Iowa SOURCE WATER Protection

GUIDEBOOK

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Introduction

The Iowa Source Water Protection Guidebook, along with the Source Water Protection Workbook, is meant to help a community proactively address drinking water quality and quantity concerns. The term "source water" is used to define drinking water in its original environment, either at the surface or below the ground, before being treated and distributed by a water system. The concept of source water protection is that carefully managing the land which drinking water travels through leads to increased natural water quality and better protection of the resource (see diagram below). These protection efforts save the community money through less treatment and less likelihood of well replacement. Also, these efforts will decrease the likelihood of a catastrophe, such as a contaminant spill, taking away your water source.

In Iowa, source water protection is voluntary, but there are numerous benefits and incentives for water systems to try to protect their water supply. Besides the obvious cost of treatment or finding a new source, the state might decrease regulated monitoring, offer grant opportunities, and offer less frequent sanitary surveys. This guide was written with the intended audience being a full-time city water operator or employee, but the steps involved can be used by anyone in the community that has an interest in protecting their drinking water.

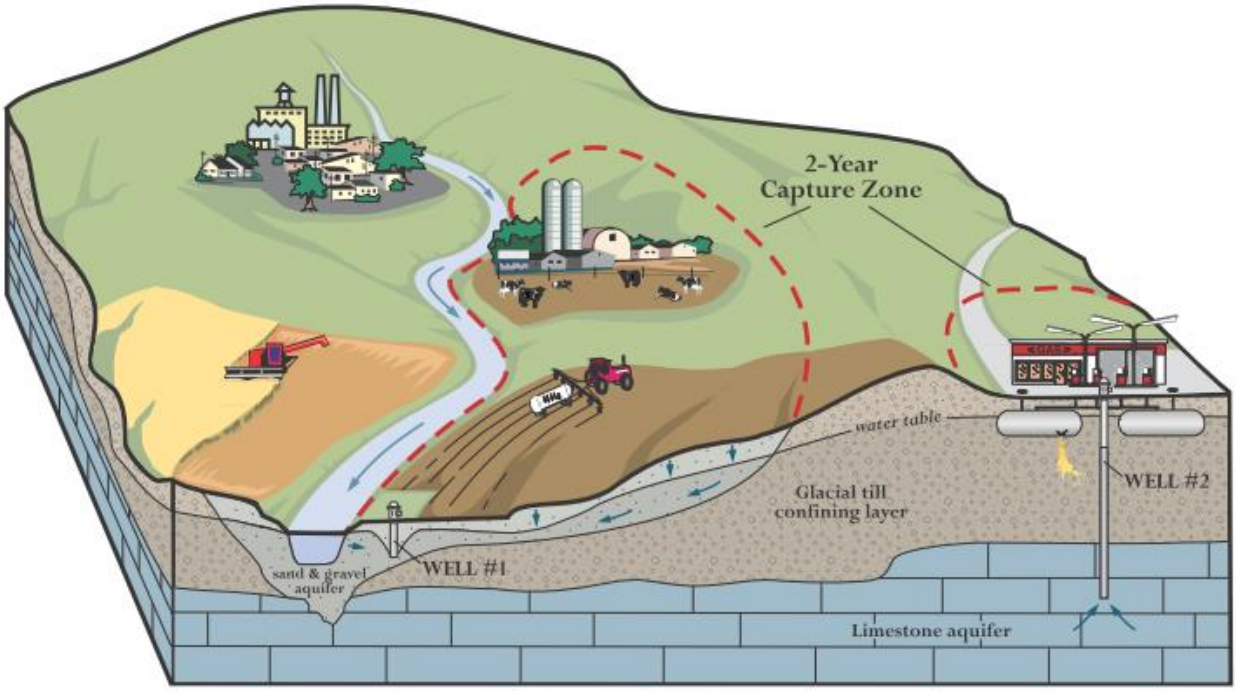

Diagram of two different source water aquifers and associated surface areas (2-year capture zone) from two wells.

