MONTANA SOURCE WATER PROTECTION

TECHNICAL GUIDANCE MANUAL - PART 1

MBMG 378

By

Joe Meek

Montana Department of Environmental Quality

Prepared in cooperation with the
Montana Bureau of Mines and Geology,
Butte and Billings

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Your commitment to the residents of the State of Montana is evident by your relentless insistence on excellence in training and education. Thank you.

Joe Meek

July 1998

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1.0. CHAPTER 1: INTRODUCTION

1.1. General

Source water protection (SWP) is an integral part of the multiple-barrier concept for public health protection. It is a preventive effort designed to eliminate unnecessary risk of contamination to the source of water used by a public water supply system. Source water protection is a community-based approach to protecting drinking water through a process that identifies the origins of certain contaminants and then determines the best way to manage them at the community level. Source water protection is achieved through the development and implementation of a SWP plan. Source water protection can work very well with existing environmental programs by serving as a basis for prioritization for permitting, inspections, and enforcement; SWP will ensure that existing programs achieve the greatest benefits for the cost.

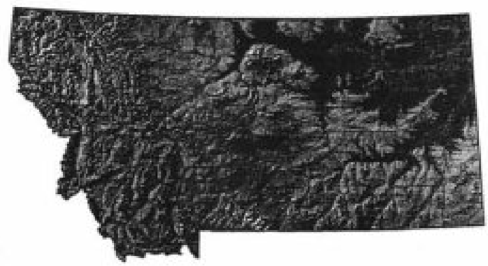
The general concepts of SWP are applied to public water supply systems using surface water, ground water (also known as Wellhead Protection), or water from a source with significant surface water / ground water interaction. Source water protection is an extension of the wellhead protection concept and includes systems using water from any type of source.

Source water protection plan development is designed to manage a specific land area identified or delineated according to the local hydrology (for surface-water systems) or hydrogeology (for ground-water systems) to prevent ground- or surface-water contamination. Guidance and assistance for setting up a SWP plan is available from DEQ, but local effort and initiative are key to developing a useful plan. Effective plans take into account local hydrological or hydrogeological conditions, land uses, and political and economic considerations.

Developing a SWP plan is a six-step process. The following is a list of the six steps in SWP:

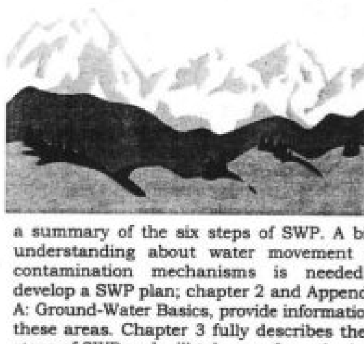
1. forming a community planning team,
2. delineating the land area to be protected,
3. identifying sources of potential contaminant sources,
4. developing a management plan,
5. planning for the future by preparing emergency plans, and
6. state plan review and certification.

The purpose of this manual is to provide guidance to public water-supply owners / operators, water-system users, and other interested persons in developing and implementing a SWP plan for a public water supply. Please note that the term *wellhead protection* is outdated and has been replaced by the term *source water protection*, because the general concepts apply to both surface- and ground-water based systems.



This manual is intended to guide you through the process with as much or as little outside assistance as you deem necessary. A complete description of each aspect of SWP is included, as are sample documents, blank forms, and reference citations.

This guidance manual is organized into two parts. Part 1 contains four chapters beginning with a brief introduction to the Montana Source Water Protection Program and



a summary of the six steps of SWP. A bit of understanding about water movement and contamination mechanisms is needed to develop a SWP plan; chapter 2 and Appendix – A: Ground-Water Basics, provide information in these areas. Chapter 3 fully describes the six steps of SWP and will take you from the initial concept through certification of a SWP plan. Chapter 4 provides an introduction to Part 2.

Part 2, Demonstration of Source Water Protection for Ground Water, shows actual examples of SWP at four different water systems in Montana. Although the delineation step is emphasized in Part 2, information for the other five steps is also included where possible.

Sufficient detail is provided in the manual to help you develop and implement a SWP plan for your water system. Should you need additional information or assistance, contact the Montana Source Water Protection Program at the Department of Environmental Quality in Helena (406-444-4806).

At the end of Chapter 1 you will find a SWP implementation chart to help you visualize what you will need for the entire project. If you are a PWS operator developing a SWP plan yourself, you can skip down the implementation chart to the row labeled "source research." The implementation chart should help keep you on track through plan development by tracking what you have completed, and by showing you what you have left to do.

Usually, the local governing body or managing entity of the PWS is responsible for development of the SWP plan. The use of a community planning team can greatly reduce the work required by any one individual and usually makes for a better overall product because of the various perspectives offered by group members. The use of a community planning team may not be feasible for small systems. If you are an operator working on a SWP plan on your own, you may want to seek input from outside sources such as Montana Rural Water Systems (MRWS), Midwest Assistance Programs (MAPS), or the Montana Source Water Protection Section at DEQ.

The technical part of SWP plan development is the delineation step (see Chapter 3 and Part 2). When the Montana Source Water Protection Program was first developed, it was anticipated that some PWSs would need assistance with their delineations, but others would not. Because of the 1996 amendments to the Safe Drinking Water Act, however, the State of Montana is developing a Source Water Assessment Program that includes the identification (delineation) of the source water used by PWSs. In other words, if you wait long enough, the state may provide the delineation for you. It will take some time to complete the delineation for the 3,000 or so wells used by PWSs in Montana. So you may decide to complete the delineation step yourself or find assistance elsewhere.

Developing a SWP plan is really nothing more than taking fairly simple and well-defined steps. The whole process may seem complicated, but the individual steps are not if they are considered one at a time. It is similar to how you often deal with your water system...you call it a water system but think of it in simpler terms such as the well, valves, distribution system, and service connections. ***The whole is more complicated than the individual parts.***

This manual is designed to help you better understand SWP and to help you describe both your

water system, and the pollution prevention activities in a SWP Plan.

1.2. A Brief Description of The Montana SWP Program

The Montana Wellhead Protection Program was mandated by the 1986 amendments to the federal Safe Drinking Water Act. The Montana Wellhead Protection Program was approved by the U.S. EPA in August of 1994, after more than 3 years of joint effort by the Ground Water Section of the Water Quality Division of the Montana Department of Health and Environmental Sciences (now called the Montana Department of Environmental Quality), by the Wellhead Protection Advisory Committee, and by many Montana citizens.

The 1996 amendments to the federal Safe Drinking Water Act require that states develop a Source Water Assessment Program that

1. identifies the source of water used by public water systems, and
2. identifies sources of potential contaminants, and assesses the susceptibility of the PWS to identified contaminant sources.

As you read this manual, you will see that the program mandated by the '96 amendments addresses only two of the six steps of the Montana SWP Program. And, as noted previously in this chapter, the concept of SWP can be applied to both surface-water PWSs and ground-water PWSs (wells) *source water protection.*

The Montana SWPP is designed to help public water systems protect their supplies from contamination. The program emphasizes local control over local water-quality issues. Participation in the program by developing a SWP Plan provides Montana communities with a viable method to ensure a safe water supply now and into the future. This is done by protecting their resource now rather than relying on technically difficult and costly ground-water clean-up efforts later. The program emphasizes education of the general public, technical assistance to local governing bodies or citizen groups, and training of professionals working with drinking water systems.

Participation in the program can begin with the expressed interest of local government, water system operator, or a citizens group. Technical support is provided to the local committee by the Source Water Protection Section at the Montana Department of Environmental Quality (DEQ) and should culminate in the certification of a SWP Plan for the public water system. Certification by DEQ ensures that the community's SWP plan meets the minimum criteria as described in the Montana SWPP as approved by EPA. Communities or users of other public water systems that have a certified SWP Plan in place may be eligible for waivers to certain monitoring requirements established pursuant to the Safe Drinking Water Act (SDWA).

The logical sequence of events necessary for SWP plan development have been divided into six steps as follows:

Step 1: ***COMMITTEE***
Identify key people who will be charged with specific responsibilities, or form an Advisory Committee / Community Planning Team using city/county government resource personnel, citizen groups, drillers, or any other interested persons.

Step 2: ***DELINEATE***
Decide on the area to be protected.

Step 3: ***INVENTORY***
Inventory the SWP area for possible ground-water contaminants.

Step 4: ***MANAGE***
Discuss management options.

Step 5: ***EMERGENCIES***
Plan for emergencies.

Step 6: ***CERTIFICATION***
Submit the package to DEQ for Certification.

1.3 Common questions about SWP

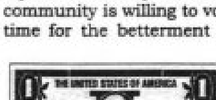
1.3.1.Should this public water supply establish a Source Water Protection Area?

Montana's Source Water Protection Program is voluntary. It was designed that way because this program emphasizes local control over local water-quality issues. Source water protection is a process by which you identify where water comes from (delineate the SWP area) and then look for potential threats to your water within the identified area (contaminant source inventory). If potential contaminants are identified, you may manage those risks in order to protect your water supply. Source water protection is a logical set of steps taken to protect your water supply. If you like this concept, establishing a SWP Plan is an excellent idea for your water system. Establishing a certified SWP Plan may also allow you to receive waivers from some federal/state mandated monitoring that may not be needed. For

example, monitoring waivers for some organic and inorganic chemicals may be available to a public water supply (PWS) that implements a certified SWP Plan. Source Water Protection Planning may also assist you in dealing with the Ground-water Disinfection Rule. ***Remember, prevention is cheaper than clean up!***

1.3.2. How will we pay for it?

If information on your watershed or aquifer is readily available, and you or your community is willing to volunteer expertise and time for the betterment of the water supply, then you should be able to complete the entire project very economically. There are always some expenses for things such as meetings, copying, phone, etc., but these are usually covered by the PWS or municipality. Local sources of funds and expertise may be available through the Local Water Quality District if one exists in your area.



Agencies such as County Conservation Districts, Montana Bureau of Mines and Geology (MBMG) (496-4167), U.S. Geological Survey (USGS) (441-1319), and Montana Rural Water Systems (MRWS) (454-1151) are sources of additional information or technical expertise. There are also numerous consulting firms that can provide expertise.

Funding for SWP planning in the form of grants is not usually available. The Environmental Protection Agency (EPA) may have a very limited opportunity for SWP grants (800-227-8917). If you are planning a new well and are applying for the Treasure State Endowment funds (444-3757) or Drinking Water State Revolving Fund (DWSRF) funds (444-6697) SWP costs can be added into the total cost of the project.

1.3.3. How do we get organized?

Source water protection for very small systems may involve the system owner/operator and those from whom the operator seeks technical advice or assistance. Other systems have used a *community planning team* to develop a SWP. The team coordinates the project, sets meeting times and places, advises local officials, and coordinates with state and local agencies. Participation by community members who represent members of the water users is critical.

Potential team members are the home-owners' association board or water users association board members. Using an existing board, committee, or group will reduce the effort required to get organized. Other possible team members could include water-system users, county sanitarians, water and wastewater operators, elected officials, city/county health officials, fire marshals, county extension agents, city/county planners, and resource conservation and development officials. Local citizens who are members of groups such as, Montana Rural Water Systems, Montana Water Resources Organization, Northern Plains Resource Council, Alternative Energy Resource Organization, Montana Water Well Drillers Association, Montana Environmental Health Association, Montana Chapter of the American Water Resources Association and the American Water Works Association are valuable team participants. Members of service organizations, senior citizen groups, youth groups, and school personnel should be considered.

1.3.4. What will the operator or community planning team be responsible for doing?

In the most basic approach, a water system owner or operator working alone or with technical assistance will put the entire SWP plan together. In other cases, a community planning team will select a leader and secretary, set goals and timetables, assemble all pertinent documents and serve as advisors to the local entity that will eventually manage the SWP area.

1.3.5. How much time should we allow for this project?

A reasonable time frame is about one to two years. A water system owner/operator will not only need to "run the business" but also to put the necessary SWP plan together. The "off-season," if one exists in your business, may provide the free time to develop a SWP plan.

The community planning team approach used in larger communities may even require more time. The approach may require monthly meetings during the first year and a meeting every other month during the second. A project that relies on volunteers will take longer than one done by an operator or paid consultants. At first glance, two years may seem like a long time to complete a relatively simple process but it is quite realistic when organizing a volunteer effort.

1.3.6. Why don't we protect the entire aquifer?

The goal of SWP is to protect that part of the watershed or aquifer that actually contributes water to the PWS. For example, many aquifers in Montana underlie the land surface far beyond the possible control of the PWS or local governing body. The protection of an entire aquifer could be an unmanageable endeavor in some cases and may be without legal basis.

1.4. So you want to know a little more about the six steps of SWP?

If you are using a consultant to complete the project, one of their most important functions is to guide you through the SWP process. The consultant should rely on the operator or planning team to make all the important decisions to assure that the final product will fit the specific needs of the water system.

This manual, however, assumes that the water system has decided to depend on the water system owner/operator or volunteers and community resources to complete the project. An implementation chart is presented in table 1 at the end of this chapter.

1.4.1. Step 1: COMMITTEE Form a Community Planning Team.

Some larger systems have used a *community planning team* to successfully establish a SWP plan (smaller systems may not have the option of forming a community planning team). The team coordinates the project, sets meeting times and places, advises local officials, and coordinates with state and local agencies. It is critical that committee participation represent the diversity of the community. For small systems, the planning team may simply involve the operator and/or PWS manager.

If the delineation is to be completed locally, the community planning team or operator should contact the following organizations to request water-resource information:

- Montana Bureau of Mines and Geology (496-4167),
- Montana State Library Natural

Resources Information System (444-5356),

- Department of Natural Resources and Conservation (444-6601), or,
- USGS (441-1319)

Contact the following organizations to find out whether there are any known sources of contamination within the delineated SWP area:

- Montana Department of Agriculture (444-2944),
- Remediation Division (444-2544) of DEQ,
- EPA (800-227-8917)
- EPA Index of Watershed Indicators via the Internet (http://www/epa.gov/surf/iwi)

If your water supply is near federal lands, a major reservoir, a mine, or an energy facility, information may be available from the managers or owners of the property. Look for any environmental impact statements that evaluate your area. Check with state universities or colleges to see if research projects have included your area.

You may wish to ask a ground-water professional to make a presentation to the team to explain the gathered information and to answer questions. Another excellent source of information on the interpretation of the well logs and well drilling and construction is your local well driller.

1.4.2 Step 2: DELINEATE Decide on the area to be protected.

At this step, you will need to find a map that is an appropriate size and scale to show the important features of the community and surrounding area. This map will be used to show the position of the wells and the boundary of the area to be protected. Topographic maps from the USGS, county maps from the Montana Department of Transportation, town plats, or aerial photos could be considered.

Next, decide who will delineate the SWP area so that it meets the criteria established in the Montana Source Water Protection Program. You should select a person familiar with hydrologic or hydrogeologic concepts and could be a consultant, or knowledgeable persons from the community who will volunteer their expertise. Alternatively, you may also decide to wait until DEQ provides a map that delineates the source of water to your PWS as required by the SDWA.

The delineation will tell you about flow characteristics in the watershed or about the direction of ground-water flow near your well. The delineation will also identify the area within which pollutants could contaminate your water supply. Theoretically, the entire area upgradient or upstream from a well or intake contributes water to the PWS and could be termed the SWP area. These large SWP areas, however, are usually divided into smaller management units. Areas that are most likely to allow contaminants to enter the ground water should be managed more rigorously than other areas.

Some communities limit management efforts to city limits or lands directly under their control. Others want to extend management as far as is legally allowed. Extending management beyond the land you own will require cooperation from the landowner(s). Overall, you need to establish the SWP area based on a susceptibility assessment considering characteristics of the flow system and characteristics of identified contaminant sources. In general, you will usually decide on boundaries that contain the delineated area and that are easiest to manage. There usually are roads, fence lines, streams, section lines, or power lines, etc., to help with boundary location.

1.4.3 Step 3: INVENTORY Inventory the Source Water Protection area.

This step is the most time intensive for the team that decides to use volunteers. All potential sources of contamination inside the SWP area are inventoried. Some sources are obvious like above-ground storage tanks, landfills, highways and sewage lagoons. Others are harder to locate like abandoned cesspools, underground tanks, and wells or old dumps and mines. It takes some detective work to find all the sources.

In many communities, senior citizens can be quite helpful for this job. They know the history of the community, are known and trusted by members of the community, and may have the time to do the necessary property inspections and interviews. You may interest a local high school science class in assisting with the inventory effort.

Placing the compiled inventory information on the map allows the team to see the number, location, and type of potential contaminant sources that exist in the SWP area. Understanding the relationship of inventoried sources to the well or intake is important in deciding on the best management options.

You may decide to wait until DEQ provides a contaminant source inventory as required by the SDWA. Keep in mind that a DEQ-generated inventory will probably be less detailed than one generated locally.

1.4.4 Step 4: MANAGE Discuss management options.

The team should set goals for managing the potential sources of contamination. Various management options should be evaluated based on reaching those goals. For instance, if the goal is to prevent contaminants from entering ground water, management options might include double containment for storage containers or simply prohibiting certain activities. If the goal is to maintain and improve the quality of the drinking water, management might include public education programs and adopting best management practices (BMPs) in local businesses and farming operations or could include the installation of monitoring wells as an early detection systems for selected threats.

