watershed delineation and assessment will be conducted in addition to the wellhead protection assessment.

4. Potential Contaminant Source Inventory

State rule (WAC 246-290-135) requires all Group A systems (including community, non-transient non-community and transient non-community types) to conduct an inventory for potential contaminant sources within their source water protection area.

This constitutes part of state wellhead protection and/or watershed control requirements.

Constrained by time and workload, the initial SWAP inventory for potential contaminant sources will be based on analyzing the SWAP "inventory areas" (wellhead protection areas, watershed control inventory areas) against the geo-coded datasets of potential contaminant sources in the various databases maintained by the state Department of Ecology. These datasets include Ecology's Facility Site Inventory data; RCRA facilities; Superfund sites; "state Superfund" sites; known illegal dump sites; small, moderate and larger generators of hazardous waste; permitted underground storage tanks, and dairy waste lagoons.

These initial inventories will be refined over time as reports from individual purveyors are integrated into the results. In addition, as SWAP GIS coverages are developed at the local level, the local government is able to inventory for potential contaminant sources using parcel and tax data. This "independent reporting" element of Washington's SWAP Program is a real strength from a quality improvement perspective. The data purveyors and local governments generate will serve as a quality assurance/quality control mechanism to augment and improve Ecology's data files with more locally generated information. It also provides a mechanism to identify and incorporate potential sources of contamination not included in Ecology's databases. This will be the primary mechanism to identify and incorporate "significant" sources not identified during the initial inventory effort. As "new" types of potential contaminant sources are identified in one part of the state, they will be incorporated into future inventory updates statewide.

Based on the inventory approaches defined, potential contaminant sources are not defined as specific chemicals. Instead, they are defined as facilities, activities or generalized chemical user profiles (*e.g.*, electroplating operations, dry cleaners).

Results of the inventory work can/will be reported in a tabular list for each drinking water source. Specific facilities, activities or sites will be identified. Inventory results can be combined for a more regional summary of potential contaminant sources.

Inventory approach

The inventory area for wells and springs will be the one, five and 10-year time-of-travel boundaries defining the wellhead protection area(s). Inventory results will be presented based on occurrence in the 3 subunits (0-1 yr., 1-5 yr., 5-10 yr. areas).

While using the entire wellhead protection area to define the inventory area of a ground water source is relatively straightforward, defining the subset of a surface water watershed that should be inventoried is not quite so straightforward. For example, while many surface watersheds used for drinking water are relatively small (300 to 500 square miles), the City of Pasco withdraws water from the Columbia River – and its watershed encompasses almost 40 percent of the area of the state. For this reason, it is impractical and inefficient to inventory and focus concern across an entire watershed. Therefore, the inventory should occur in the surface area/water that will be supplying drinking water in the relatively near-term.

The relative risk to the drinking water supply increases as the physical proximity of the facility to the surface water body decreases.

Based on this assumption, the following subset of the watershed will be inventoried for sources of potential contamination to surface drinking water supplies:

- 500[4] feet along surface waters (lakes, rivers, streams up-gradient of intake) up to 24 hours upstream based on stream flow velocities associated with a 10-year flood event.
- A general land use survey in proximity of the intake point (1,000-foot radius).

ODW is hesitant to provide detailed or prescriptive directions for prioritization or identification of "significant sources." Our preferred approach is to provide all available information and then let local communities prioritize based on local conditions.

5. Susceptibility Assessments

Under 1986 amendments to the SDWA, ODW developed a source-specific and/or area-wide monitoring reduction waiver process to evaluate whether any given drinking water source had to monitor for a variety of chemicals (e.g., volatile organic chemicals, pesticides, synthetic organic chemicals). The method uses information on well age, construction, depth, past water quality history, degree of confinedness, etc., to provide an assessment of the source water's "physical susceptibility to contamination." This assessment (high, medium, low) combined with potential contaminant source inventory data enables ODW to assign a susceptibility rating for groups of contaminants including volatile organic compounds (VOCs), synthetic organic compounds (SOCs – primarily pesticides) and microbial contamination. The process was based on both an areawide monitoring study conducted with the USGS and EPA, and site-specific data submitted by the purveyor. The process was reviewed and approved by EPA in 1995.