By going through this guidebook our hope is you will understand the details of the steps needed for source water protection in Iowa; where you can go for assistance, and what information is available. Each of the seven steps listed in this document are vital for increased confidence that your water will be safe and plentiful for years to come. Provided in this guide are examples, lists of potential contacts, and helpful tools to make your job as easy as possible. In conjunction with this guidebook the source water

program also has a workbook with forms and templates available for you to use. Whenever you see a ***[. Worksheet X.X]*** there is an available worksheet to help you in the Source Water Protection Workbook. There are also numerous resources available online from the Iowa Source Water Protection Program, many of which will be referenced in this document.

We recognize that all public water supplies are unique, and that your system may have special needs not addressed in this guidebook. If you feel that is the case for you, feel free to contact us for additional support at 515-725-8343.

Source Water Protection Plans and implementation are promoted and monitored in Iowa by the Source Water Advisory Group (SWAG). This group of public and private stakeholders reviews plans and implementation efforts by each community in Iowa. The list of entities in SWAG are provided on ***. Worksheet 7.1***, and are available to contact if a specific question arises in your source water protection efforts. The SWAG strongly encourages all Iowa communities to submit a plan when they are completed. The SWAG will then either approve your plan, or send it back with specific recommendations to help improve it. To assist you in knowing what the advisory group will check for, every major task has a checklist associated with it. If all of the items are checked, chances are that your plan will be accepted.

There are a total of seven steps listed as keys to source water protection in Iowa. All seven of these steps are essential and required for a proper Source Water Protection Plan. Although these are listed in a specific order, there will be plenty of interaction between these steps as a source water plan takes shape. For example, you might notice in step 3 (contaminant source inventory) that there is a landowner who takes a majority of space in the source water area. That land owner could then be brought into the source water team (step 1) to help with your community's protection efforts.

Depending on your community, each of these steps will vary considerably in length and effort required. For example, some communities might have a motivated population and desire to join a source water team; many others will have more difficulty getting local people involved. However, successful plans will have made progress in each of the seven areas. The seven steps are briefly discussed below.

Step 1: Organize a source water team

A motivated and knowledgeable source water team is essential to get the ball rolling on protecting your drinking water. The source water team will guide the development of the plan, and decide which areas should be the most important and addressed accordingly. Most decisions, consequences, funding, and work will happen at the local level and require substantial input from community leaders, landowners, and activists.

Step 2: Identify your source water areas

Without a proper understanding of the area your drinking water comes from, there is little you can do to protect it. In Iowa there are numerous types of surface and groundwater sources available to communities, and each can change with different pumping rates and geologic/surficial conditions. The Iowa Department of Natural Resources has completed source water areas in the 'Phase 1' assessment.

These assessments are available online from the Source Water Tracker application. These source water areas were made using the best available science at the time, but depending on your situation your city might opt to define its own source water area.

Step 3: Inventory well and contaminant sources

All potential contaminant sources, and potential conduits such as wells, need to be thoroughly tracked and inventoried for a successful Source Water Protection (SWP) Plan. Having an accurate and thorough potential contaminant source list is the foundation for better source water protection. With the recent advances in availability and reduction of cost for Geographic Information System (GIS) software, hardware, and coverages, the tools available to any community for easily inventorying wells and contaminant sources have grown substantially over the past decade.

Step 4: Assess and rank contaminant sources

Not all potential contaminant sources are created equally. All potential contaminants should be carefully assessed and compared to other contaminants in the source water area. We also have the benefit of history to help us with assessments. Structures such as leaking underground storage tanks and fertilizer storage bins have understandable life spans, and often enough information is gathered about them to predict how the contaminant could affect your drinking water source.

Step 5: Develop an action plan

The action plan gives a list of activities for a community to perform to protect its source water area, and a timetable for each specific item. The action plan will be different for each community, but it is important that the highest ranking contaminant sources addressed in step four get adequately addressed in the action plan.