If the inventory reveals a large number of different types of sources, the committee may want to prioritize the sources according to how likely they are to contaminate ground water or how dangerous they may be to human health. This process is part of a susceptibility assessment.

Recommendations should be prepared for the person that will be responsible for managing the SWP area. The team should also suggest a time frame for evaluating the success in reaching the management goals.

Most cities and towns are aware of their authority to protect their water using ordinances. A non-municipal PWS can request the governing body of the county adopt an ordinance to regulate, control, and prohibit conditions that threaten the quality of water used within the SWP area.

1.4.5 Step 5: EMERGENCIES Plan for emergencies.

The team should review the emergency plan for the water supply system and make any suggestions for updating the plan. This would be a good time for the County Emergency Coordinator to meet with the team to discuss coordination in case a disaster threatens the water supply. An emergency plan is written as part of SWP plan development process if one does not already exist.

1.4.6 Step 6: CERTIFY Certify the Source Water Protection Area.

If the team has collected all the information generated during the project, it should be fairly simple to apply for certification of the SWP plan from DEQ. A plan checklist is available. The information should include the following information:

- a brief description of the characteristics of the community, public water supply, and aquifer or water source that influenced the decisions made by the team
- a list of the key individuals and groups that participated in the decision-making process, and those who will manage the Source Water protection area
- a map showing the location of existing intakes, wells, and sites for new wells. The boundaries of the SWP areas should also be shown on the map.
- well construction and yield information or well log information
- the contaminant source inventory of the SWP areas in proper format for inclusion in a statewide data base and the results of the susceptibility assessment
- the management options selected and include any ordinances adopted
- the goals that the management options are designed to achieve and a time frame for evaluating their success
- the contingency plan for dealing with emergencies

Table 1. *SWP Implementation Chart*

Activity	Output
Obtain resolution of intent from PWS schedule volunteer solicitation meeting - publicize meeting: - mailings - post public places - PSAs to media - make phone contacts	Governing body resolution of intent to participate. Volunteer recruitment meeting notices.
Hold volunteer solicitation; meeting name; community planning team members; schedule 1st organizational meeting; contact DEQ for presentation	Appointed Community Planning Team. Scheduled organization meeting.
Hold first organizational meeting, designate leader, designate secretary, DEQ presentation, set goals/objectives, complete plan calendar, make sub-committee assignments	Written goals and objectives. Begin planning calendar.
Source research: contact: PWS operator, DEQ/PWS/GW, MBMG-logs & geology, USGS-geology, DNRC-water rights	Compiled source data.
Delineate SWPA - select base map or photo - do technical delineation - develop overlays	SWPA delineation package completed.
Publicity:-meeting dates -media updates -post info in public places -interest group contacts -other government agencies	Ongoing press releases and public information dissemination
Inventory: identify participants -provide training -contact agencies for existing info do field work -map work(overlay)	Completed inventory forms. Completed map showing potential contaminants.
Mgmt: publicity - prioritize risks - discuss strategy - meet with governing body - develop/select BMPs - develop education plan - develop ordinance, if any write mgt. plan	A report that evaluates various management strategies with an implementation plan.
Develop contingency plan: -meet with local DES -meet with PWS -assess capabilities -assess needs -discuss options -write short-term plan -write long-term plan	A written contingency plan.
Write/compile plan report: - do checklist - hold public meeting - edit report - compile package	Compilation of a complete SWP package.
Submit Plan for DHES cert. amend, as needed	Plan submitted for certification.
Inventory update	
Plan re-certification	
Ongoing public / BMP education	
Manage ordinance	

2.0. CHAPTER 2: GROUND-WATER CONTAMINATION

Almost all of the public water supplies in Montana provide water that is safe to drink. Incidents of ground-water contamination, however, have been reported in every state. The following statistics demonstrate the need for communities to protect their ground-water supplies from contamination (U. S. EPA, 1990a; U. S. EPA, 1990c):

- More than 200 chemical contaminants have been identified in ground water.
- Some 52,181 cases of illness associated with ground-water contamination (mostly short-term digestive disorders) were reported between 1971 and 1985.
- Seventy-four pesticides have been detected in the ground water of 38 states.
- Approximately 10 percent of public water supplies derived from ground water exceed federal drinking water standards for bacteriological contamination.

This section discusses how ground water can become contaminated, the sources of contamination, and the potential effects on human health and local economies. It also presents an overview of federal laws and examples of state regulations designed to prevent ground-water contamination.

2.1 How Ground Water Becomes Contaminated

Depending on its physical, chemical, and biological properties, a contaminant may move within an aquifer in the same ways that ground water moves. Some contaminants, however, do not follow ground-water flow. It is possible to predict, to some degree, the transport within an aquifer of those substances that move along with ground-water flow. For instance, both water and many contaminants flow from recharge areas to discharge areas. Soils that are porous and permeable tend to transmit water and certain types of contaminants with relative ease to an aquifer below.

Just as ground water often moves slowly, so do contaminants in ground water. Because of this slow movement and because of non-turbulent flow, contaminants usually remain concentrated in the form of a **plume** (figure 1) that often flows along the same path as the ground water. The size and speed of the plume depend on the amount and type of contaminant, its solubility and density, and the velocity of the surrounding ground water (U.S. EPA, 1990c).

In addition, there is growing concern about the contamination of ground water through **macropores**. These are root systems, animal burrows, and other systems of holes and cracks that supply pathways for contaminants.

In areas surrounding pumping wells, the potential for contamination increases because contaminated water in the zone of contribution is drawn into the aquifer and subsequently into the well. Some drinking water wells maintain an adequate water yield through **induced infiltration**, whereby water from a nearby stream, lake, or river contributes to the well uptake. Contaminants present in the surface water can degrade the water quality of the aquifer.

Some wells rely on **artificial recharge** to increase the amount of water infiltrating into an aquifer. In Montana, water from small streams have been used for this purpose. Under certain conditions, pumping can also cause the ground water (and associated contaminants) from another aquifer to enter the one being pumped. This phenomenon is called **inter-aquifer leakage**. A case of inter-aquifer leakage has occurred in Montana; it was discovered when petroleum contamination from a shallow aquifer showed up in a deeper aquifer. Thus, properly identifying and protecting the areas affected by well pumping is important to the maintenance of ground-water quality.

Usually, the greater the distance between a source of contamination and a ground-water source, the more likely that natural processes will reduce the impacts of contamination. Processes such as oxidation, biological decay (also called bio-remediation, which sometimes renders contaminants less toxic), chemical reactions, and adsorption (binding of materials to soil particles) may take place in the soil layers of the unsaturated zone and reduce the concentration of a contaminant before it reaches ground water (U.S. EPA, 1990a).

Even contaminants that reach ground water directly, without passing through the unsaturated zone, can become less concentrated through dilution (mixing) with the ground water. Because of the laminar flow usually associated with ground water, however, contaminants often undergo little dilution.

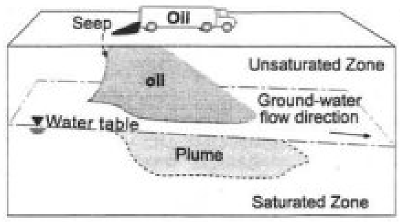


Figure 1. Contaminant plume

2.2 Sources of Ground-Water Contamination

Ground water can become contaminated from natural sources or from numerous types of human activities. Residential, municipal, commercial, industrial, and agricultural activities can all affect ground-water quality. Contaminants may reach ground water from activities on the land surface, such as industrial waste storage or spills; from sources below the land surface but above the water table, such as septic systems; and from structures beneath the water table, such as wells. Some of these sources are discussed below.

2.2.1. Natural Sources

Some substances found naturally in rocks or soils, such as iron, manganese, chloride, fluoride, sulfates, or radionuclides, can become dissolved in ground water. Other naturally occurring substances, such as decaying organic matter, can move in ground water as particles. Whether any of these substances appear in ground water depends on local conditions. Some of these substances may pose a health threat if consumed in excessive quantities; others may produce an undesirable odor, taste, or color. Ground water that contains these substances in relatively high concentrations may be treated to remove these substances. Naturally occurring nitrate appears to be present in some areas of Montana, as does relatively high levels of arsenic (source is Yellowstone National Park).

2.2.2. Septic Systems

One of the main causes of ground-water contamination in the United States is the effluent from septic tanks, cesspools, and privies (U.S. EPA, 1990a). Approximately one-quarter of all homes in the United States rely on septic systems to dispose of their human wastes (U.S. EPA, 1991c). Although each individual system releases a relatively small amount of waste into the ground, the large number and widespread use of these systems makes them a potential contamination source. Septic systems that are improperly sited, designed, constructed, or maintained can contaminate ground water with bacteria, viruses, nitrates, detergents, oils and chemicals (U.S. EPA, 1990c). Commercially available septic system cleaners containing synthetic organic chemicals (such as 1,1,1-tricholoroethane or methylene chloride) have contaminated ground water. Septic tank additives interfere with natural decomposition processes in septic systems (MSU Cooperative Extension Service).

The Montana Board of Water Well Contractors has established construction standards for water wells. State and county septic-system regulations require specific separation distances between septic systems and drinking water wells.

2.2.3. Disposal of Hazardous Materials

Hazardous waste should always be disposed of properly through a licensed hazardous waste handler or through municipal hazardous-waste collection days. Many chemicals should not be disposed of in household septic systems, including oils, whether cooking oils or motor oils, lawn and garden chemicals, paints and paint thinners, disinfectants, medicines, photographic chemicals, and swimming pool chemicals. Similarly, many substances used in industrial processes should not be disposed of in drains at the workplace because they could contaminate a drinking water source. Companies should train employees in the proper use and disposal of all chemicals used on site. The many different types and the large quantities of chemicals used at industrial locations make proper disposal of wastes especially important for ground-water protection.

2.2.4. Chemical Storage and Spills

Underground and above-ground storage tanks are commonly used for chemical storage. Approximately five million underground storage tanks exist in the United States (U.S. EPA, 1990a). Some homes have underground tanks for heating oil. Many businesses and municipal highway departments also store fuel oil, diesel, gasoline, or other chemicals in onsite tanks. Industries may have storage tanks to hold chemicals used in industrial processes or to store hazardous wastes for pickup by a licensed hauler. Underground tanks are regulated by the Montana Department of Environmental Quality, Permitting and Compliance Division.

If an underground storage tank develops a leak, which commonly occurs as the tank ages and corrodes, chemicals can migrate through the soil and reach the ground water. It has been estimated that about one-third of underground storage tanks nationwide are leaking (U.S. EPA, 1990a). Newer tanks are more corrosion resistant, but they may not be totally leak-proof. Abandoned underground tanks pose another problem because their location often is unknown. Above-ground storage tanks can also pose a threat to ground water if a spill or leak occurs and adequate barriers are not in place.

Improper chemical storage and handling, and poor quality containers can be major threats to ground water. Tanker trucks and train cars pose another chemical hazard. Each year, approximately 16,000 chemical spills occur from trucks, trains, and storage tanks, often when materials are being transferred (U.S. EPA, 1990a). At the site of an accidental spill the chemicals are often diluted with water, washing the chemical into the soil and increasing the possibility of ground-water contamination (Pettyjohn, 1989).

2.2.5. Landfills

Solid waste is disposed of in municipal landfills throughout the state. Chemicals that should be disposed of in hazardous waste landfills sometimes end up in municipal landfills. In addition, the disposal of many household wastes is not regulated. Once in the landfill, chemicals can move into the ground water by means of precipitation (figure 2). New landfills are required to have clay or synthetic liners and leachate-(liquid from a landfill containing contaminants) collection systems to protect ground water. Most older landfills, however, do not have these safeguards. Older landfills were often sited over aquifers and in permeable soils with shallow water tables, enhancing the potential for leachate to contaminate ground water. Abandoned landfills can continue to pose a ground-water contamination threat if they are not capped with an impermeable material, such as clay, before closure (U.S. EPA, 1990a).

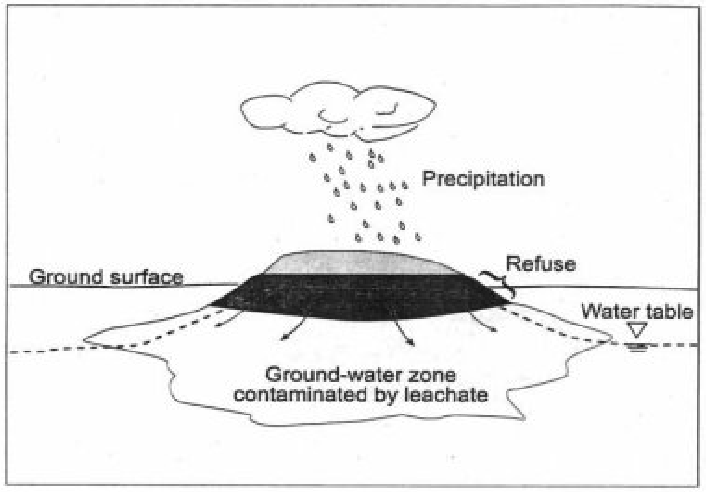


Figure 2. Landfill leachate contaminant plume

2.2.6. Surface Impoundments

Surface' impoundments are relatively shallow ponds or lagoons used by industries and municipalities to store, treat, and dispose of liquid wastes. As many as 180,000 surface impoundments exist in the United States. The standards that existed when many small sewage lagoons were first built in Montana have changed as we learned more about ground-water flow and contamination. Like landfills, new surface impoundments are usually required to have liners and monitoring wells for leak detection.

2.2.7. Sewers and Other Pipelines

Sewer pipes carrying wastes sometimes leak fluids into the surrounding soil and ground water. Sewage consists of organic matter, inorganic salts, heavy metals, bacteria, viruses, and nitrogen (U.S. EPA, 1990a). Other pipelines carrying industrial chemicals and oil brine have also been known to leak, especially when the materials transported through the pipes are corrosive or under extreme pressure. Some pollutants are denser than water and can move through the joints in older sewer pipes. Sewers and septic systems all carry common household products that can contaminate ground water. Table 2 provides a list of these common products.

Table 2. *Potentially harmful components of common household products. Source: Natural Resources Facts: Household Hazardous Wastes, Fact Sheet No. 88-3, Department of Natural Science, University of Rhode Island, August 1988.*

Product	Toxic or Hazardous Components
Antifreeze (gasoline or coolants	Methanol, ethylene glycol
Automatic transmission fluid	Petroleum distillates, xylene
Battery acid	Sulfuric acid
Degreasers for driveways and garages	Petroleum solvents, alcohols, glycol ether
Degreasers for engines and metal	Chlorinated hydrocarbons, toluene, phenols, dichloroperhloro-ethylene
Engine and radiator flushes	Petroleum solvents, ketones, butanal, glycol ether
Hydraulic fluid (brake fluid)	Hydrocarbons, fluorocarbons
Motor oils and waste oils	Hydrocarbons
Gasoline and jet fuel	Hydrocarbons
Diesel fuel, kerosene, #2 heating oil	Hydrocarbons
Grease, lubes	Hydrocarbons
Rustproofers	Phenols, heavy metals
Car wash detergents	Alkyl benzene sulfonates
Car waxes and polishes	Petroleum distillates, hydrocarbons
Asphalt and roofing tar	Hydrocarbons
Paints, varnishes, stains, dyes	Heavy metals, toluene
Paint and lacquer thinner	Acetone, benzene, toluene, butyl acetate, methyl ketones
Paint and varnish removers, deglossers	Methylene chloride, toluene, acetone, xylene, ethanol, benzene, methanol
Paint brush cleaners	Hydrocarbons, toluene, acetone, methanol, glycol ethers, methyl ethyl
Floor and furniture strippers	Xylene
Metal polishes	Petroleum distillates, isopropanol, petroleum naphtha
Laundry soil and stain removers	Hydrocarbons, benzene, trichloroethylene, 1,1,1-trichloroethane
Other solvents	Acetone, benzene
Rock salt	Sodium concentration
Refrigerants	1,1,2-trichloro-1,2,2-trifluoroethane
Bug and tar removers	Xylene, petroleum distillates
Household cleaners, oven cleaners	Xylenols, glycol ethers, isopropanol
Drain cleaners	1,1,1-trichloroethane
Toilet cleaners	Xylene, sulfonates, chlorinated phenols
Cesspool cleaners	Tetrachloroethylene, dichlorobenzene, methylene chloride
Disinfectants	Cresol, xylenols
Pesticides (all types)	Naphthalene, phosphorus, xylene, chloroform, heavy metals, chlorinated hydrocarbons
Photochemicals	Phenols, sodium sulfite, cyanide, silver halide, potassium bromide
Printing ink	Heavy metals, phenol-formaldehyde
Wood preservatives (creosote)	Pentachlorophenols
Swimming pool chlorine	Sodium hypochlorite
Lye or caustic soda	Sodium hydroxide
Jewelry cleaners	Sodium cyanide

2.2.8. Pesticide and Fertilizer Use

Millions of tons of fertilizers and pesticides (including herbicides, insecticides, rodenticides, fungicides, and avicides) are used annually in the United States for crop production. In addition to farmers, some home owners, businesses (such as golf courses), utilities, and municipalities also use these chemicals. A number of pesticides (some highly toxic) and fertilizers have entered and contaminated ground water following nor-mal, registered use. Some pesticides remain in soil and water for many months to many years. Routine monitoring of several PWS wells scattered around the state has resulted in pesticide detections. A case of nitrate contamination of a public water supply (PWS) well from poor bulk fertilizer storage has been documented in Montana.