ODW's process for determining susceptibility ratings for individual supply sources is initiated by a public water system completing a Susceptibility Assessment Survey Packet for each of its sources.

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[4] For GIS analysis purposes, a value of 1,000 feet will be used to offset imprecisions in the geocoded locational information of potential contaminant sources in Ecology's databases.

The Susceptibility Assessment (SA) is required of all Group A water systems having ground water or spring sources, as part of the Wellhead Protection Program. A source must also have nitrate data and have completed a minimum of one VOC analysis[5]. After ODW determines source susceptibility and evaluates nitrate and VOC data, it applies additional parameter-specific criteria to determine the source's specific contaminant group (microbial, VOC, SOC) susceptibility rating. This potentially results in numerous rankings per source (one per contaminant category). ODW provides this information to the system in writing.

Overall, the state susceptibility rating is based on assessment of source vulnerability to contamination (hydrogeologic susceptibility); and, in the absence of direct/precise measurements of contaminant use and exposure, evaluating surrogate indicators such as the physical setting of the source and surrounding land use.

The first component, hydrogeologic susceptibility, is an evaluation of the physical potential for a source to be contaminated by the movement of chemicals from the land surface into a water supply.

The second component involves assessing the risk of source exposure to contaminants by determining whether contaminants were used in the water supply area. This can be complicated because inventorying all chemicals that have ever been used in an area is very difficult. In addition, once contaminants have entered the environment they can behave very differently, making it difficult to predict ground water pollution from surface exposure. The contaminant use assessment is also subject to change over time as surrounding land uses change. For these reasons, ODW regulations require water systems to update their Potential Contaminant Source Inventory every two years.

Susceptibility ratings are based on an evaluation of the Susceptibility Assessment, historical water quality information (as obtained by the system or the state), and other parameters to determine source vulnerability (Table 1). A source can be determined to have low, moderate, or high vulnerability to contamination (Susceptibility). By definition, all surface water sources are rated highly susceptible.

The Susceptibility Assessment requires system and source information on the local geology; well construction; aquifer characteristics; delineation of ground water six-month, one-year, five-year and 10-year time of travel boundaries; identification of certain industries, facilities, and land-use within the five-year time of travel; and the size of the water system.

Systems rated "low susceptibility" to contamination have met stringent criteria regarding source hydrogeologic setting (such as well completed in a confined aquifer or excessively deep), historical water quality, and well construction. Although the absence of critical contaminant sources is among the criteria, it is not heavily weighted in determining a system's susceptibility rating. The major difference between a system with low susceptibility and moderate susceptibility is that a moderately susceptible source is completed in a higher risk hydrogeologic setting. High susceptibility is based on a source not being able to meet one or more of the moderate susceptibility requirements.

[5] The required VOC analysis consists of one analytical method, which encompasses all of the 1986 SDWA stipulated analytical parameters, including the unregulated VOC compounds.

Table 1: Source Susceptibility Assessment Criteria

Susceptibility	♦ Criteria / Critical Factors
Low	♦ Susceptibility assessment shows source is • confined aquifer • unconfined, excessively deep aquifer (>250 ft) and has • nitrates < 5 mg/L • no VOC detections • no inorganic MCL violations • adequate well construction based on recorded age, region & type of construction ♦ Vulnerability data cross checked with DW database ♦ Review of 6 month & 1 yr. time of travel shows no critical contaminant sources warranting immediate investigation
Moderate	♦ Susceptibility assessment shows source is • unconfined aquifer (>150 ft deep), and • nitrates < 5 mg/L • no VOC detections • no inorganic MCL violations • adequate well construction based on recorded age, region & type of construction ♦ Vulnerability data cross checked with DW database ♦ Review of 6 month & 1 yr. time of travel shows no critical contaminant sources warranting immediate investigation
High	♦ Susceptibility assessment shows source is • unconfined aquifer (<150 ft deep), or ♦ Source construction is questionable or unverified, or ♦ Source water quality has • nitrates > 5 mg/L but <10 mg/L or • other inorganic MCL violations • no VOC detections ♦ Vulnerability data cross checked with DW database
High (Water Quality)	♦ Susceptibility assessment & DW database cross check shows: • VOC detection, or • Nitrate >10 mg/L • Any prior SOC detection, or • Has never tested for VOC
High (surface water)	♦ All surface water systems are considered highly susceptible

D. Making the results available

The extent to which the SWAP data is distributed and used for better decision making is a key measure of success. For this reason, ODW used many of its SWAP SRF related resources to provide grants to local governments to generate GIS coverages of key SWAP data, such as wellhead protection areas, watershed boundaries and water system service areas. Generating GIS coverages at the local level helps ensure the coverages will be incorporated into the local GIS data systems.