Step 6: Construct or update your emergency response plan

In Iowa, every community water supply over 3,300 people is required to have an emergency response plan. Although not directly related to protection of source water, these plans are essential to help a community respond quickly to an emergency, such as floods, chemical spills, main water break, loss of electricity, etc. Many communities have benefitted from having a well thought out plan when a disaster occurred.

Step 7: Submit and Implement your SWP Plan

Without implementation, a source water plan is just an exercise in imagination, with no real protection taking place. For this reason, the Iowa Source Water Advisory Group has started to monitor implementation efforts using a benchmark called ‘substantial implementation’. Substantial implementation occurs when a community has proven that it’s made enough effort to protect itself from future problems. Typically this entails addressing the top contaminants or issues addressed in the action plan (Step 5).

Inherent in a proper source water plan is the need to periodically revise and update several of the key steps. For example, if your community decides to drill a new well or build a new reservoir the source water area may change drastically, with old potential contaminants becoming no longer an issue as new potential contaminants arise. Also changes in pumping, infrastructure, and knowledge can have profound effects on your source water plan.

We're here to help

The Iowa Source Water Protection Program, and the dozens of communities that have already gone through source water protection planning and implementation, are valuable tools to help assist you in your goal of protecting your drinking water. You can find information on these communities through the online Source Water Tracker Database. This database houses Source Water Protection Plans, groundwater investigations, contact information, and many other SWP efforts that communities have gone through to protect their drinking water.

Pre-Planning

Before starting the source water protection process it is important that some time and effort are put into understanding your water system's infrastructure and some basic essentials of surface and/or groundwater movement. These efforts should occur before beginning the steps to a successful SWP Plan, and are designed to help with understanding the basic science and history of your system. For this reason, we recommend reading the following documents (***. Worksheet 0.1***):

- **Your community's "Phase 1" Source Water Assessment**. These are available free of charge from the Source Water Tracker application. This report details the general step-by-step process of generating a Source Water Protection Plan, the fundamental source water principals, along with your source water area, listing of all state and federally known potential contaminant sources, your community's susceptibility ranking, and consumer confidence language. Included in the document is a map of your water source and tables of the above information.

- **Your last sanitary survey**. These reports are completed roughly every 2-3 years by a regional field office of the Iowa Department of Natural Resources. This is also available online from the Source Water Tracker application. These reports give information on the water source, water wells, some history of the supply, and contacts for the water operator.

- **Iowa's Groundwater Basics**. If your system uses groundwater (like the majority in Iowa), a copy of the book "Iowa's Groundwater Basics" will help you understand the fundamentals of groundwater movement and common sources and extents of Iowa's aquifers. This book covers all of Iowa's major aquifers, plainly details basic groundwater information, and has examples of source water efforts. Hard copies are also available at no charge from the Iowa Geological Survey.

The documents above are easily accessible to anyone with an online computer, but there are also many paper documents that could help with understanding the history of your drinking water supply. Many communities in Iowa are now over 150 years old, and the water system/wells used by the community can be almost as old. Finding out the history of the wells, water usage, and various spills can be very useful in determining what can happen to your system in the future. If, for instance, your community has had one well for nearly a century, efforts might switch to planning efforts on the best location and protection options available for your community. History of a water supply is often located in paper files in the water operator's office and/or city hall. Additionally, some aspects of well and system history is available online from the Source Water Tracker application in the form of well records, Iowa Department of Natural Resources (IDNR) sanitary surveys, and if you are a city, municipal water supply inventory (MWSI) files.

Geographic Information System (GIS) Technology

For more computer-savvy individuals there is free GIS software, online tools, and statewide coverages custom made for the source water program. While not required for a successful source water plan, having GIS maps of your local wells, source water areas, and potential contaminants is a powerful tool to assist in visualizing your community's water system infrastructure, potential contaminants, and source water area. The Iowa DNR Source Water Protection Program has a GIS Resources webpage that communities may find helpful.