Nutrients and other contaminants from animal wastes can percolate into the ground. Feedlots should be properly sited, and wastes should be removed at regular intervals.

EPA's Office of Pesticides and Toxic Substances and Office of Water conducted a National Pesticide Survey (NPS) between 1985 and 1992. The purpose of the survey was to determine the number of drinking water wells nationwide that contained pesticides and nitrates and the concentration of these substances. It also analyzed the factors associated with contamination of drinking water wells by pesticides and nitrates. The survey included samples from more than 1,300 public community and rural domestic water-supply wells. The NPS found that approximately 3.6 percent of the wells contained concentrations of nitrates above the federal maximum contaminant level and that over half of the wells contained nitrates above the survey's minimum reporting limit for nitrate (0.15 milligrams per liter). The NPS also reported that approximately 0.8 percent of the wells tested contained pesticides at levels higher than federal maximum contaminant levels (MCLs) or health advisory levels (HALs). Only 10 percent of the wells classified as rural were actually located on farms. The incidence of contamination by agricultural chemicals in farm wells used for drinking water is greater.

After further analysis, EPA concluded that a significant percentage of wells contained pesticides at concentrations exceeding MCLs or HALs. Approximately 15 percent of the wells tested contained one or more pesticides above the minimum reporting limit set in the survey. EPA established specific minimum reporting limits for each pesticide tested for in the NPS, ranging from 0.10 micrograms per liter for di-bromochloropropane to 4.5 micrograms per liter for ethylene-thiourea. The most common pesticides found were atrazine and metabolites (breakdown products) of di-methyl tetra-chloro-tere-phthalate (DCPA- commonly known as Dacthal), used in many utility easement weed control programs and for lawn care.

2.2.9. Improperly Constructed Wells

Several problems associated with improperly constructed wells can result in ground-water contamination from the introduction of contaminated surface or ground water. Types of wells that are a source of potential ground-water contamination include:

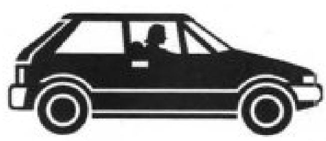
- *Sumps and dry wells*, which collect storm water runoff and spilled liquids and are used for disposal. These wells sometimes contain contaminants such as used oil and antifreeze that may discharge into water supply areas.
- *Drainage wells*, which are used in wet areas to remove some of the water and transport it to deeper soils. These wells may contain agricultural chemicals and bacteria (U.S. EPA, 1990a).
- *Injection wells*, which are commonly used to dispose of hazardous and non-hazardous industrial wastes. These wells can range from a depth of several hundred to several thousand feet. If properly designed and used, these wells can effectively dispose of wastes. But undesirable wastes can be introduced into ground water from injection wells when the well is located directly in an

aquifer, or if leakage of contaminants occurs from the well head or casing or through fractures in the surrounding rock formations (U.S. EPA, 1990a).

- *Improperly abandoned wells* act as a conduit through which contaminants can reach an aquifer if the well casing has been removed, as is often done, or if the casing is corroded. In addition, some people use abandoned wells to dispose of wastes such as used motor oil; these wells may reach into an aquifer that serves drinking water supply wells. Abandoned exploratory wells (e.g., for gas, oil, coal) or test hole wells are usually uncovered and are a potential conduit for contaminants.
- *Active drinking water supply wells* that are poorly constructed can result in ground-water contamination. Construction problems, such as faulty casings, inadequate covers, or lack of concrete pads, allow outside water and any accompanying contaminants to flow into the well. Sources of such contamination can be surface runoff or wastes from farm animals or septic systems. Contaminated fill packed around a well can also degrade well water quality. Well construction problems are more likely to occur in older wells that were in place prior to the establishment of well construction standards and in domestic and livestock wells.
- Poorly constructed irrigation wells also can allow contaminants to enter ground water. Often pesticides and fertilizers are applied in the immediate vicinity of wells on agricultural land.

2.2.10. Highway Sand

More than 11 million tons of salt are applied annually to roads in the United States to remove ice (U.S. EPA, 1990c). In Montana, salt is usually added to road sand (at +/- 3%). Precipitation can wash the salt from storage piles into the soil where it can then enter the ground water. High sodium levels in water pose a health risk and also damage vegetation, vehicles, and bridges.



2.2.11. Mining Activities

Active and abandoned mines can contribute to ground-water contamination. Precipitation can leach soluble minerals from the mine wastes (known as spoils or tailings) into the ground water below. These wastes often contain metals, acids, and sulfides. Hundreds of abandoned mines exist in various areas of Montana. Even modern facilities using the cyanide heap-leach process have caused contamination of ground water in some locations. In addition, mines are sometimes pumped to keep them dry; cessation of the pumping can allow an upward migration of contaminated ground water as is the case with the Berkley Pit in Butte.

2.3 Effects of Ground-Water Contamination

Contamination of ground water can result in poor-quality drinking water, loss of a water supply, high cleanup costs, high costs for alternative water supplies, and/or potential health problems. Some examples include:

- In Judith Gap, a leaking underground storage tank released gasoline into the aquifer. A nearby well had to be abandoned because of contamination of the town's drinking water supply.
- In Missoula, a city well had to be abandoned because of chemical contamination originating from a nearby wood treatment facility.
- In Bozeman, a small PWS owner was forced to abandon his well when a migrating plume of dry cleaner fluid

contaminated ground water, rendering his water unfit.

2.3.1. Degradation or Destruction of the Water Supply

The consequences of a contaminated water supply can be serious. In some cases, contamination of ground water is so severe that the water supply must be abandoned as a source of drinking water. (For example, less than 1 gallon of gasoline can render 1 million gallons of ground water non-potable [U.S. EPA, 1991c]). In other cases, the ground water can be cleaned up and re-used, if the contamination is not too severe and if the PWS is willing to spend a lot of money. Water-quality monitoring is often required for many years.

A PWS well is a valuable item. A typical well for a small community in Montana can cost $100,000-200,000.

2.3.2. Costs of Cleaning Up Contaminated Ground Water

Ground-water contamination can remain undetected for long periods of time. This makes cleanup of a contaminated water supply difficult, if not impossible. If a cleanup is undertaken, it can cost thousands to millions of dollars.

Once the contaminant source has been controlled or removed, the contaminated ground water may be treated in one of several ways:

- Containing the contaminant to prevent migration,
- Pumping the water, treating it, and returning it to the aquifer, or,
- Leaving the ground water in place and treating either the water or the contaminant

A number of technologies can be used to treat ground water. They most frequently include air stripping, activated carbon adsorption, and/or chemical treatment with filtration. Different technologies are effective for different types of contaminants, and several technologies are often combined to achieve effective treatment. The effectiveness of treatment depends in part on local hydrogeological conditions, which should be evaluated prior to selecting a treatment option (U.S. EPA, 1990a). **Not all contaminated ground water can be treated successfully with current technology.**

2.3.3. Costs of Alternative Water Supplies

Given the difficulty and high costs of cleaning up a contaminated aquifer, some communities choose to abandon existing wells and use other water sources, if available. Using alternative supplies will probably be more expensive than obtaining drinking water from the original source. A temporary and expensive solution is to purchase bottled water, but this is not a realistic long-term solution for a community's drinking water supply program. A community might decide to install new wells in a different area of the aquifer. In this case, appropriate siting and monitoring of the new wells are critical to ensure that contaminants do not move into the new water supplies.

2.3.4. Potential Health Problems

A number of microorganisms and thousands of synthetic chemicals have the potential to contaminate ground water. Drinking water containing bacteria and viruses can result in illnesses such as hepatitis, cholera, or giardiasis. Methemo-globinemia or "blue baby syndrome," an illness affecting infants, can be caused by drinking water high in nitrates.

Benzene, a component of gasoline, is a known human carcinogen. The serious health effects of lead are well known: learning disabilities in children; nerve, kidney, and liver problems; and pregnancy risks. These and other substances are regulated by federal and state laws. Hundreds of other chemicals, however, are not yet regulated, and many health effects are unknown or not well understood. Preventing contaminants from reaching the ground water is the best way to reduce the health risks associated with poor drinking water quality.

3.0. CHAPTER 3: THE STEPS OF SOURCE WATER PROTECTION

3.1. Step 1: Getting Organized

A water system or operator contemplating the development of a source water protection plan should make every effort to involve the water system users, area landowners, and the community in order to generate support. Source water protection plan development without input from people possibly affected can divide a community and lead to failure of the effort. One way to make sure interested persons are included is to form a community planning team to assist in the development of the plan and invite volunteers to help. **If you are concerned because the concept of a "planning committee" does not really seem to fit your situation remember that source water protection for very small systems may simply involve the system owner/operator and those from whom the operator might seek technical advice or assistance.**

This section describes the process using a community planning team approach. If you are a small system operator putting the SWP plan together by yourself, please read on. The general concepts still apply and the steps needed to complete the project are still basically the same. The difference is that you will be doing these things yourself instead of using volunteers. Either way, the team coordinates the project, sets meeting times and places, advises local officials, and coordinates with state and local agencies. Participation by community members who represent the diversity of the water users is critical.

Many communities have used a *community planning team* in successfully establishing a source water protection area to protect their source. The team coordinates the project, sets meeting times and places, advises local officials, and coordinates with state and local agencies. Committee participation that represents the diversity of the community is critical. Team size will depend on the availability of volunteers but 5-7 seems to be ideal. More can be cumbersome due to scheduling difficulties and fewer can result in non-productive meetings if absenteeism occurs.

The community planning team will need to be somewhat structured by defining member roles and responsibilities. Structure will help a diverse group successfully function in a manner that accomplishes the goals within the time frames set by the group. Possible team members are county sanitarians, water and wastewater operators, elected officials, city/county health officials, fire marshals, county extension agents, city/county planners, and resource conservation and development officials.

Local citizens who are members of groups such as Montana Rural Water Systems, Montana Water Resources Organization, Northern Plains Resource Council, Alternative Energy Resource Organization, Montana Water Well Drillers Association, Montana Environmental Health Association, Montana Chapter of the American Water Resources Association, and the American Water Works Association, are valuable team participants. Members of service organizations, senior citizen groups, youth groups, and school personnel should be considered. You might even consider asking the state Source Water Protection Program Manager (444-4806) to serve on the team.

3.1.1. How do we get organized?

If you have come this far, then you are probably the person who will need to take the first several steps to get the project rolling even if you're not going to be a part of the whole SWP process. You may be an operator, a council person, a homeowners association board member, a water users association member, or just a concerned citizen. It always takes initiative by someone to get things started.

Make sure you have got the approval of the PWS or governing body in your community before you begin to organize. While costs are expected to be minimal, you may need some support for postage or copying costs. You may also find that the PWS can assist with administrative support such as addressing envelopes, customizing mailings, arranging meeting rooms, etc. You should ask that the governing body, homeowners association, or water users association pass a *RESOLUTION OF INTENT TO DEVELOP A SOURCE WATER PROTECTION PLAN* to document their support and lend added authority to your efforts.

The rest of this section describes the recruitment of community team members and the operation of a community planning team in a "cookbook" format. Several blank forms are included and intended for you to copy and use as needed.

3.1.2. Steps for Recruiting a Community Planning Team

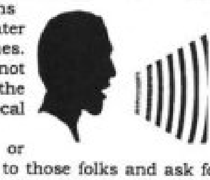
3.1.2.1. Schedule a SWP volunteer solicitation meeting.

Contact the public library, school, fire hall, county extension, NRCS, BLM, US Forest Service, or other government agencies for possible use of a meeting place. Your meeting date may be dictated by the availability of an adequate meeting place. You should allow yourself about 6 weeks to plan and publicize the meeting. Best meeting time is usually around 7 PM in the middle of the week.

Be sure to consider other happenings in the community so that you can schedule a meeting date/time that doesn't conflict. For instance, haying season, calving season, grain harvest, and school sporting events can make many potential volunteers unavailable at certain times of the year. Schedule your meeting with this in mind.

3.1.2.2. Publicize the initial meeting.

- Mail a meeting notice (see attached example) to any citizens who have expressed interest or have qualifications with water supply issues. If you're not part of the PWS or local governing body (city or county), go to those folks and ask for recommendations. You may be able to use an existing citizen group that will greatly simplify the process. Follow up each mailing with a phone call to confirm receipt and encourage participation. Recruiting soley by letter is not productive.



- Mail a meeting notice to any water-resource agencies in your area. Look in the yellow pages under *government* headings or under *United States* and *Montana* listings. Possible federal agency entries include: Agriculture Dept of Agriculture Stabilization & Conservation, Soil Conservation Service, Forest Service; Interior Dept-BLM and/or Geological Survey. Possible state agency entries include Disaster and Emergency Services, Fish Wildlife and Parks, Natural Resources and Conservation-Dept of, State Lands-Dept of.
- Mail a meeting notice to the county health department, disaster and emergency services coordinator, and local planning office. Follow up with a phone call and encourage participation.
- Mail a meeting notice to local offices of environmental consulting firms (yellow pages under *Environmental*).
- Mail a meeting notice to local water well drillers (yellow pages under *Well Drillers*).
- Mail a notice to any local community or business organizations such as the Chamber of Commerce or service groups such as Kiwanis, Lions, or Rotary clubs.
- Post a meeting notice at the post office, city hall, courthouse, public library, senior center, state/federal agency buildings, and any other public bulletin boards.
- Place public notice in the local daily or

weekly newspaper. Call the local print media listed in the Yellow Pages and ask how to place a public meeting notice. They may simply write a brief article based on the Public Service Announcement or actually place a public notice in the classified section.

- Issue a public service announcement to the local radio and TV stations (see attached example).

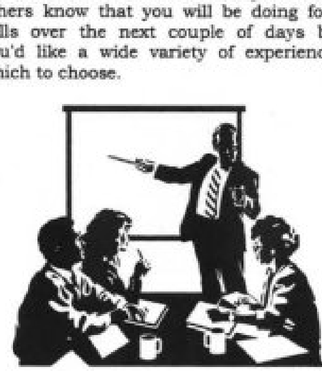
3.1.2.3. Hold the volunteer solicitation meeting as scheduled.

Be well prepared. A poorly organized and executed meeting may dissuade potential volunteers from wanting to participate. Be sure to have handouts available so potential volunteers can learn more about SWP in the following day or 2 and at their own pace. Sample materials can be found in section 3.1.7 on pages 27 and 28.

It will also be helpful to display general information about wells, maps, and a sample source water protection time line planner so potential volunteers can ascertain just what might be expected of them. *Display materials* are available from the SWP Program Coordinator. In fact, you may also want to invite the Montana SWP Program Coordinator (444-4806) to make a presentation to this group.

Toward the end of the meeting you will want potential volunteers to identify potential strengths they may contribute to the effort. By now, they should know that SWP is a multi-faceted endeavor and that the experience brought by a wide variety of volunteers is needed for success. Do this by passing out a sheet of paper (see examples in section 3.1.7.) to each person and ask them to write out their name, address, phone number, and a brief sketch of their knowledge or experience. Also ask them to identify any particular skill they may possess that might be useful to the group. Give examples such as good writing skills, or the ability to write clearly; the ability to deal with all kinds of people, or good people skills, or sales ability; or technical training in geology, engineering, planning, or geography; leadership skills or personnel management skills. It can be difficult for potential volunteers to respond so you will need to encourage them. Allow 5-10 minutes before collecting the information sheets.

You should pass a sign up sheet (see attached example) around before closing the meeting. This will allow potential volunteers to make a positive decision and will identify those persons most committed to the process. Let the others know that you will be doing follow-up calls over the next couple of days because you'd like a wide variety of experience from which to choose.



3.1.2.4. Follow-up calls to potential volunteers should occur within a few days of the meeting.

Allowing more time to pass causes enthusiasm to diminish resulting in a lower recruitment rate. Many communities will need all who volunteer so you don't want to lose them through inaction or delay.

If more citizens volunteer than you have room for, you may want to increase the community planning team size somewhat or select those that best represent the diversity of experience and skills needed for SWP planning. Be sure to call all who wished to be considered to thank them for their interest. Remember, you may need replacements later in the process and these folks have already expressed an interest in SWP.

If you don't attract potential volunteers to the first meeting, you will need to try to find out why and either address the problem or form a community planning team in some other way. You may find that, despite your efforts, you can't seem to attract volunteers, in which case you will probably need to proceed without them.

3.1.3. What will the community planning team be responsible for doing?

The community planning team should select a leader and secretary, set goals and timetables, assemble all pertinent documents and serve as advisors to the local entity that will eventually manage the source water protection area. This team should oversee the delineation of a source water protection area, the completion of an inventory of potential contaminant sources, and the evaluation of a contingency plan to take care of emergencies. The team should make recommendations on management approaches and appropriate sites for new water supply wells. The team should make the routine decisions that guide the project.