Integrated information allows drinking water protection questions to be raised early in the scoping phase of a project by quickly identifying if the prospective project falls within a "critical area."

Having informed citizens is a key to long term drinking water protection. With conflicting priorities and demands for resources and attention at the local government level, educated and engaged citizens asking informed questions ensure drinking water protection receives adequate attention.

It is also important to have informed water system owners and operators. Water systems receive a copy of their Susceptibility Ratings. They already know their wellhead protection areas and/or watershed control areas. They generate their own Potential Contaminant Source inventory list and will have access to the GIS-generated list of potential contaminant sources.

A major component of Washington's SWAP Program is making the data available to anyone who has access to the Internet. Most of Washington's public libraries have computers available for public use. So, even if an individual does not own a computer, he or she does has access to the Internet through the state library system.

ODW is developing two complementary Internet access strategies.

The first is to make the data available to interested entities that have sophisticated GIS capabilities, such as selected nonprofit organizations, local governments, consultants and the private sector. GIS coverages of wellhead protection areas and drinking water watersheds will be provided, upon request, along with the appropriate metadata[6] for proper usage.

The second is to develop an "Interactive GIS" Internet application for the general public. Individuals can access the Internet and be able to view a selected subset of the state, down to the subcounty and/or large water system level. Individual water systems' service areas will be displayed along with wellhead protection area boundaries, watershed control boundaries, inventory results and susceptibility ratings.

ODW expects water systems to include a brief mention of their SWAP findings and the Internet application in their Consumer Confidence Report (CCR). The purveyors themselves are also expected to answer direct SWAP queries from their customers.

E. Program Implementation

1. Implementation Summary

Washington's SWAP program is well on its way to successful implementation. What follows is a brief summary of progress as of May 2005 plus estimates to accomplish the remaining work:

- 100 percent of community, transient and non-transient non-community Group A sources have a defined Source Water Protection Area and Susceptibility Rating.

[6] Metadata is the term for "information about information", i.e., data about the database-such as when was it created, using what sources and assumptions, with what level of precision.

- 99 percent of community, transient and non-transient non-community Group A sources have GPS coordinates within five meters. Additional work is ongoing to get GPS coordinates for the remaining systems.
- An Interactive GIS Web site has been available to water systems for their review since the summer of 2004.
- A publicly accessible version of the SWAP Interactive GIS Web site is being beta tested and should be operational by late fall 2005.

2. Coordination Mechanism

Interagency coordination efforts that arise as Washington's SWAP Program is implemented will be conducted through three major mechanisms: the Interagency Ground Water Committee, the Water Supply Advisory Council and the Unified Watershed / Regional Watershed planning efforts. Other existing or new avenues will be utilized or developed if a need arises.

F. Source Water Protection Integration Efforts

The extent to which SWAP data is distributed and used for better decision making is a key measure of success. ODW believes it can enable SWAP data to be integrated into resource planning and protection efforts by:

- Getting SWAP data in a GIS format.
- Enabling local governments to collect and develop SWAP data coverages.
- Working with other government agencies to share information on public water systems and potential contaminant sources.
- Making the information easily accessible through the Internet.

Most land use decisions occur at the local level. Making SWAP data easily accessible to federal and state agencies and local planning departments is an excellent proactive planning mechanism. Information on wellhead protection area boundaries and susceptibility ratings can help redirect development to non-critical areas. It is also being used to help target educational and regulatory efforts.

Ecology is developing GIS-based query capabilities among its various regulatory programs. Inspectors of underground storage tanks, RCRA facilities and dairy waste lagoons can identify which of their regulated facilities are located within sensitive source water protection areas, and target them for compliance inspections or technical assistance.