The following are examples of GIS software and coverages we feel can be used for source water planning (***. Worksheet 0.2***).

- **GIS Software.** ArcView and ArcMap from ESRI are the standard for GIS desktop computer presentation and manipulation. These programs display, manipulate, and edit most types of geographic information, no matter what the extension or projection. However, although useful, we understand the software can be quite expensive for a small community. Fortunately there are also free programs available that display the same data, though without all of the bells and whistles available in ArcView or ArcMap. ESRI also offers ***ArcExplorer***, a free tool that you can download and view existing GIS coverages. ArcExplorer offers the ability to manipulate graphics and layers for your system, but does not have the editing capabilities to do such things as move potential contaminants from a wrong location.

  For editing as well as viewing GIS, the two most commonly used free versions are ***Quantum Software*** and ***MapWindow***. Many other GIS software packages are available, and there are also tools for converting GIS layers into the more traditional CAD format. Here is a comparison of geographic information systems software.

- **GIS Layers.** There are many GIS layers available to help you with locating wells, local land-use, facilities, historic spills, etc. All of the layers below can be found through Iowa's NRGIS library. Some of the major examples are listed below:

  - **Source Water Wells.** A spatial coverage of public wells in Iowa, including depth, geology, and hydrology. The coverage includes links to Iowa's geologic database (GEOSAM).

  - **Source Water Areas.** A statewide two-dimensional coverage of areas contributing water to a public water supply. The coverage lists technical information on the date of the area's delineation and hydrogeologic properties/assumptions that were made when completing the delineation. The coverage is also linked to an online source water database.

  - **All Contaminants.** A spatial coverage of all federal and state monitored potential contaminants as a "point" coverage (not 2-dimensional). The coverage includes Leaking Underground Storage Tanks, Air Permit facilities, wastewater treatment facilities, spills, etc. Hyperlinks to online databases are included when available.

- **All Wells. A s**tatewide coverage of all known wells in Iowa. The coverage includes registered abandoned wells, public wells, geologic points, and private wells. Hyperlinks to respective databases are included when available.

The above are commonly used GIS coverages specifically designed for source water protection. Your community might have other specific needs not addressed by the above layers. The NRGIS library has many more layers available, including historic air photography going back to the 1930's, soil coverages, historic land use, high-resolution statewide elevation (i.e., LiDAR), and many more. Please search the NRGIS library for any layer you feel might fit your community's needs.

The GIS layers associated with the source water program are available through an online mapping tool called the "Source Water Mapper". This application is meant to be used as an easy method for publishing assessment, or Phase 1 data to the public. All information is hyperlinked to the associated database or online resource.

If you have read and researched the above information, then you have a great head start on getting a handle of your community's drinking water. Once you have this information it is important to get other people involved, as source water protection is a community effort. The next chapter covers how to best select a community source water team that will be knowledgeable and proactive in protecting your water supply.

Step 1. Organize a source water team

Your local Source Water Protection (SWP) Team will guide the development of the source water plan, and more than likely oversee implementation efforts once the plan is approved. Having a knowledgeable, motivated and effective team is one of the most important aspects of source water protection. Every community has different types of citizens that would be the best fit. Also, the number of participants in a SWP Team will vary greatly depending on the location, size and source of water used for your supply. Typically we find that 5-7 people is a good size for a team; it isn't so large that scheduling hassles regularly arise, and it isn't so small that important constituents are left out. Depending on the size of your community, however, you may feel the need to increase or decrease this number.