3.1.4. How much time should we allow for this project?

A reasonable time frame is about two years. The team would probably meet once a month during the first year and perhaps every other month during the second. A project that relies on volunteers will take longer than one completed by consultants.

The community planning team will actually set the schedule for the effort by completing a time line in the first meeting or two, so the length of time it takes to complete the project will be locally driven. While setting and achieving goals is important to keep the project on track, some flexibility is needed to account for unforeseen circumstances.

3.1.5. Public Participation is the Key to Success

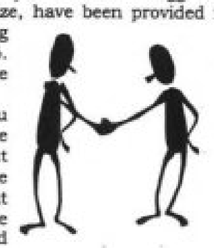
Part of the community planning team's responsibilities will include communicating with the public. In fact, *without the support of the community, you will probably fail.*

Let the community know what the team is doing and learning. Involve the local newspaper and radio station. Consider writing letters to the editor. Post minutes of your meetings in a prominent place. Invite interested members of the community to attend your meetings and other planned activities.

A series of newspaper articles or an educational newspaper column is one way to raise awareness of water issues and expose the community to the efforts of the community planning team.

If you have followed the recommendations outlined earlier in this notebook you have already assigned the task of managing publicity. The person assigned to this task should contact the local newspaper and offer to meet with the editor to discuss a column of approximately 500 words every 2-4 weeks (when meeting with a media representative you should be prepared to submit a couple of examples of your articles). If a regular column cannot be arranged, you might want to try for a reporter-written article based on suggested topics or your regular committee meetings.

Column or article topics should be timely and should be presented in a logical fashion. Potential topics and some suggested points to emphasize, have been provided in the following section 3.1.6. These ideas are merely suggestions; you may adjust these as you see fit but be sure to keep the articles up-beat because people usually will read useful and positive information. If you alienate your readers they may either discontinue reading the articles or engage in destructive dialogue about SWP in the community.



Some of the topics may be sensitive to some people. While you want to present all the issues important to SWP and ground-water education, please note that each topic suggestion ends with a positive thought or idea.

The source water protection information you present should educate and inform a large portion of the community or newspaper readership, both within the city limits and in the adjacent area. In fact, most rural residents will enjoy learning more about water and wells because the vast majority use wells for their domestic water supply.

When writing your articles, it is also suggested you contact the resources listed to better provide a local perspective on the topics. While various state officials can be contacted and even quoted, the readership is probably more interested in what's happening in your immediate area.

The articles should begin very early in your SWP process. The articles are designed to be educational with regard to managing the local water resource and the community planning team's activities. The articles should be relatively short and hit a few main points. The following section 3.1.6 contains some suggested topics.

Tables 3 and 4 on page 29 and 30 provide a list of contacts if you need additional help.

3.1.6. Suggested Topics for Public Education

The Community Water System

- what is a public water system in Montana
- who operates the local PWS
- what is the water source
- provide general information about sampling requirements
- describe physical extent of distribution system/number of users
- describe summer vs. winter water use
- describe per capita consumption
- describe the cost of developing a PWS well
- describe possible homeowner water conservation methods

What is ground water?

- definition and example, define aquifer
- describe confined vs. unconfined
- describe GW vs. SW, what is base flow
- provide example of aquifers in the local area and their uses
- describe benefits/risks of using shallow vs. deep aquifers
- describe the local PWS water source

General Concerns about Ground Water

- describe local ground-water use and quality
- describe how GW can become unusable for these purposes
- spills
- LUST leaks
- septic tanks/lagoons
- injection wells
- storm-water infiltration
- fertilizers
- sumps / french drains/dry
- sumps/infiltration gallery
- storage areas
- describe general management practices that minimize risk of GW contamination
- describe local recycling opportunities

The Improper Handling of Solvents and Other Hazardous Materials

- what are solvents
- who uses them
- historic methods of waste solvent disposal
- current VOC contamination in GW concerns
- VOC monitoring, detects, and the local PWS
- what regulations apply
- modern methods of solvent handling

Maintenance of Underground Storage Tanks

- historic tank installation methods
- the fire code
- LUSTs
- gasoline/diesel and ground water
- what regulations apply
- modern methods of tank installation
- describe tank operation and maintenance procedures

Spills in the Community; Cars, Trucks, and Trains

- why do we care about spills
- what's a reportable spill and who gets the report
- describe historic spills and GW in the local area
- describe the main transport route in town and materials transported Xdescribe the local DES response and PWS preparedness

Community Sewage Treatment; the Lagoon

- hat is the local public sewage treatment system
- who operates the local system
- describe physical extent of collection system/flow rate/number of users
- describe sewer line infiltration and impact on local system
- describe industrial type users and any pre-treatment requirements
- describe substances than should not enter the treatment system
- describe the difference between storm sewers and sanitary sewers
- provide general information about sampling requirements
- describe possible homeowner water conservation methods

The Local Landfill

- who operates the local collection/ disposal system
- landfill vs. dump, what's the difference
- historical practices of waste disposal
- describe the connection between dumps and GW
- what regulations apply to landfills now
- how's a modern landfill constructed
- what about waste disposal on my own property
- describe local recycling opportunities

Septic System Installation and Maintenance

- what is a septic system
- how do they work
- who regulates septic tanks
- what site conditions are limiting and why
- what is septic system maintenance
- septic system failure, what is it
- septic system effluent as GW recharge
- the do and don't list for septic systems

Agriculture and Ground Water

- describe the primary local agricultural activities
- describe local GW use by agriculture
- describe potential pollution from various agricultural activities
- describe SW/GW interaction potential
- describe general agricultural BMPs to prevent pollution
- describe locally used BMPs to prevent pollution, give examples

Pesticides and Water Quality

- describe general local pesticide use
- describe operator requirements and regulation
- describe label requirements
- describe Dept of Ag ground- water monitoring
- describe BMPs, IPM, and the economy of pesticide use

Abandoned Wells

- what is an abandoned well
- abandoned wells vs. wells taken out of service
- what laws apply to well abandonment
- how many wells are in
- why do we care about proper well abandonment
- special concerns about flowing wells
- what is proper well abandonment

Montana Ground-Water Protection Regulations

- describe ground water
- describe ground-water use locally and in Montana
- describe general threats to GW
- describe local, state, and federal regulations to protect GW
- describe local examples of efforts to protect GW

What is source water protection?

- describe local use of GW and population served
- describe potential pollution threats
- describe GW remediation potential, technology availability, costs
- describe PWS well and domestic well development costs
- describe PWS sample waiver potential and cost savings
- describe the Montana Source water protection Program
- describe the (voluntary) local SWP effort
- describe the involvement of local citizens
- describe efforts that can be taken by a domestic well owner

What is the community planning team?

- describe how members were solicited and appointed
- describe the organization of the team
- describe the duties/function of the team
- describe potential for citizen input

What is SWPA delineation?

- what is a SWPA
- describe various methods of SWPA delineation
- describe the local aquifer(s)
- describe the local method of SWPA delineation
- describe the regions of a SWPA and how they differ
- describe impacts to local property owners within the SWPA

What is a potential contaminant inventory?

- describe PWS well development costs
- describe the local SWPA delineation and GW flow
- describe general potential threats to GW
- describe the importance of identifying threats before they are problems
- discuss remediation vs. prevention, available technology and costs
- describe possible inventory methods by regions
- discuss the use of inventory information

Management of the SWPA

- describe the delineated SWPA
- describe how the contaminant inventory was completed
- outline the inventory findings
- describe identified contaminant priorities
- outline management options available to local government
- describe options recommended by community planning team
- describe benefits to community of contaminant inventory and management before actual contamination occurs

What is emergency planning of the PWS?

- describe why emergency planning is important
- outline probable emergency responders
- include Awhat if≅ scenario
- describe short-term emergency plan
- describe long-term emergency plan
- outline the cost benefits of designating a replacement well

PWS Production Well Development

- what is a PWS
- who operates the local PWS
- describe local PWS water use
- who regulates a PWS and why
- describe emergency plan and designated replacement well area
- describe PWS well plan review requirements
- describe water rights requirements
- outline PWS well development and costs
- compare domestic well development verses public well development

What is SWPP certification?

- describe the 6 steps of SWP
- outline the local SWP plan development
- describe community involvement in the process
- describe certification criteria of the Montana SWPP
- describe the benefits of certification
- describe the local SWP plan
- describe inventory update requirements
- describe any long term educational or public awareness type
- activities required by the local plan

3.1.7. Samples of public service announcement and volunteer information

PUBLIC SERVICE ANNOUNCEMENT

[insert PWS name and
contact name /phone here]

For Immediate Release

[insert date here]

Volunteers are Needed for the Source water protection Community Planning Team in [insert community name here]

Community Planning Team volunteers are being sought in [insert community name here] to learn more about the drinking water source and where it comes from.

A community planning team volunteer recruitment meeting will be held on [insert date here] at [insert location here] starting at [insert time here].
For more information, please call [insert contact name and phone number here].

Anyone interested in protecting the drinking water while learning more about ground water in Montana is encouraged to attend this introductory meeting.

[insert date here]

Volunteers Needed for Community Planning Team

Help Protect our Ground-Water
Source Water Protection
Come to [insert community name here]

Do you live in [insert community name here]? Do you ever wonder about the water you drink?

Community Planning Team volunteers are being sought to work on a source water protection project underway in [insert community name here]. Members will learn more about our water source and where it comes from and then will help design and implement a source water protection plan for [insert community name here]. The end product will be a source water protection plan tailored to our community and water system and will be designed to ensure quality water now and into the future.

If you're interested in learning about protecting our drinking water and helping on this project, please contact [insert city contact and phone number here].

Source water protection efforts benefit from diversity on the planning team. This may be an opportunity for you to contribute by volunteering in the community while learning more about ground water in Montana.

Sincerely,

attachment
SWP summary

Volunteer Information

Name________________________________ Phone Number ____________________________

Best times to call____

Mailing Address____

Residence Address____

How I heard about this meeting ____

Why I=d like to be involved in this project____

Experience I think might be helpful____

Special skills or education that might be helpful______________________________________

Name and phone number of someone else you know would be interested in this project____

Table 3. *Who do we call for help?*

RESOURCE NAME	ADDRESS	CONTACTS	PHONE	TOPICS	REF
Department of Environmental Quality (DEQ), Permitting/Compliance Division (PCD)	1520 East 6th Ave POB 200901 Helena MT 59601-0901	Public Water Supply Program	444-4400	Public water supply regulation, well construction stds., sampling requirements, regulatory compliance	1
DEQ, Planning, Prevention and Assistance Division (PPAD)	Same as above	Source Water Protection Program	444-4806	Source Water Protection Program, ground-water (GW) information, GW protection regulations, well construction, loca water-quality districts	2
DEQ, PCD	Same as above	Permits	444-1374	Wastewater discharge permits, spill reporting, GW discharge permits, sewage lagoons, storm-water management, regulatory compliance	3
DEQ, PPAD	Same as above	Technical and Financial Assistance	444-6697	General information about sewage lagoons, etc.	4
DEQ, PCD	1520 East 6th Ave Metcalf Bldg. Helena MT 59601	Solid Waste Management	444-4323	Landfills, solid waste management, regulatory compliance	5
DEQ, Remediation Division	Same as above	Hazardous Waste	444-1420	Hazardous wastes, regulatory compliance	6
DEQ, Remediation Division	Same as above	Underground Storage Tanks	444-1420	Mgt. and regulation of underground fuel tanks, UST list for local area, regulatory compliance	7
DEQ, Remediation Division	Same as above	Leaking Underground Storage Tanks	444-1420	Regulation and mgt. of leaking underground storage tanks, LUST list for local area, regulatory compliance	8
MSU Extension Service, Pollution Prevention Program (P2)	Taylor Hall Bozeman MT 59717	P2 Program	994-3451	Recycling information, industrial waste mgt. assistance, general waste mgt. information	9
Montana Bureau of Mines and Geology	MBMG Main Hall Butte MT 59701	Ground- Water Information Center (GWIC)	496-4336	Well logs, ground- water information	10
Local public water supply	Contact city government, water users association, water district, or resource # 1	Public works director, system operator, mayor		Specific PWS information	11
Local health department, sanitarian	Contact city government, water users association, water district, or resource # 1	Sanitarian, environmental health specialist, local water quality district		Septic tanks, drillers, local environmental concerns and activities, local public health issues, regulatory compliance	12
Local well driller	See yellow pages under "Well Drilling"			Local drilling information, conditions, costs, activities	13
Montana Department of Natural Resources, Water Resources Division	1520 6th Ave Helena MT 59601 (also have regional offices across state)	Water Rights or Board of Water Well Contractors	444-6601	Water rights, well drilling contractor standards, regulatory compliance	14
Local Conservation District and Natural Resource Conservation Service office	See County Government in phone book	Local conservation district supervisor		Streambed management, local soil and water conservation (agriculture related) issues, local agricultural water use, regulatory compliance	15
Montana Department of Agriculture	303 N. Roberts POB 200201 Helena MT 59601-0201	Field Services Bureau	444-3730	Pesticide regulation and management, regulatory compliance	16
Local Disaster and Emergency Coordinator	See County Government in phone book	DES coordinator		Local emergency planning, spill response	17
State Fire Marshall	303 N. Roberts, Rm 365 Helena MT 59601-1417	Fire Prevention Bureau	444-2050	Flammable liquids storage (above ground fuel tanks), regulatory compliance	18
DEQ, Enforcement Division	1520 East 6th Ave POB 200901 Helena MT 59601-0901	Ground-Water Program	444-0379	Ground-water (GW) discharge permits, GW quality stds. and issues, hydrogeologic information, GW protection regulations, land application of liquid wastes, feedlots, regulatory compliance	19
DEQ, PPAD	1520 East 6th Ave POB 200901 Helena MT 59601-0901	Watershed Management, non-point source program	444-6697	Agricultural impacts, forestry practices, surface-water quality	20

Table 4. *Key to table 3*

KEY WORD	REFERENCE
abandoned wells	14,19,2
agricultural water use	15,10,14
agricultural issues	15,16,12,3,2
aquifer	19,2,11,1,13
base flow	10,14,2
best management practices (BMPs)	9,2,3,5,14,15
commercial waste management	9,5,6,15
complaints	19
conservation	11,1,9,15
diesel	7,8, 18
discharge permits	3,
distribution system	11,1
domestic wells	13,14,10,12
dumps	12,5
emergency planning	17,11
feedlots	3
fertilizer	15,9,16
fire code	18
flowing wells	13,14,10,2
french drain	6,3
fuel tanks	7,8,18
gasoline tanks	7,8,18
ground-water information	2,11,13,12,10
ground- water discharge permits	3
ground- water regulations	2,3
hazardous wastes	6,12
hydrogeologic conditions	2,14,10,15,13
industrial waste management	9,5,6
injection wells, infiltration	3
IPM-integrated pest management	16,9
lagoons	3,4
landfills	12,5
leaking underground storage tanks	8,3,6
livestock feeding	3,20
local PWS	11,1
Local water-quality districts	2,12
local environmental issues	12
Monitoring waivers	11,1
LUSTs	12,8,3
Montana Pollution Discharge Elimination System Permits	3
Montana Ground Water Pollution Control System Permits	3
Control System Permits	3
oil, waste	12,5,9,18
on-site sewage disposal systems	12
operator, water	11,1
pesticide issues	16,9
pesticide regulation	16
petroleum products	7,8,19,18
public sewage system	11,4,12,1
Public Water Supply	11,12,1

KEY WORD	REFERENCE
PWS	11,12,1
recycling	12,9,5
sample waivers	11,1
sampling requirements	1,11,12
sanitary sewer	11,4,1,12
septic systems	12
sewage lagoons	3,4,12
source water protection	2,11,1
shop wastes	6,9,12
solid waste disposal	5,12
spills	17,3,12,6,
storm water	11,3
storm sewer	11,3
sumps	9,6,3,12
Subdivisions	3
tanks	7,8,18,12
underground storage tanks	7,12
USTs	7,12
violations	10,1,3,5,6,7,8
VOCs, general	11,12,19,6,9
VOCs in drinking water	11,1,12
waivers	11,1
waste motor oil	12,5,9,18
waste management	12,9,5,6
wastewater discharge permits	3
water source	11,1,10
water use	1,11,14
water rights	14
watersheds	20
water use	1,11,14,15
well driller standards	14
well construction costs	11,1,13
well drillers	13,12
well logs	10,14
well construction/ development	1,2,14

3.1.8. What exactly do I need to complete Step 1?

- Obtain resolution of intent to create a source water protection plan.
- Schedule volunteer solicitation meeting.
- Publicize meeting.
- Hold volunteer solicitation meeting.
- Name community planning team members.
- Schedule first organizational meeting.
- Contact DEQ to arrange presentation at meeting.
- Hold first community planning team organizational meeting.
- Designate community planning team chairman and secretary.
- Set goals and objectives.
- Complete time-line planning calendar.
- Make sub-committee assignments.