Although every SWP Team is different, there are a number of people we feel are integral to a successful SWP Plan and implementation. The following members for your local team are strongly suggested:

1) **Your local water operator.** Your community's water operator knows your water system. Many have been around for a long time and also have a historical perspective on past wells, pumping levels, system infrastructure and land use changes. Often the water operator is also a member of your community, and can have important historical knowledge of your town and/or community.
2) **A local city and/or governing representative.** Your community representatives are important to enact any local policy changes/ordinances that your source water team deems necessary. Also, having a local governing representative makes sure that your community leaders understand what is happening for source water protection.
3) **A land owner/business operator within the source water area.** Having a local business leader/land owner from the source water area is important due to the fact that most implementation efforts, land use changes etc. typically include the local businesses and land owners within the capture zone. They also bring an important perspective to the table regarding regulation and ordinances.
4) **Iowa Department of Natural Resources Field Office representative** (for inaugural meeting). The local Iowa DNR Field Office representative can be very useful for informing your community on what other source water efforts have occurred in your region, what success and obstacles they faced, and how each system has dealt with it. Also the local DNR representative can have historical information on your system.

The development of a good SWP Plan doesn't require any assistance or involvement of an engineer or consultant. However, most often we find that municipalities do not have much experience with these kinds of projects, and you may find it useful to contact an outside entity for assistance. Additionally, the Iowa Rural Water Association provides experienced source water consultation and assistance for developing SWP plans at no charge to the public water supply. The Iowa Association of Municipal Utilities can also help with source water plans.

It is important to represent a wide range of stakeholders in your SWP Team. If the right stakeholders are not involved from the very beginning, often any efforts for implementation will be met with roadblocks and difficulty later on. We feel that the local water system should generally take the lead in identifying the appropriate members as typically the water supply knows the businesses and people best to get the maximum out of your source water team. Additional suggested people for a team include local business leaders, local historians, educators, farmers, extension service staff, county sanitarians, non-profit environmental groups, land conservation groups and citizens. A list of contacts for various local, county, regional, and state-wide groups that could be included on your SWP Team are in ***. Worksheet 1.1***.

When forming a SWP Team, it is also important to look at your source water area. In some cases, the public water system doesn't have the legal authority over the area that needs to be protected. For example, recently many communities have moved their well fields from the middle of the city to a farm field adjacent to a stream or river, and surface water systems can have watersheds that comprise entire counties, or have regions that extend outside the state of Iowa. Once your SWP Team has been decided, write it down in ***. Worksheet 1.2.***

One of the first tasks of a local SWP Team is to understand source water basics, and establish a vision and goals for the community. The very first meeting is essential to communicate these to the SWP Team. ***. Worksheet 1.3*** is a sample agenda meant to help with meeting preparation. We recommend you contact the Iowa DNR at 515-725-8343. IDNR staff will work with you on presentations on the fundamentals of groundwater/surface water movement and how contaminants can move to a well or intake. Also, contacting the IDNR will give them the opportunity to review the 'Phase 1' source water assessment for your community, which may or may not be outdated.

Establishing proper goals and timelines for your community is an essential aspect of your SWP Team. For example, if your community wants to improve the quality of its source water over time it is important to set various benchmarks for implementing the land use changes to improve the water, then monitoring the quality of water afterwards to see the benefits. ***. Worksheet 1.4*** includes a draft timeline. In Iowa, a constant concern is high levels of nitrate in young water (surface or near surface). The goal of decreasing nitrate concentration in specific wells is often long-term, but including that in the source water timeline is important to measure changes and improvements. Other goals such as public education, research, and contaminant source inventories might be easy to address, but it is nonetheless important to include them.

During and after each meeting, write down the minutes and meeting attendees (***. Worksheet 1.5).*** Having a written record is important, especially when months can go by before every important SWP Team member will be able to attend a follow-up meeting.

Once your community's water system history, issues, and concerns are known, (not always done in the first meeting!), make an inventory (***. Worksheet 1.6***). This can be used to better strategize methods and resources in the future of your SWP Plan.

Finally, informing the general public about the happenings and accomplishments of your local SWP Team can help promote and grease the wheels for later implementation efforts. Also, it is extremely critical that citizens know how their local land affects the quality of their drinking water. Activities such as applying pesticides, fertilizing lawns, and improperly disposing oil might not seem to have large impacts on drinking water quality, but every little effort helps. Developing a long-lasting relationship between a community's citizens and their drinking water staff and supply leads to multiple benefits down the road.

SWP Plan Components that should result from this step:

- Source water team members
- SWP Team roles and responsibilities
- SWP timeline and goals
- SWP Team Issues and Concerns
- Scheduled meetings
- Methods to involve the general public

Source Water Plan Checklist for Step 1:

- ☐ Source Water Team member names and affiliations
- ☐ Source Water Team member roles
- ☐ Source water team meeting times and locations
- ☐ Source water timeline and goals for your community

Step 2. Identify source water areas.

Identifying your source water area is the most technical of all the source water protection steps, and usually will require a groundwater professional and/or hydrologist to complete. Fortunately in Iowa most community water systems have already had the source water area defined free of charge by the Iowa DNR. All source water capture areas are available from the Source Water Tracker application through the 'Phase 1' source water assessment report. If for some reason your community is not included on the list, be sure to contact the Iowa DNR to request a completed report. GIS coverages of public water system capture zones are also available on Iowa's Natural Resources GIS library.

In general, most source water areas in Iowa are modeled using the 2-dimensional analytical element (equations) method (Visual AEM), but can include more complicated 3-dimensional models such as MODFLOW. Analytical element models divide the area to be modeled into cells and assign flow directions and rates to each cell based on the characteristics of the wells and aquifer. In certain circumstances where there is a lack of data, a fixed radius circle of 2,500 ft. (400 ft. for systems determined to be non-community) is used instead of a groundwater capture zone to represent the source water area. Below are the major types of source water areas delineated in Iowa:

- **Karst (one-mile radius) area**. If your source aquifer consists of highly fractured and porous bedrock which allows water and contaminants to migrate over a large distances rapidly, you'll likely have a 1-mile 'karst' delineation. The one-mile circle assumes that groundwater and contaminant sources located within this radius can potentially migrate to your wells very quickly.

- **2,500 ft. radius area**. These source water areas typically are used when there is little information about a community well and/or aquifer. When parameters such as well depth, construction, or hydrogeologic properties are unknown a fixed radius of 2,500 feet is delineated around each active well. This distance is the minimum required by the state's Source Water Protection Program and assumes that groundwater and contaminant sources located within this radius can potentially migrate to your well. The Iowa DNR can provide a more precise source water area if the appropriate well data is provided to them.

- **400 ft. radius area**. These source water areas are derived in the same way and for the same reasons as the 2,500 ft. radius circle, but are smaller due to the fact that the water supply is not designated as a community water supply. The 400 ft. circle assumes groundwater and contaminants located within the radius can potentially migrate to your well. The Iowa DNR can provide a more precise source water area if the appropriate well data is provided to them.

- **Hydrologic boundary**. In an alluvial setting, when the surface area of the alluvium is too small and restricted by glacial till at the valley walls to contribute a computer-modeled time of travel, then a hydrologic boundary is used for the source water area. Typically, several assumptions about the limits of the aquifer are made when delineating the hydrologic boundary. In Iowa, this usually includes using the estimated extent of the alluvial aquifer to the valley walls where it contacts the glacial till and the river as boundaries.

- **Surface runoff area**. If a water supply has a surface water intake, or a well in a shallow aquifer, a surface runoff area is added to the source water protection area. The surface runoff area is typically the watershed above the intake or well next to the stream. The area used for this could be as small as the area surrounding an intermittent stream to an entire river watershed.

- **Modeled capture zone**. Computer models are used when there is sufficient information about wells, the aquifer, and pumping conditions to estimate your source water area. Computer models use characteristics of your source aquifer that describe how water moves through it including porosity, flow gradient, and hydrologic conductivity along with well pumping rates to trace water flow through the subsurface. For most water supplies the source area is divided to show the estimated areas of groundwater flow during 2-, 5-, and 10-year "time of travel" periods. These source water capture zones are typically estimated using the two-dimensional analytical element model (Visual AEM), but when detailed information is available, a three-dimensional model such as MODFLOW may be used instead.