3.0. CHAPTER 3: THE STEPS OF SOURCE WATER PROTECTION, cont.

3.2. Step 2-Delineation - See also Part 2 of the Technical Guidance Manual

3.2.1. General

Delineation is the process used to identify and map the area around a pumping well that supplies water to the well or spring, or to identify and map the drainage basin that supplies water to a surface-water intake. The size and shape of the area depends on the characteristics of the aquifer and the well, or the watershed. Within a SWP area potential sources of contamination are inventoried and then managed to prevent pollution of the water used by the PWS (these topics are described in the next sections). The goal is to ensure that potential contaminant sources are managed in a manner that protects drinking water used by public water systems.

There are a couple of approaches that can be taken at the beginning of this step. First you will decide who will do the scientific delineation of the SWP area so that it meets the criteria established in the Montana Source Water Protection Program. You should select a person familiar with hydrogeologic or hydrologic concepts. This person could be a consultant, or knowledgeable person(s) from the community who will volunteer their expertise. Alternatively, you may decide to wait until DEQ provides a map that delineates the source of water to your PWS as required by the SDWA. If you are to be supplied with the delineation by an outside source such as DEQ or a consultant you can skip to the next step. If you are working on the delineation yourself or simply wish to become familiar with delineation methods, read on.

Delineation describes the characteristics of water flow in the aquifer or drainage basin and then narrows the focus to show areas where potential releases of certain contaminants would most probably end up in the community's water supply. Usually, the delineated *source water protection area* is further divided into regions. These are called the *control zone*, *special protection region*, and *protection region*. Regions allow you to incorporate different management regimes based on separation distances between a potential contaminant source and the well or intake.

Part 2 of the Montana Source Water Protection Technical Guidance Manual provides detailed examples of delineation methods for the following four ground-water systems:

1. City of Dillon
2. Town of Fairfield
3. Hillside Hutterite Colony
4. City of Sidney

The DEQ is currently in the process of providing SWP area delineations for all water supplies. This project will require a few to several years to complete and is occurring on a priority basis considering PWS classification, size, and vulnerability.

3.2.2. Regions of a Source Water Protection Area

Once identified, a SWP area will be divided into regions to distinguish between areas where it takes only hours or days for water to reach a well or intake and areas where it takes much longer water to travel to the public water supply. This division allows for differential management of potential pollution sources. Differential management imposes stricter controls on potential contamination sources that are closer to a water source than those that are farther away from a water source. Delineating regions allows a community to focus limited resources on the regions closest to the well. Management of identified potential sources of contamination is discussed in 3.4. Management.

3.2.2.1. Control Zone

The control zone is the region closest to the well or intake. It is usually a circular area around a well (100' radius) where ground water may reach the well within days (figure 3). For surface-water systems the control zone should apply to all flowing water including flowing drain ditches within one mile of the intake where water may reach the intake within hours.

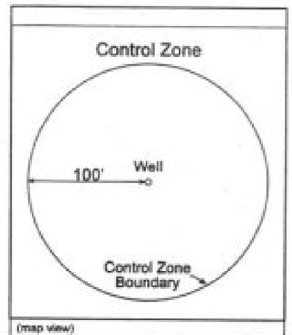


Figure 3. Control zone for a well

3.2.2.2. Special Protection Region

For ground-water systems the special protection region coincides with the area that contributes ground water to the pumping well over a set period of time. The special protection region should be delineated using an analytical method, such as the one presented in figure 4, to determine how the pumping well modifies regional ground-water flow.

The Uniform-Flow Equation presented in figure 4 provides a method for calculating X_L, the distance to the down-gradient null, or stagnation, point. The distance X_L, defines the down-gradient point beyond which water does not flow into a pumping well.

The lateral boundary limit of flow to a well is given in figure 4 as Y_L. The distance Y_L defines the lateral distance up-gradient from a pumping well that contributes flow to a well.

For detailed examples of how to use the Uniform Flow Equation for calculating stagnation points and lateral boundary limits, refer to Part 2 of this manual.

The criteria for determining the distance the region will extend upgradient will vary with the type of aquifer. See tables 5 and 6 for the criteria for establishing the size of these areas. A community will delineate a special protection region to define an area for intensive management of potential sources of contamination.

Similarly, for surface-water systems the special protection region is an area that contributes water to the intake within a set period of time. The boundaries of the special protection region are delineated by applying a time of travel criteria to all contributing surface water within the drainage basin upstream from the intake. The effects of interaction between ground water and surface water should also be considered. While the special protection region should include the entire area within the TOT criteria, the PWS may want to consider using the concept of buffers or setback zones (streamside management zones) when determining susceptibility.

A typical buffer/setback zone for a surface-water SWPA is a strip of land vegetated 50 to 200 feet in width along the shore of a stream or reservoir that is upstream of a public water supply intake. The determination of the width of buffer zones is often based on the consideration of such factors as: the topography of the land, the local land uses, the political and legal feasibility of setting aside such buffers, the slope and size of the stream and land ownership rights.

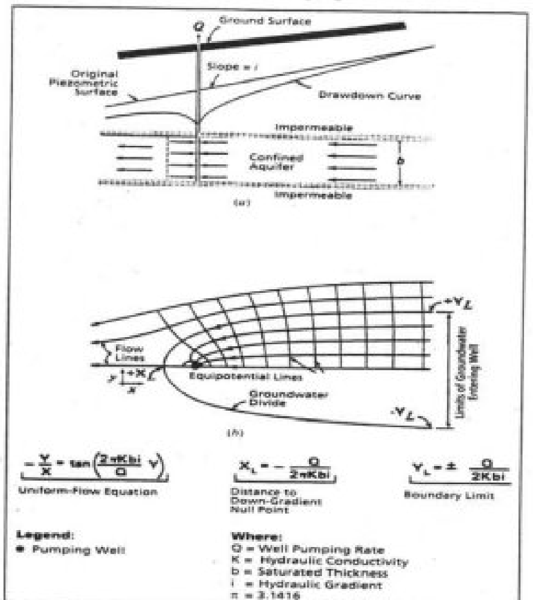


Figure 4. The Uniform-Flow Equation used as an analytical method for delineating a special protection region (EPA 1993)

Surface-water buffer zones and setbacks are often used as a means of reducing the adverse impacts of runoff on drinking water sources. The primary purpose of buffers/setbacks is to filter sheetflow and, to a lesser extent, encourage increased ground-water infiltration.

Buffer zones ("green areas") may be intended to serve several functions such as: wildlife habitat, stream bank integrity, protection of the hyporheic zone for aquatic life, residential or commercial exclusion, or SWP.

The stream-flow time-of-travel (TOT) approach facilitates heightened management of those stream reaches most critical to protecting drinking water intakes from potential sources of contamination. This method also enhances delineations of surface-water SWP areas by facilitating spill- and other emergency-response activities. This method calculates the TOT of flow in a stream between a drinking water intake and a point(s) upstream. It is the stream-flow TOT between the intake and the upstream point of interest that provides the opportunity for managers to enhance protection from long-term potential contaminant sources and to respond to a contamination event.

The use of this method would be of greatest importance for drinking water utilities tapping rivers that receive municipal and industrial wastewater discharges. Water-quality flow models provide a means through which specific hydrologic, geographic, and water quality parameters can be used to estimate the travel time for a contaminant introduced into a river to reach a drinking-water intake and to estimate the level of contamination at that intake.

3.2.2.3. Protection Region

The protection region for surface-water systems is the drainage basin up to the hydrologic divides. For ground-water systems the protection area is the land area around a well or well field that supplies ground water to the well over a long period of time. It is at least a part of the recharge area for the aquifer tapped by the PWS. The hydrogeologic mapping method is recommended for the delineation of protection regions. For examples of hydrogeologic mapping techniques, please refer to Part 2 of this manual.

3.2.3. Delineation Criteria for Community Systems Using Ground Water

3.2.3.1. Unconfined Aquifers

The vast majority (more than 75%) of public water supplies in Montana have wells completed in unconfined, alluvial valley aquifer systems.

Use of un-confined bedrock aquifers is rare, but a few public water supply wells are installed where bedrock formations outcrop along mountain fronts. Bedrock formations used as aquifers are typically composed of sandstone, limestone, and fractured metamorphic or igneous rocks. Some limestone formations may exhibit karst features.

The criteria listed in table 5 must be used to delineate SWP areas for community public water supply wells in unconfined alluvial valley or bedrock aquifers.

Water supplies may opt to use a more scientific method, such as a numerical flow model, to delineate the regions of the SWP area.

Some public water supply wells may tap semi-confined aquifers. Water supplies in semi-confined aquifers may use delineation methods for unconfined aquifers.

Other PWSs use springs. The hydrogeologic setting of the spring should be evaluated to determine whether the aquifer is confined or unconfined.

Table 5. *Summary of delineation methods for community public water supplies using unconfined aquifers*

Aquifer	Region	Method	Criteria - Minimum Value
Alluvial valley	1) Control 2) Special Protection 3) Protection	1) 100-ft. radius 2) Analytical method 3) Hydrogeologic mapping	1) Distance - 100 feet 2) Distance- 1,000-ft. up-gradient or 3 year TOT (see discussion below) 3) Flow boundaries - physical and hydrologic
Bedrock	1) Control 2) Special Protection 3) Protection 4) Recharge	1) 100-ft. radius 2) Analytical method 3) Hydrogeologic mapping 4) Hydrogeologic mapping	1) Distance - 100 feet 2) TOT = 5-yr. TOT or flow boundary 3) Flow boundaries - physical and hydrologic 4) Flow boundaries - physical and hydrologic

Methods and criteria appropriate to the hydrogeologic setting should be used to delineate the SWP area for the spring.

The control zone should extend a distance of at least 100-ft. radius around the well. Management is usually intensive and restrictive in the small area.

The analytical method may be used to delineate the special protection region (also known as the Zone of Contribution (ZOC)) for a well. The special protection region, or ZOC, is the area surrounding a pumping well that encompasses all areas or features supplying ground-water recharge to the well.

The special protection region should extend a distance of 1,000 feet upgradient from the well for an unconfined aquifer, or a distance equivalent to a three-year time of travel (TOT), whichever provides the most logically and reasonably managed area. A community should focus pollution prevention activities that may restrict some activities and include implementation of BMPs as well as educational efforts.

The special protection region for an unconfined bedrock aquifer coincides with the geologic and hydrologic features that allow water to enter the portion of the aquifer supplying water to the well or spring considering TOT and may be delineated using hydrogeologic mapping. See table 5 for the criteria for establishing the size of these areas.

Darcy's Law may be use to determine the time of travel, or flow-velocity, in unconfined conditions. Darcy's Law states that,

$$Q = KAi,$$

or, re-arranging for velocity, v

$$v = \frac{Ki}{n}$$

where:

Q =discharge (pumping rate)
K = hydraulic conductivity
A = cross-sectional area
i = hydraulic gradient
v = velocity (distance/time), and
n = porosity.

For a detailed example of how to use this equation, refer to the discussion of the Fairfield site in Part 2 of this manual.

The hydrogeologic mapping method may be used to delineate the protection or recharge region. Ground-water flow boundaries that coincide with ground-water divides and physical aquifer hydrologic boundaries may be used to identify the extent of the protection region.

If a well is drilled into the depths of an alluvial valley aquifer or deep into a fractured bedrock formation, local, semi-confined ground-water conditions may be encountered. At locations where ground water is semi-confined, communities should use delineation methods for unconfined aquifers.

3.2.3.2. Confined Aquifers

This section describes the delineation methods and criteria for community public water supplies with wells constructed in confined alluvial valley aquifers or confined bedrock aquifers. These aquifers comprise fewer than 25% of the public water supplies that depend on ground water. The majority of confined bedrock aquifers used by public water supplies are deeper sandstone or limestone formations. Some public water supply wells are installed in relatively deep portions of glaciated alluvial valley aquifers where confined conditions exist. The criteria listed in table 6 must be used to delineate SWP areas for community water supplies in confined aquifers.

***Table 6**. Summary of delineation methods for community public water supplies using confined aquifers*

Aquifer	Region	Method	Criteria - Minimum Value
Alluvial valley	1) Control 2) Protection 3) Recharge	1) 100-ft. radius 2) Analytical method 3) Hydrogeologic mapping	1) Distance - 100 feet 2) TOT - 3 years 3) Flow boundaries physical and hydrologic
Bedrock	1) Control 2) Protection 3) Recharge	1) 100-ft. radius 2) Analytical method 3) Hydrogeologic mapping	1) Distance - 100 feet 2) TOT - 10 years 3) Flow boundaries; physical and hydrologic

The control zone should extend a distance of at least 100-ft. radius around the well. Management is usually intensive and restrictive in the small area. The remainder of the SWP area should be managed as a protection region.

The protection region for a well in a confined aquifer should be delineated by using an analytical method. The upgradient boundary should extend a distance of at least three years TOT for confined alluvial aquifers and ten years time of travel for confined bedrock aquifers. The hydrogeologic mapping method (see Part 2 of this manual) may be used to delineate the protection region in bedrock aquifers. Ground-water flow boundaries that coincide with ground-water divides and physical aquifer hydrologic boundaries may be used to identify the extent of the protection region.

For SWP area delineation for confined aquifers with regional sloping potentiometric surfaces, one method of calculating times of travel uses the following equation.

$$Tx = \frac{n}{Ki}\left[X_L - \frac{Q}{2\pi Kbi}\ln\left(1+\frac{2\pi Kbi}{Q}X_L\right)\right]$$

(EPA, 1993)

where:

Tx = travel time from point x to pumping well

n = porosity

X_L = distance from pumping well over which ground water travels in Tx (time); X_L is either positive or negative depending on whether point x is up-gradient (+) or down-gradient (-) of the pumping well

Q = discharge

K = hydraulic conductivity

b = aquifer thickness

i = hydraulic gradient

For examples of how to use this equation, see the discussions of the Dillon, Hillside Colony and Sidney sites in Part 2 of this manual.

Public water supplies tapping confined aquifers may delineate a recharge region that may or may not be contiguous with the protection region. A recharge region may be delineated by hydrogeologic mapping. The boundaries of the recharge region should extend to both the physical and hydrologic flow boundaries.

Community public water supplies that use confined aquifers may opt to use a numerical flow model, to delineate the regions of the SWP area. Table 6 summarizes the delineation methods and minimum criteria for community public water supplies in confined aquifers.

The hydrogeologic mapping method is also recommended to delineate a recharge region for a bedrock aquifer. Ground-water flow boundaries that coincide with ground-water divides and physical aquifer hydrologic boundaries may be used to identify the extent of the recharge region.

3.2.4. Delineation Method for Community Systems Using Ground Water

3.2.4.1. Select a base map

A base map is used to show the PWS wells, delineated wellhead protection area, and other important features. The base map will show the location of relevant features. The map may be a 7.5-minute quadrangle map (topographical map), a plat map, or possibly an air photo with mylar overlays. In some cases base map selection is dictated by map availability.

There are many places to obtain a suitable base map. A 7.5-minute quad map may be available from a local sporting-goods store, land-surveyor office, the Montana Bureau of Mines and Geology, or the U.S. Geological Survey in Denver. Plat maps may be available at city hall or the local planning office. Air photos may be ordered from the USGS in Denver and mylar (clear plastic overlay) is usually available from a survey supply, office supply, or blueprint shop.

If you are uncertain about map selection or have difficulty in finding an appropriate map, contact the Source Water Protection Progam at (406) 444-4806 for assistance.

3.2.4.2. Where to obtain the data you will need

- well log(s) with lithology – may be obtained from PWS files, DNRC, GWIC, or the driller
- peak well discharge – from PWS records or from field measurement
- hydraulic conductivity of aquifer – ideally from results of aquifer testing, but can be estimated from specific capacities found on some well logs
- saturated thickness of aquifer – from well logs and measurement of local and regional static water levels
- hydraulic gradient of aquifer – as above
- porosity of aquifer – estimated from lithology from well logs
- ground-water elevation map – usually must be created with the static water-level data
- ground-water flow direction – derived from ground-water elevation map
- location of ground-water divides – as above
- location of ground-water barriers or boundaries – as above
- geologic map, surficial – from MBMG or USGS
- geologic map, bedrock – as above

3.2.4.3. Delineate

The analytical method using the Uniform Flow Equation shown in figure 4 may be used to define zones of contribution (special protection regions) based on aquifer and pumping characteristics.

As previously mentioned, this equation calculates lateral boundary limits and the down-gradient stagnation (null) point. A time of travel distance is calculated based on criteria shown in the tables above and the calculated boundaries are drawn or overlain on the base map. The result is a delineation of the special protection region. EPA's WHPA Model can also be used to calculate the special protection region by using a computer to complete the equations.

The protection region can be drawn on the base map by outlining the hydrologic boundary of the area contributing water to the aquifer upgradient from the well.

Delineation is the technical part of SWP and may be best left to those persons trained in hydrogeology, geology, or engineering. As noted earlier in this section, you may decide to retain a consultant or seek assistance to complete the delineation. You may also be careful in the your selection of the community planning team members and find someone who is both qualified and interested in assisting with this technical aspect of the effort.

3.2.5. Delineation Criteria for Non-community Systems Using Ground Water

Non-community systems may use the fixed radius method to delineate a source water protection area. The area should be dicided into a 100-ft. radius Control Zone and a one-mile radius Special Protection Region. All land uses within the Special Protection Region must be identified and a contaminant source inventory completed based on land uses. Non-community systems may opt to use a more scientific method to delineate the source water protection area.

3.2.6. Delineation Criteria for Systems Using Surface Water

(This section will be completed after the development of the Montana Source Water Assessment Program document)

3.2.7. What exactly do I need to complete Step 2?

- Decide on who will do delineation. If outside consultant, provide information as requested.
- Contact PWS operator for source and pumping information.
- Contact DEQ for source information.
- Contact GWIC for well logs.
- Contact MBMG/USGS for geologic and hydrogeologic information.
- Contact DNRC for water-rights information.
- Select base map.
- Do technical delineation.
- Develop map overlays.
- Publicize SWP activities.

3.0. CHAPTER 3: THE STEPS OF SOURCE WATER PROTECTION, cont.

3.3. Step 3: Contaminant Source Inventory

3.3.1. General

The inventory of the delineated regions comprising a SWP area can be the most time intensive of the 6 steps. A potential contaminant source inventory identifies all contaminant sources and land uses in the delineated area and shows their locations in relation to the well or intake as an overlay on the base map. Some sources may be obvious like above ground storage tanks, landfills, livestock confinement areas, highway or railroad right of ways, and sewage treatment facilities. Others are harder to locate like abandoned cesspools, underground tanks, french drains, dry wells, and wells or old dumps and mines.

Certain conditions in the community and/or area may influence your decisions about how you do your inventory. For instance, you may do a intensive inventory in the control zone and special protection region with a much lesser effort in the protection region due to risk considerations when conditions are such that activities beyond the special protection region have little possibility of contaminating your source water. The SDWA requires the source water assessment program provide both an inventory and susceptibility assessment to each PWS. While this effort will focus on contaminant sources deemed by DEQ to be significant making it less inclusive than a community generated inventory, when complete it will provide very basic inventory data on which you can build.

Many communities have found existing citizen groups to be the best volunteers. For example, a senior citizen group may know the history of the community, are known and trusted by members of the community, and may have the time to do the necessary property inspections and interviews. You may also interest a local high school science class in assisting with the inventory effort. The use of an existing group may reduce the amount of time you need to spend in getting things organized.

Placing the compiled inventory information on the base map allows the team to see the number, location, and type of potential contaminant sources that exist in the SWP area. Understanding the relationship of inventoried sources to the well or intake is important in deciding on the best management options. Some community planning teams have noted that the inventory step generates considerable paperwork. It is important that all land uses within the control and special protection regions be identified for the effort to be of value.

A community generated inventory process starts by locating lists of contaminant sources compiled by federal, state, and local agencies. Locations are marked on the base map (sites are visited as needed to fill in data gaps). Next, an inventory of the control zone is completed, usually by the certified operator since he/she is usually very familiar with the area immediately around the well or intake. Identified land use and contaminant sources of concern that are located in the control zone, are also marked on the base map. Then, a combination of visual survey, mail survey, or site visit is used to identify significant land uses and contaminant sources within the special protection region. Finally, potential contaminant sources in the protection region are inventoried using an appropriate method. Potential contaminant sources in these regions are prioritized based on an assessment of the susceptibility of the source water. Usually, all land uses and selected contaminant sources are identified on the base map.

3.3.2. Data Management

Land uses within the delineated SWPA should be identified on your base map, usually a 7.5-minute topographic map. Land uses can be described using table 7.

While it is important to identify general land uses within the boundary of the SWP area, certain specific activities or sites of concern should have an inventory sheet completed due to high risk factors. Risk is elevated by proximity to the well, shallow ground water, or the nature of a land-use activity.

All land uses should be identified within the entire SWP area on the base map using the map code. An inventory sheet should be completed for each property within the control zone. In the special protection region, an inventory sheet should be completed for sites of special concern. At all sites for which you complete an inventory sheet an identification number should be entered on both the inventory sheet and base map. Site details should then be described for these selected sites on the inventory sheet.

When complete, you will have a base map showing general land uses in your SWP area and specific sites noted by a map locator number that corresponds to the inventory sheet upon which specific site information is maintained.

Information on the completed contaminant source inventory sheet should include:

- SWP area region and a unique site identification number
- Address of the site or latitude/longitude or township/range/section
- Name, address and phone number of landowners
- Name, address and phone number of any renters or lease holders
- Nature of property and type of land use activity
- Chemicals used or stored
- Sketch of site

The inventory of each local SWP area should be updated at least every year and the updated inventory submitted to the DEQ after five years.

Table 7. *Land Use Codes*

LAND USE DESCRIPTION	MAP CODE	EXAMPLE LAND USE
sewered residential	SR	residential area without septic systems
sewered commercial	SC	retail or business area without septics
sewered mixed	SM	mixed use on septics
unsewered residential	UR	residential area on septic systems
unsewered commercial	UC	retail or business area on septics
unsewered mixed	UM	mixed use on septics
industrial	I	heavy industry
railroad or highway	ROW	transportation corridors including county maintained roads
agriculture irrigated crop	IC	flood or sprinkler irrigated crop areas
agriculture irrigated pasture	IP	flood or sprinkler irrigated pasture
agriculture dryland crop	DC	typically small grain
agriculture dryland pasture	DP	non-irrigated pasture
forest	F	forest, timbered riparian areas

3.3.3. Potential Sources of Ground-Water Contamination

The following sources of contamination (table 8) have been documented in Montana. This information is presented to alert you to some of the pollutants that have contaminated water resources in Montana.

Important potential sources of ground-water contamination are underground injection wells. These are also known as sumps, french drains, drainfields, seepage or infiltration pits, or drain tiles. Underground injection wells include sumps at car washes and auto maintenance shops, and some storm water drains. These potential sources of organic and inorganic contaminants are usually located on unconfined aquifers in urban areas.

The Montana EPA estimates that there are about 10,000 storm drains, 400 industrial injection wells and 500 automotive injection wells. About 150 automotive injection wells have been closed.

Approximately 120,000 individual, on-site septic systems, are used by 300,000 people in Montana. Improperly located, constructed, or maintained septic systems and septic system failures are suspected to cause substantial, widespread coliform bacteria and nutrient contamination to ground water.

Montana has registered about 23,000 underground storage tanks. The majority of tanks were installed 10 to 20 years ago on residential, commercial, or farm property. There have been 1500 confirmed releases from underground tanks and new reports come in at a rate of 20 to 30 per month. The number of new releases is decreasing as old tank are removed and better containment and early detection systems are installed. About half of the releases reach ground water, and several have resulted in benzene contamination to public water supplies. Unregistered tanks (due to small size or owner omission) continue to pose a threat to public water supply wells.

Table 8 is a list of potential contaminant sources. Sources are listed based on their relative threat to water quality. The three broad categories shown on the left column are used to categorize the potential sources of contamination based on the general location of occurrence. This list is not exhaustive and is very general, but it can be used as a starting point. Montana has eight sites listed on the federal Superfund National Priority List. As of October 1991, there were 236 sites prioritized for remedial action through the Montana Comprehensive Environmental Cleanup and Responsibility Act (CECRA). Unlike the federal Superfund Act, this act also addresses sites that have asbestos or petroleum contamination. Fifty-nine of these sites have documented impacts to ground water.

Montana has approximately 416 registered generators and recyclers of hazardous wastes. There are about 40 registered hazardous-waste transporters. Many smaller businesses handle hazardous materials but are not required to register. An average of 300 accidental spills are reported each year to the Hazardous Materials Emergency Response System. About 5% require extensive cleanup and monitoring.

Numerous pesticides have been detected in Montana ground water including dioxins, pentachlorophenol, atrazine, 2,4-D, dicamba, dinoseb, MCPA, picloram, simazine, bromacil and aldicarb. The levels in the drinking water were below established water quality standards except for pentachlorophenol and dinoseb. The statewide general pesticide management plan has been completed under the Montana Agricultural Chemical Ground-water Protection Act. The act also directs MDA and DEQ to develop specific management plans implementing BMPs where pesticides are detected (within certain parameters) in the ground water. About three-fourths of the mines that have used cyanide to process ore in Montana have had documented releases. There are about 30 ore-processors that have used cyanide; most of the processors are inactive at this time. Of the releases, four affected ground-water quality beyond the boundaries of the mine property and two resulted in the contamination of nearby domestic wells.

The American Petroleum Insti-tute estimated that for the 623 wells drilled in 1985, 4.5 million barrels of drilling fluids were produced, an average of 7,330 barrels per well. This fluid can contain benzene, phenanthrene, barium, fluoride, antimony, along with high concentrations of calcium, magnesium, sodium, chloride, and sulfate. The fluids can easily migrate into the ground water. There are documented cases where these fluids have contaminated domestic water supplies in eastern Montana.

Table8. *Potential sources of ground-water contamination*

Location of potential contaminant	**Contaminant or site-specific contaminant source**
land surface	hazardous waste generators, storage and disposal spills fertilizer and pesticide use areas, mixing and loading sites irrigated lawns and crops brine pits land disposal of solid or liquid waste illegal dumps facilities using or storing chemicals land farms for sludge, sewage, or petroleum contaminated soil de-icing salt usage or storage animal feedlots holding ponds and lagoons accumulation of airborne particulates mine tailings and waste rock transportation routes, pipelines, terminals, and above-ground storage tanks
soil above the water table	sumps and dry wells gravel pits and construction excavations storm water sumps and ponds septic tanks, cesspools and privies underground storage tanks and pipelines sanitary landfills cemeteries and animal burial sites sewer lines and lift stations artificial recharge projects
below the water table	underground injection wells mine shafts secondary recovery operations chemigation wells drainage canals and saline seep wells sites with ground- water permits operating water wells and monitoring wells abandoned wells geothermal, oil and gas wells

Leachate, migrating from solid-waste landfills, is a source of ground-water contamination in Montana. Twenty-five years ago there were about 500 in the state. In 1992, there were 123 licensed Class II (municipal) waste management facilities: 87 landfills, 26 container systems, 6 transfer stations, 2 sewage sludge injection sites, 1 incinerator, and 1 composting operation. Of the 87 landfills, only a dozen had begun ground-water monitoring. In the future, smaller, local, landfills are expected to close and be replaced by 50-75 larger, regional facilities.

3.3.4. Regulation of Contaminant Sources in Montana

The following state agencies identify and evaluate sources or potential sources of contamination (air/water/soil) in Montana. Some are entering the data into databases for easy retrieval. These agencies are a source of initial information on sources of contamination that may exist within a SWP area.

The Enforcement Division at DEQ (406-444-0379) tracks spills that may contaminate ground water and enters the information into a data base.

The Permitting and Compliance Division at DEQ (406-444-4323) also maintains data bases on ground water, storm water, and surface-water discharge permits.

The Permitting and Compliance Division also maintains a database of establishments that use 20 gallons or more annually of halogenated solvents.

To date, 400 businesses have registered. The DEQ also has copies of the SARA Title III data base for Montana.

Specific state programs regulate specific categories of contaminants, such as the Underground Storage Tank Program, Agrichemicals in Ground Water Program, or Hazardous Waste Program. Each agency implements its own inventory of sources. In the future, because of GIS mapping, these various inventories will be combined and displayed for easier information access and management by NRIS. Some ground-water pollution data is currently available from NRIS. The DEQ, DNRC, MDA, and local entities supply the contaminant source information for the database.

Local fire chiefs inspect work places and may have information on the hazardous chemicals used and stored. The Employee and Community Hazardous Chemical Information Act (MCA 50-78-301) requires each work place to inventory and properly label all hazardous chemicals. Certain local water quality districts in Montana also maintain potential contaminant source databases.

Federal land management agencies have inventoried hazards and prepared management plans that outline the activities occurring on the public lands. When public lands are contained within the SWP area, site specific information is available from the land management agency. In addition, the in-formation may be in GIS.

3.3.5. What exactly do I need to complete Step 3?

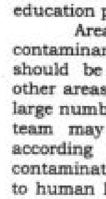
- Decide on type of inventory.
- Identify inventory participants.
- Make inventory assignments.
- Provide training.
- Contact agencies for existing information.
- Distribute inventory forms.
- Conduct field inventory.
- Prioritize sites, reduce field data.
- Transfer field data to base map overlay.

3.4. Step 4: Management

3.4.1. General

The goal of protective management is to maintain and improve the quality of the water source used by a PWS. Experience has documented that contaminants, contaminant sources, and specific land uses can be managed to help reduce the likelihood that water will be rendered unfit for PWS uses. Protective management strategies are applied within the delineated SWPA and may include: increased monitoring or inspections at potential sources of contamination, prioritizing regulatory controls on sources of contamination, implementation of best management practices (BMPs), and public education programs.

Areas more likely to allow contaminants to enter the source water should be managed more intensively than other areas. If the inventory has discovered a large number of different types of sources, the team may want to prioritize the sources according to how likely they are to contaminate ground water or how dangerous to human health the contaminants are using the susceptibility assessment from Step 3.



The team should set goals for managing the potential sources of contamination in the regions of the SWPA. Various management options should be evaluated based on reaching the team's goals. For instance, if the goal is to prevent contaminants from entering ground water, management options might include double containment for storage containers or simply prohibiting certain activities. If the goal is to maintain and improve the quality of the drinking water, management might include public education programs or implementing BMPs in local businesses and farming operations.

Recommendations to the governmental entity that will be responsible for managing the SWP area should be prepared by the community planning team. The team should also suggest a time frame for evaluating the success in reaching the management goals.

Many communities find that political boundaries (such as the city limits, streets, streams, or section lines) are easier to manage than the scientific boundaries of the delineated regions. Communities are encouraged to use political or geographic boundaries for the SWP regions if these boundaries also include the scientifically-determined delineation boundaries.

Local entities may choose to manage their SWP areas in a variety of ways. The choice of management techniques is determined by the size and nature of the SWP area, the type of local entity, the operation of the potential source of contamination, the characteristics of the chemicals used, and the source management already in place. For more assistance contact the Source Water Assessment Section at DEQ (406-444-4806).

3.4.2. Differential Management by Regions

Differential management means that the regions of a SWP area may receive different types or levels of management. Management intensity usually decreases away from the well or intake. The management types described in this document are: control management, intensive management, and protective manage-ment. Management types correspond to the SWPA regions.

Control management is applied to the control zone immediately surrounding the well. *Intensive management* is used in special protection regions where ground water can migrate to the well or move downstream to an intake within a short period of time. *Protective management* is used in protection regions that include a larger portion of the aquifer supplying the well or the upper watershed area.

The goal of control management in ground-water systems is to protect against damage to the well and prevent the introduction of contaminants into the well or ground water in the immediate area. At surface-water systems control management should be use to prevent the discharge of contaminants in the area immediately upstream from the intake. Control management is implemented in the control zone by the public water supply and/or a local entity. Ownership, easement, or lease of the land immediately surrounding the well may be necessary to control certain activities around or entry to the well site or intake area. Examples of control methods include the following: fencing the property, prohibiting improper chemical storage or use, sloping the land away from the well, building a secure well house, or installing positive controls on the intake.

The goal of intensive management is to focus pollution prevention activities in the special protection region where water is expected to be captured by a pumping well or surface-water intake. Intensive management may address specific contaminants such as microbes, nitrates, solvents, and herbicides. Certain PWSs will also want to consider intensive management for sediment, TOC, metals, and possibly sulfates. Intensive management includes: prohibitions against specific sources of pollution, leak detection monitoring, requirements for existing septic systems to connect to a public sewage treatment system, secondary containment for storing specific chemicals, or use of agricultural BMPs.

If a recharge region is delineated for an unconfined, fractured bedrock aquifer, the region may also be intensively managed. Even though this region may be many miles away, fractures and solution cavities in the formation can facilitate the movement of pollutants to the well or spring.

3.4.3. Management Options

Local entities may choose to manage their SWP areas in various ways. The choice of management techniques is determined by the size and nature of the SWP area, the type of local entity, the operation of the potential source of contamination, the characteristics of the chemicals used, and the source management already in place. For more information contact the Source Water Protection Section at (406-444-4806).

3.4.3.1. Management options are:

- Source prohibitions and permits
- Municipal ordinances
- Design and operating standards
- Public education
- Inspectors at construction/drilling site
- Best management practices (BMPs)
- Local water quality district
- Ground- water monitoring
- Subdivision regulation
- Site plan review
- Sole source aquifer designation
- Purchase of property and development rights

It is important to prioritize the potential sources of contamination for management by determining which sources are managed adequately by existing federal or state laws or local ordinances, and which sources need additional management. Potential sources of contamination within the control or special protection region and those that use, generate, or store chemicals that are regulated by a drinking water standard should be prioritized for management. For the priority sources, accurate locations can be determined with geographic positioning equipment. The community may request this service from the DEQ. Table 9 lists suggested management methods for each SWP region.

Table 9. Suggested Management Methods

Control Zone	Special Protection Region	Recharge Region
Lease	Municipal Ordinance	Best Management Practices
Direct Ownership	Operating and Design Standards	Surface-Water Monitoring
Operating and Design Standards	Source Prohibitions	Operating and Design Standards
Easements	Permits	Site Plan Review
Source Prohibitions	Best Management Practices	Cooperative Agreements
Zoning	Inspections	Education

3.4.4. Authority to Protect Source Water

The authority of local government or a community to regulate certain activities detrimental to the public water supply or to engage in activities that protect the public water supply is described, in part, by the following excerpts from the Montana Code Annotated (MCA):

7-1-4123 MCA

A municipality has the legislative power to adopt ordinances or resolutions to secure and promote the general public health and welfare.

7-4-4306 MCA

The mayor may exercise such power vested by ordinance to enforce public health ordinances and regulations in all places within 5 miles of the city limits.

7-13-2218 MCA

Any county water district may lease or purchase water, land, or rights necessary for pollution abatement and may commence proceedings to prevent interference with ground water within the district.

7-13-4402 MCA

The city or town has the power to carry out means for securing a supply of water.

7-13-4406 MCA

Cities and towns have control over the source of streams from which water is taken for the enforcement of sanitary ordinances, the abatement of nuisances, and the preservation of the purity of the water supply, with the power to enact ordinances.

7-21-4204 MCA

The city or town has the power, within the city or within 3 miles to regulate any offensive and unwholesome establishments.

7-33-4205 MCA

The city or town has the power to regulate and prevent the storage of kerosene, oils, and inflammable materials within 3 miles of the city limits.

75-6-120 MCA

The governing body of the county in which a certified source water protection area exists may adopt an ordinance to regulate conditions that threaten water quality within the SWPA.

85-2-506 MCA

The Montana Department of Natural Resources (DNRC) may restrict ground-water withdrawals in a designated area by a petition of a state or local public health agency for identified public health risks.

Local fire chiefs may make onsite inspections of hazardous chemicals in the work place and report violations found to the county attorney or law enforcement (50-78-301, MCA).

Local entities that share an aquifer, drainage, or area may establish and cooperatively manage a joint SWP area through an inter-local agreement (7-11-101 to 230, MCA). Table 10 lists Montana laws and regulations that may be useful in managing potential sources of contamination at the local level.

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Table 10. *Montana Codes Annotated*

Legislation	Action
MCA 75-5-103	Defines pollution
MCA 75-10-403	Defines hazardous waste
MCA 75-10-101, 203 ARM 16.14.502	Defines solid waste
MCA 75-10-701	Defines hazardous and deleterious substances
MCA 75-10-403	Defines regulated substances
MCA 75-10-451	Defines halogenated solvents
MCA 50-78-102	Defines hazardous chemicals
42 USC 300f	Contaminants identified that affecting water quality
MCA 75-10-602	Defines hazardous substances
ARM 36.21.601 to 680	Construction standards for water wells
ARM 36.21.801 to 810	Construction standards for monitoring wells
ARM 16.45.403	Requires leak detection equipment for underground storage tanks and lines
42 USC 300f, 300h-3(e)	Describes designation of a Sole Source Aquifer
40 CFR 302	Lists known hazardous and toxic properties
40 CFR 122.21	Lists toxic pollutants
MCA 7-13-4501 to 4529	Describes creation and operation of Local Water Quality Districts

3.4.5. Exactly what do I need to do to complete Step 4?

- Prioritize potential contaminant threats within each delineated region.
- Discuss possible management options.
- Meet with local governing body to discuss regulatory options.
- Develop or identify BMPs.
- Develop education plan
- Request adoption of local ordinance.
- Write SWP management plan.

3.5. Step 5: Emergency Planning

3.5.1. General

Emergency planning is one of the most valuable parts of the SWP process. It puts answers to many of the "**what if**" type questions and can enable your system to react thoughtfully to a problem instead of reacting to a crisis. For example,

"What if a tanker spill or tank leak occurred today that caused a large pool of fuel within 300 feet of one of your wells or within a mile upstream from your intake?."

- *Is the well or intake threatened?*
- *Is there an emergency response mechanism in place sufficient to contain the spill?*
- *Should you shut down the well or intake?*
- *Can you provide a alternate and safe supply of water for a short period of time until the threat has past?*
- *Do you have the funding to pay for water via a tank truck for a short period of time?*
- *Is providing an alternative source of water an option?*

These are the types of questions to which you should have answers before you actually need them. It is a form of short-term planning.

In addition to the short-term response described above, ground water-based systems should also consider the type of response if a well is permanently contaminated. Do you have a back-up source or at least an idea of where to locate a back-up well? For example, the delineation effort (section 3.2.-Step 2) will have provided useful information concerning the source of water. Use that information to complete a SWP area delineation for a new well location.

The Montana Source Water Protection Program requires that a plan include the delineation of a SWP area for a replacement well. A back-up well should be included if community growth will require the construction of an additional well within the next ten years. The SWP area delineation for a future well can be a 2500-ft. radius around the well, or a more rigorous method may be used to increase delineation accuracy. The delineated area should be inventoried as described in section 3.3. Step 3.

Long term planning needs for a surface water-based system vary considerably between PWSs. Surface-water systems may be able to allow serious contamination threats to pass by, by closing intake valves and then reopening after the threat has passed. Surface water - based systems on small streams should consider their response to a total loss of their current supply through contamination or drought as a response planning exercise.

To begin the Emergency Planning step, the community planning team or operator should review the PWS emergency plan (if one exists) and make any needed modification to update the plan or, if no emergency plan currently exists, should put one together. This would also be a good time for the county Emergency Coordinator to meet with the operator or team to discuss how you will interact in the event a disaster threatens the water supply. It is important that the local DES official know about the SWP delineated area to ensure priority response should a spill or disaster occur.

Disruptions to the PWS may occur due to natural disasters, accidents, or even vandalism. The local governing entity and public water supply should plan for these emergencies and should be prepared to provide an alternative drinking water supply.

3.5.2. Emergency Planning in Montana

The Department of Military Affairs, Disaster and Emergency Services Division and DEQ coordinate federal, state, and local services during emergencies (10-3-101 to 1115 MCA). Local disaster and emergency services exist on the county level. The state and local emergency organizations promote disaster prevention, planning, training, public education, and development of a comprehensive disaster and emergency plan. They also maintain a survey of industries, resources, and facilities within their area.

The Montana Hazardous Materials Response Plan covers four phases.

1) Pre-disaster phase includes plans for warning and communication, state emergency operation center, public information, and evacuation.
2) Disaster phase includes plans for search and rescue, health and medical services, law enforcement, transportation, fire suppression, and military support.
3) Recovery phase includes plans for disaster field office, state disaster assistance programs, damage assessment and damage survey, social services, housing and shelter, debris removal, crisis counseling, private and voluntary relief organizations, and mortuary services.
4) Hazard mitigation includes non-discrimination, disaster assistance center, repair and restoration, debris removal, temporary housing, unemployment assistance, individual and family grant program, food and commodities distribution, legal services, crisis counseling, community disaster loans, temporary communications and public transportation, fire suppression, timber removal, and federal assistance.

The Field Services staff of the Drinking Water Program at DEQ is drafting the Montana Emergency Drinking Water Plan. The plan will address: objectives, relationship of the plan to existing emergency services plans, support resources, emergency response, communication, alternative water supplies, remediation, emergency source development, and review and update of the plan.

The Department of Military Affairs, DEQ, Department of Transportation, MDA, Department of Justice, and Fish, Wildlife and Parks coordinate with federal, state, local, and Canadian disaster and emergency services. The Montana Hazardous Materials Response Plan meets the requirements of the Superfund Amendments and Re-authorization Act, Title III for contingency planning. In addition, Montana has joined with other states in an Interstate Mutual Aid Compact. Montana has published the *Local Government Disaster Information Manual* to outline funding procedures for emergencies.

The state coordinates the activities of local disaster and emergency services when the emergency crosses jurisdictional boundaries or when back-up help is required. An "Incident Command" procedure is used. Local, state, and federal personnel are trained to join or withdraw from the incident command structure to effectively respond to the developing emergency. This process enhances efficient use of personnel and equipment. Equipment and supplies needed for a water supply emergency are emergency chlorination and filtration units, bottled water, water tanker trucks, portable chemical toilets, and portable showers.

Several laws have been enacted to facilitate coordination of emergency operations:

- Uniform Transboundary Pollution Reciprocal Access Act, 75-16-101 to 109, MCA;
- Interstate Emergency Services Mutual Aid Act, 10-3-207, MCA; and,
- Northwest Interstate Compact on Low Level Radioactive Waste Management, 75-3-501, MCA.

The DEQ and the Department of Military Affairs maintain a Hazardous

Materials Emergency Response System. The phone number is 406-444-6911 and is staffed 24 hours a day. All spills or releases of hazardous materials or other wastes, regardless of size, that pollute or threaten to pollute state water must be reported, contained, removed, and disposed of to protect water quality.

Local fire fighters should be involved in emergency-response planning. They should be informed of any extraordinary risks that might exist in your SWPA because some materials can pose a significant threat under conventional fire fighting conditions. Site-specific fire fighting plans should be developed for these sites.

Spills of materials that may contaminate ground or surface water generate a response that usually includes monitoring to determine if residual contaminants exist and if they are migrating into the vadose (unsaturated) zone, ground water, or into a surface-water body. If contamination is found, treatment facilities are installed to return the water to pre-spill conditions or non-degradation standards. Remediation and monitoring plans are submitted to DEQ for approval, and monitoring data is submitted on a regular basis. The responsible party is liable for clean up, providing alternative sources of drinking water, and monitoring for ground-water contamination as specified in ARM 16.20.1025.

For drinking water-standard violations that are naturally occurring or that have no identifiable responsible party, the public water supply is responsible to provide a safe supply of drinking water. If the contamination is significant, it can become a ground-water clean up site under WQA, CECRA, or other state or federal authority.

State emergency funds for supplying an alternative source of water may be available in a declared state emergency through the Environmental Contingency Account (75-1-1101 MCA). Where there is no declared emergency, funds can be sought from the Environmental Quality Protection Fund (75-10-704 MCA). Infrastructure development loans may be available if a new well is needed.

3.5.3. Elements of an Emergency Plan

The public water supply must have an emergency plan describing procedures to be followed to correct problems with the distribution system, wells, and source water. The plan should describe the following:

I. Identification of possible disruption threats.

A. Have you identified the principal threats to your PWS?

B. Have you educated water system users in recognition of principal threats and recommended response?

II. Designation of an emergency coordinator for the public water supply.

A. Have you designated an emergency coordinator for the PWS?

B. Has this person been trained in emergency procedures?

C. Do other PWS personnel and local/state DES coordinators know to contact the designated emergency coordinator when an emergency arises?

D. Have you described the chain of command at the local level and within the DES system.

E. Have you identified the legal authority that authorizes an emergency response.

III. Equipment and material resources.

A. Have you identified equipment and material resource needs for principal threats to your PWS?

B. Have you identified which items need to be on hand and which need to be available?

C. Have you described how you will access equipment and materials in an emergency?

IV. Procedures to shut down and isolate the threatened or contaminated well from the distribution system.

A. Can you isolate various parts of your distribution system?
B. Can you monitor selected parts of your system if contaminants have gained entry?
C. Are important shut off valves mapped, marked, and maintained?

V. Procedures to coordinate with county and state emergency response agencies.

A. Have you added your contingency plan to the county's Comprehensive Disaster and Emergency Plan?
B. Have you included a list of local and state DES personnel names and phone numbers?

VI. Procedures to effectively communicate with the water users.

A. Have you established a policy concerning how and when you will alert the media such as radio, newspaper, and TV?
B. Have you described how to directly alert water users if an emergency warrants such action?

VII. Sources of emergency water for drinking and other household uses as well as sources of equipment to transport, disinfect, and distribute the water.

A. Do you have a list of possible alternative sources of DEQ approved potable water and supply plan?
B. Do you have a plan for water rationing?
C. If your normal water system is disrupted, do you have a mechanism for emergency water disinfection?

VIII. Procedures to decontaminate the distribution system and the well.

A. Have you described how you might disinfect or decontaminate the entire water system?
B. Have you described a policy for resumption of water service following disruption?

IX. Sources of emergency funds and procedures for requesting and dispersing such funds.

A. Have you budgeted emergency funds?
B. Do you know how to request emergency funds from the state?
C. Have you planned long term well replacement, have you identified funding mechanisms?

X. Replacement well or wellfield.

A. Have you identified the replacement well location on your base map?
B. Have you shown a 2500' radius as the delineated SWPA on your base map?
C. Have you included the contaminant source inventory for the replacement well SWPA?

An emergency plan can be developed by completing the following example emergency plan or by addressing each of the indexed items listed above as a section heading and then providing a descriptive answer, name and phone number list, or map to the bulleted questions. The following information may help you complete your contingency plan development.

Possible disruption threats include chemical or fuel spills, leaking above or underground storage tanks, pipeline leaks, flooding, pump failure, main breaks, power outages, and vandalism. A major highway, rail line or industrial area near your well or intake may increase the chances of an emergency. The inventory step should have identified many of these potential threats already. Water-system users can also assist in the recognition of emergency situations by educating them through an annual water bill insert.

Once a problem is identified and reported, response personnel need to be notified. A roster with names, telephone numbers, responsibilities, and back-up personnel should be created. A chain of command should describe each individuals responsibility and one person should be designated as the emergency coordinator. The legal authority under which you act can be identified through discussions with the local DES coordinator or the local governing body. It is especially important for non-municipal PWSs to know what authority they can use to protect their water supply in the event a crisis occurs.

A list of existing and needed equipment and materials (spare parts, disinfection chemicals, spill containment supplies, personnel protective equipment) should be compiled. Sources for outside assistance and equipment that may be needed in a emergency such as well drillers, excavators, portable pumps, generators, emergency disinfection equipment and technical consultants should be identified. A contact sheet listing the need and probable source should be generated.

A map of your distribution system with important valve locations should be included in the contingency plan. It may be possible to color code various sections of your system on the map to clearly identify sections that you can isolate and where the valves are located. Include a description of your maintenance schedule for important valves. The map should also show possible sample points to be used in the event a contaminant is isolated in certain parts of the system.

Contact the local DES coordinator (usually at the courthouse or through the sheriffs office) to be sure they are aware of your SWP area delineation and contingency plan. Many DES coordinators aren't specifically aware of PWS emergency planning and this is an opportunity to coordinate but not duplicate efforts.

A listing of locally available media contacts should be generated. You should also develop a policy regarding media contact and designate a specific media contact person to ensure correct information is disseminated when deemed necessary. Regulations concerning many potential contaminants dictate how and when you must notify your water system users of a Maximum Contaminant Level (MCL) exceedance. Some situations require an immediate alert mechanism so you need to identify ways in which you can reach your users such as a phone network. For example, a water system operated by an water user's association may state that the operator will contact each board member who in turn will contact a specified portion of the water users.

There are several ways to replace a contaminated water supply. Some systems may have access to a back-up well that could be physically connected to the distribution system should the need arise. It is wise to ensure that the back-up is maintained in a potable condition. Other systems may use bottled water or a water hauler may provide an emergency supply. Identify these possible sources and make sure they are an approved source. You should also include a written procedure describing routine tank truck disinfection because this is often the weak link in a short-term water supply plan.

Resumption of water service following an emergency is usually based on one or more "clean" samples and may be dictated by regulation. Your local health department may be willing to assist with sample collection that should be verified now and included in your emergency plan. You should be aware of emergency funding sources that may exist at both the local and state levels. Contact the local DES coordinator and the PWS program for assistance. A list of possible funding sources and contacts should be maintained so valuable time is not lost dealing with this issue during an emergency.

For new public water supply wells, construction standards for large public water systems are contained in DEQ circulars. The standards require submission of plans and specifications to DEQ prior to construction. The design engineer must ensure that the proposed well site is not threatened by known contamination events.

Before anyone can drill a new well that yields more than 35 gallons per minute, the owner must obtain a permit from the DNRC to appropriate water. The process begins with the owner filing an application for beneficial use and submitting a filing fee. In order to receive a permit, six criteria must be met:

1) Unappropriated water is available.

2) No other water rights are adversely affected.

3) The proposed well construction and operation are adequate.

4) The water is put to beneficial use.

5) The proposed use does not adversely affect the water quality required for other beneficial uses of water-right holders.

6) The well owner owns the land where the well will be drilled, or has the permission of the land owner.

The community may seek a water right reservation from DNRC. This establishes the intent to put the water to beneficial use at a site where public water supply wells will be drilled in the future.

A good technique to use after you have developed an emergency plan is to run through a couple of mock emergencies. You cannot anticipate everything, but pre-planning can save many headaches when something really does happen. Emergency plans should be dynamic and should include a built-in mechanism for annual review and updates. You might try to tie your emergency plan review and update to some other regularly scheduled event or put it on the time line planning calendar you use for sample planning.

3.5.4. Elements of an Emergency Plan (Example)

The emergency plan identifies the principal threats to the source water, designates an emergency coordinator, and then describes a series of potential responses planned in the event of a problem arises. Another important aspect of the plan is an estimate of the equipment and materials that would be needed in the event of an emergency, a description of how a short-term replacement water supply would be handled, and a description of the funding available to deal with an emergency response.

3.5.4.1. Identification of Possible Disruption Threats

The principal threat to the PWS has been identified as a spill, leak, or discharge in the control zone that could contaminate the source water by entering through the well bore or perhaps along with contaminated shallow ground water through a failed casing. Included are spills from vehicles, spills from mobile liquid holding tanks, leaks from above or underground tanks, leaks from waste carrying pipes, and insert specific identified threats.

Describe any other major or secondary identified threats in the special protection or protection regions. Most PWSs will include a transportation route and potential spill as a secondary threat and some will have a specific activity occurring in the SWP area that pose a significant threat. Not all potential sources should be listed here, only one or two for which you should genuinely be prepared.

3.5.4.2. Designation of an emergency coordinator

The emergency coordinator for (insert PWS name and operator name). His phone number is (406- (insert phone #). The back-up emergency coordinator is (insert name and phone number).

The emergency coordinator is familiar with the county and state DES procedures and is responsible for contacting the appropriate officials should a spill or other threat to the source water occur. The (insert county name) County DES coordinator 24-hour phone number is (insert phone #). The State of Montana 24-hour Spill Hotline phone number is 406-444-6911.

3.5.4.3. Equipment and material resources

The principal identified threats to the well are usually limited to spills in the control zone. Resources that may be needed to respond to a spill are, heavy equipment for berm and excavation work and, absorbent materials. Describe the local availability of equipment and materials and specific details about how you can access them. Should additional resources be needed due to the magnitude or chemical nature of a spill the insert PWS name will contract with an emergency response firm properly trained and equipped. A list of possible contractors is maintained and updated by the DEQ Enforcement Division 406-444-0379.

If secondary threats have been identified, describe the equipment and material resource needs of the PWS and how you would access them.

A catastrophic loss of water will require the contracted services of a water-hauler, a design engineer, and a well driller.

3.5.4.4. Procedures to shut down the well

The well can be turned off and isolated from the water supply system. (Important valves are located as shown in appendix__.) Under ideal conditions, the system can operate without the well by using water in the water storage tank can for approximately (insert actual value). Well shut down is the responsibility of the certified operator or back-up operator.

3.5.4.5. Coordination Procedures

The (insert PWS name) SWP Plan has been made available to the (insert county name) County DES coordinator. Additionally, reportable spills will be handled as per the mandated reporting requirements as follows:

- Agricultural chemical or fertilizer spills will be reported to the MT Department of Agriculture 406-444-5400.
- Any refined petroleum product such as gasoline, diesel, asphalt, road oil, kerosene, fuel oil, and derivatives of mineral, animal, or vegetable oil spills in excess of 25 gallons will be reported to the DES hotline 406-444-6911.

3.5.4.6. Procedures to communicate with water users

The nature of the PWS should allow the well to be isolated from the distribution system in the event of a spill in the control zone that threatens source water quality. If it is determined that the source water was exposed to a contaminant the well will remain off line until sampling proves the water to be safe, an evaluation that will be done is cooperation with the MT DEQ, PWS Section.

Describe how an emergency would be communicated to water users. You may describe a network scheme where certain individuals (e.g., board members) will be responsible to call a portion your water users. You may also reference a local radio or TV station with phone numbers.

3.5.4.7. Source of emergency water

The following is general in nature. You should consider what real options would be available to you today if one of your identified disruption threats actually happened, and then tailor this section to those options.

Some PWSs have inactive wells that may be used in an emergency. If available, describe how an inactive well might be returned to service. An inactive well will need to be flushed, disinfected, flushed, and shown to be free of bacteria and below the nitrate MCL before it is brought into service. A Health Advisory would be in effect until the sample results were available. If the well were in use for more than two weeks, full sampling would need to occur to ensure compliance with the standards established by the SDWA.

If the well is out of service for more than insert actual value, an emergency supply of water may need to be arranged. The short-term plan is to haul water using a DEQ-approved water-hauler from a DEQ approved water source. Should this be necessary, a hauler will be contracted and a short-term plan relating to the source water and disinfection requirements will be submitted to DEQ-PWS Section for approval. Describe the availability of a water hauler in your area that would be capable of meeting your needs.

Should a total loss of water occur, the services of a design engineer and well driller will be retained to assess the options. Plans and specifications for any new well will require DEQ-PWS Section review and approval prior to construction.

3.5.4.8. Disinfection and resumption of water service

The well and storage tank can be disinfected for bacteriological contamination as per the (insert PWS name) standard disinfection and tank cleaning procedures under the direction of the certified operator.

Normal water service resumption will occur after sample results indicate the supply is safe as approved by DEQ-PWS Section and the certified operator.

3.5.4.9. Funds

Describe the funding available to implement the emergency actions you have considered.

Indicate why this is sufficient.

3.5.4.10. Sample form for important emergency contacts and phone numbers

CONTACT NAME	TITLE	PHONE	RESPONSIBILITY
insert(operator name)	insert position title	insert phone #	describe areas of responsibility
insert (back-up operator name)	insert position title	insert phone #	describe areas of responsibility
insert (county DES coordinator name)	insert position title	insert phone #	describe areas of responsibility
insert (Montana Spill Hotline)		insert phone #	describe areas of responsibility
insert (DEQ Enforcement Division)		insert phone #	describe areas of responsibility

3.5.5. Exactly what do I need to do to complete Step 5?

- Identify principal risks to ground water in your SWP area.
- Meet with local DES coordinator.
- Meet with the local Fire Marshall.
- Write detailed contingency plan.
- Submit plan to local DES coordinator and fire Marshall for review/comment.
- Include contingency plan in the over-all SWP plan.

3.0. CHAPTER 3: THE STEPS OF SOURCE WATER PROTECTION, cont.

3.6. Step 6: Plan Certification

3.6.1. General

Many public water systems have recognized the value of planning for the future by considering the development of a SWP plan. In part, this is because water resource agencies and technical assistance programs have been very active in getting information about SWP to system operators and managers. But another significant reason we're seeing more and more systems begin development of a SWP plan is because "***it just plain makes good sense.***" The concepts are easy:

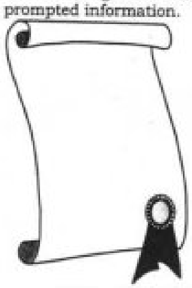
1) Find out where your water comes from,

2) Identify potential threats located within the source area, and,

3) Decide how to manage those threats.

While the concept is easy, some of us have a tougher time when it comes to 'putting pencil to paper' that is actually the writing of the plan. A few suggestions follow that may help you see your way through the process. And while you're reading this through and thinking, *"yeah, I get the concept, but I just don't write things down very well"* give some thought to getting help from someone else you might know who can handle paperwork type stuff. With everything you have got to do, you maybe don't need an exercise to demonstrate your writing skills. Look around and find someone to help out. A spouse, or perhaps someone else involved with the PWS can help put it together. A SWP plan template or fill in the blank form is included as an attachment to this manual to help you get started.

There are many ways to effectively use the template. One method is to gather all your SWP information at a computer work station, bring the document provided on the disk to the screen using a word processing program, and then simply fill in the specific information where prompted. If there are sections for which you do not have complete information you will need to add it before submitting your plan to DEQ for certification review. If you are one of the people who does not have a computer available or does not like using computers you can request an expanded paper version of the document that provides space under each heading into which you can write the prompted information.



Your SWP plan should be of sufficient detail to allow an unfamiliar reader to fully understand how your water system works, what steps you have taken to identify and manage potential contaminants, and your planned response to an emergency. In other words, your source water plan should be a document that **fully** describes your PWS including distribution system and water source(s). Some of the description will be written and some will be graphic (maps, diagrams, etc.) attached as appendices. The complete plan will include a title page, six chapters, a reference page, and appendices.

It is important that your plan be put together in a manner that will allow others to fully understand your community and water system based on the work you have done. Certified operators change as do city councils and water user association board members. The plan will be used by others who were not involved with its creation, therefore it must be a stand alone-type document.

3.6.2. How Are Plans Certified?

To certify a SWP plan, a PWS submits their plan to the Source Water Protection Section at DEQ for review. The purpose of the review and certification is to verify that your plan meets the requirements of the Safe Drinking Water Act (SDWA) and the Montana Source Water Protection Program. DEQ will evaluate your plan to determine if it contains the information described in the MSWPP. For those of you considering a monitoring waiver application, ***REMEMBER,*** a well thought out and documented certified SWP plan can be submitted in place of a monitoring waiver application.

3.6.3. Elements of a Source Water Protection Plan

How can the "template," "certification checklist," and "elements of an emergency plan," help you with your SWP plan? With your draft plan in hand, compare it with the checklist. An entry is made for each item on the checklist that is covered by your plan. The format prompts you to consider all aspects of SWP planning described by the Montana Source Water Protection Program. If an item is not checked "yes," you will need to include an explanation in the space provided. The checklist also prompts you to describe the method of SWP area delineation and to include the technical information that should be attached to your plan to support the delineation.

All the information making up your SWP plan should be consolidated into one package for certification review. Your package should closely follow the outline of the checklist. It is important to include copies of completed inventory forms and any other relevant attachments.

A SWP plan will usually include the following:

1. ***a brief description*** of the characteristics of the community, public water supply and aquifer that influenced your decisions; this may be a paragraph or so long
2. ***a list of the key individuals*** and groups that participated in the decision making process, and those who will manage the source water protection area; this also is a paragraph or so long
3. ***a map*** showing the location of existing wells and sites for new wells and showing the boundaries of the source water protection areas
4. ***well construction and yield*** information and well-log information
5. ***the contaminant source inventory*** of the source water protection areas in proper format for inclusion in a statewide data base; this may be a few, to many, pages in length depending on the community
6. ***the management options*** selected and include any ordinances adopted; this should include a paragraph, or more, describing how management options were considered and selected
7. ***the goals*** the management options are designed to achieve and a time frame for evaluating the success of implementation; this may be a paragraph or so long
8. ***the emergency plan*** this is probably a page or more that fully describes your plan of action in an emergency along with a personnel list; many systems have ideas about emergency response but have never written them down. This section of your plan should describe the general steps to be taken in a manner that someone other than the operator could carry out the emergency plan.

The checklist is used to help determine that all information necessary for certification is included with your plan. You can see a typical SWP plan for a small water system might be 15-20 pages long that includes attachments such as the well logs, maps, and contaminant inventory. The writing portion that many people try to avoid, is really a small part of the overall SWP plans. Don't let a few paragraphs of writing stand in the way of SWP plan development.

3.6.4. SWPP Certification Checklist

DATE REC'D
ACTION
CERT'D: NO
SUB.DATE

DEPARTMENT OF ENVIRONMENTAL QUALITY (Date)

In order to certify a Source Water Protection Plan (SWPP), a community submits their plan to the Source Water Protection Section of the Department of Environmental Quality (DEQ) for review. The purpose of the review and certification is to verify that the SWPP meets the requirements of the SDWA and the Montana Source Water Protection Program (MSWPP). DEQ staff will evaluate the plan to determine if it contains the information described in the MSWPP and as outlined by this checklist (see also MSWPP 2.1.7).

CHECKLIST INSTRUCTIONS:

This checklist is used to help determine that all information necessary for certification is included with your plan. It is intended to be used in conjunction with the SWPP "template" (fill in the blank form). It is purposefully quite detailed to make sure that you have created a "working SWPP." The reader of your SWPP should be able to understand your water system including efforts to protect the source from identified threats based on the information you provide wholly in the report.

An entry should be made for each item on the checklist. If an item is not checked "yes," include an explanation in the space provided at the end of the checklist or on a separate sheet of paper.

All the information making up your SWPP should be consolidated into one report or package for certification review. Please use the plan template to guide you through this process as it parallels the outline of this checklist. Be sure to include copies of completed inventory forms and any other relevant attachments. Suggestions concerning report format such as section or chapter titles, map insertions, appendices, etc., are included on the checklist within parentheses and marked with and double asterisks.

Department certification will be given in writing within 60 days of submittal if all necessary information is included and your SWPP meets the minimum criteria described in the Montana Source Water Protection Plan. If the plan is incomplete or does not meet the requirements of the SDWA and the Montana Source Water Protection Program, DEQ will notify the PWS of the deficiencies within 60 days of receiving the submittal. If it is resubmitted within 60 days, the community retains its original priority standing relative to other submittal. If it is resubmitted after 60 days, the community loses its original standing.

A. (Include the following in your report as the "TITLE PAGE")**

NAME OF SYSTEM________________ PWSID________
OPERATOR NAME________________
SWP CONTACT________________
(Person to receive SWP correspondence)
ADDRESS________________

B. (Include this information in report as STEP-1, entitled "INTRODUCTION")**

1. Is a description of the community included?________ yes
2. Is the number of residents included?________ yes
3. Is the geographic setting described?________ yes
4. **(**Include a vicinity map showing the location of the PWS)**
5. Is the PWS source and distribution system described?________ yes

6. **(**Include a layout map of the PWS system showing mains, valves, wells, etc.)**
7. Is a general description of the source(s)included?________________yes
8. Is a description of the factors influencing decisions included?____________yes
9. Is a list of key persons involved with SWPP development included?________yes
10. Is a description of who will manage the SWPA included?________________yes

C. (Include this information in report as STEP-2, entitled "DELINEATION")**

1. Is a base map showing existing wells, replacement wells, SWPA boundaries, and management regions included?________________yes
2. Has the SWP area been delineated using the appropriate method meeting the minimum criteria? – see tables below________________yes
3. Is documentation supporting the delineation method meeting the minimum criteria included?________________yes
4. **(**Include a hydrogeologic map, geologic map, or similar documentation, potentiometric map, and all model/equation input parameter details)**
5. Are the well construction details described?________________yes
6. Are the source well logs included?________________yes
7. Has a replacement source or well been designated?________________yes
8. **(**if none needed, describe reasoning)**
9. Has a control zone been delineated?________________yes
10. **(**Show on base map)**
11. Has a SWPA been for the replacement source been delineated?__________yes
12. **(**Show on base map)**

UNCONFINED AQUIFERS

Aquifer	Region	Method	Criteria - Minimum Value
Alluvial valley	1) Control Zone 2) Special Protection 3) Protection	1) 100-ft. radius 2) Analytical method 3) Hydrogeologic mapping	1) Distance-100 ft. 2) Distance-1,000 feet upgradient, or 3-year TOT (see section 4.2.3.1.) 3) Flow boundaries- physical and hydrologic
Bedrock	1) Control Zone 2) Special Protection 3) Protection	1) 100-ft. radius 2) Analytical method 3) Hydrogeologic mapping	1) Distance-100 feet 2) TOT- 5 years or flow boundary 3) Flow boundaries-physical and hydrologic

CONFINED AQUIFERS

Aquifer	Region	Method	Criteria - Minimum Value
Alluvial valley	1) Control Zone 2) Special Protection 3) Protection	1) 100-ft. radius 2) Analytical method 3) Hydrogeologic mapping	1) Distance-100 ft. 2) TOT -3 years 3) Flow boundaries-physical and hydrologic
Bedrock	1) Control Zone 2) Special Protection 3) Protection	1) 100-ft. radius 2) Analytical method 3) Hydrogeologic mapping	1) Distance-100 feet 2) TOT-10 years 3) Flow boundaries-physical and hydrologic

D. (Include this information in report as STEP-3, entitled "INVENTORY")**

1. Have all potential contaminant sources been inventoried?______________yes
2. Has the inventory method been described?________________yes
3. Are potential contaminant sources shown on the base map?____________yes
4. **(**the source number on each individual inventory sheet should correspond to the same number at the correct location on the base map)**
5. Is the contaminant inventory included in proper format?______________yes
6. **(**append your SWP plan with copies of the inventory sheets)**
7. Has annual update schedule and method been described?______________yes

8. Has a susceptibility assessment been completed?________________________yes
9. For organic chemical monitoring waiver application purposes, have you: -identified **all** land uses within the one mile radius including road right-of-ways?_____yes

E. (Include this information in your report as STEP-4, entitled "MANAGEMENT")**

1. Are SWP management methods described by region?______________________yes
2. Is schedule for management option implementation included?_____________yes
3. Is a list of the persons who will manage the SWP area included by name and position title?____yes
4. Are the specific responsibilities under the SWP plan of these persons described?___ ____yes
5. **(**Include a list with names, positions, addresses, phone numbers, and specific SWP responsibilities)**
6. Are any necessary agreements or Memos of Understanding included?______yes
7. Are goals of SWPP described?___________________________________yes
8. Is a schedule for evaluating success of implementation included? _______yes

F. (Include this information in report as STEP-5, entitled "EMERGENCY PLANNING")**

1. Is an emergency plan included?__________________________________yes
2. Is an emergency coordinator listed?_______________________________yes
3. Are the procedures to coordinate with other emergency response agencies included? ____yes
4. Have procedures to communicate the emergency to users been described?_yes
5. Have written procedures been included that describe how to shut down or isolate a threatened or contaminated well?_____________________________yes
6. Has a source of temporary or emergency water supply been described?____yes
7. Is a transportation method for an emergency supply described?__________yes
8. Have disinfection methods been described?__________________________yes
9. Is a method to distribute emergency water described?___________________yes
10. Have procedures to decontaminate the distribution system been described?yes
11. Has a funding method for emergency water been described?_____________yes

Explanation

3.6.5. Exactly what do I need to do to complete Step 6?

- Publicize the status of your SWP effort.
- Compile all your SWP information.
- Complete the SWP checklist.
- Fill in any necessary missing data.
- Do final check of SWP plan against checklist.
- Submit plan to DEQ for review.
- If plan review indicates data missing, adjust plan and re-submit to DEQ.