The specific method of delineation is given in your community's 'phase 1' assessment report. If a model was used, precise parameters needed for the model, such as aquifer information and system pumping data are also provided.

There are a couple of important characteristics of source water areas to consider. All are described in the phase 1 assessment, but will be briefly mentioned here. The first is that the area shown on the map is actually three-dimensional. It may either be at the land surface or buried beneath geologic confining layers. The depth to the aquifer may range from a few feet up to thousands of feet. The second is that modeled areas inherently have a "time of travel" for the movement of water. Time of travel is important because movement of water through the hydrologic cycle, if given enough time, will include the entire planet Earth. In Iowa, we typically use a 2-, 5-, and 10-year time of travel periods for our models. A ten year period was chosen on the upper end to reflect the fact that many systems will typically use wells for about that amount of time before significantly changing pumping, shutting down a well, or drilling a new well. The ten year limit also reflects inherent uncertainties with longer travel periods in aquifer property estimations.

Other areas besides the designated source water area in the Phase 1 assessment report should also be included in your planning efforts. This includes the 200-foot 'zone of control' required by the Iowa DNR for community wells that have been in existence since 1979. The 200-foot zone of control is the area where the community should have direct ownership or legal control of the land around the well. The ownership should preclude potential contaminants such as leaking underground storage tanks, and businesses that store or use harmful chemicals from buying land near the well. Other regulated 'setback' distances exist for categories of potential contaminant sources. ***. Worksheet 2.1*** lists setback distances for 'deep' and 'shallow' wells as defined by the Iowa Code. Both of the 'zone of control' and 'setback distance' requirements are state regulations, though often not followed by many Iowa communities.

Another common source water area designation includes "under the influence of surface water". This designation is often used for alluvial wells located near a stream, or a river that may serve as a source of

direct recharge to the groundwater used directly by the well field. In this situation, surface water areas are often included with the groundwater area. These are delineated using the latest topographic maps, or more recently LiDAR high precision elevation data. Surface water areas are the most likely path rain and surface water will take to get to a stream before becoming groundwater. The checklist for your community's source water protection areas is on***. Worksheet 2.1***.

Many communities in Iowa have opted to have their source water area defined by a third party, instead of using the basic two-dimensional model (Visual AEM) provided by the SWP Program. There are many reasons for this approach, including complex geology, water quality issues, or highly variable pumping schedules. If your community would like to have a more extensive model done for its source water area, feel free to contact a trusted engineer or the source water program at 515-725-8343 to find a 3rd party solution that best fits your needs.

Another characteristic of the source water area, included in the phase 1 assessment, is the "susceptibility" of the source aquifer to contamination originating from the land surface. The determination of susceptibility recognizes that certain aquifers are better protected than others. Research has shown that subsurface layers that impede the movement of water, such as clay, till, or shale, can be used to estimate the probability of contaminants entering the aquifer. For this reason the source water program has designated four categories of susceptibility based on the cumulative confining layer thickness above the aquifer (below).

Confining layer thickness	**Susceptibility designation**
<25 feet	Highly susceptible
25 to 50 feet	Susceptible
50 to 100 feet	Slightly susceptible
>100 feet	Low susceptibility

Besides geology, another important tool to use to determine your source aquifer susceptibility to surface contamination is water quality, specifically nitrate. In Iowa, nitrate at the land surface is nearly ubiquitous due to the amount of fertilizer used for agricultural production. Nitrate is also sampled in all public water supplies in the state on a regular basis providing a large number of results to evaluate. Because nitrate is used as a food source for plants and bacteria near the land surface, nitrate concentrations tend to decrease with increasing water depth and aquifer protection. For these reasons nitrate-N concentrations are often useful to determine how much surface water is entering your source water aquifer. If values are close to 5-10 parts per million (ppm), there is a high likelihood your source water has recently entered the aquifer, or can be said to be, young, and your well(s) are susceptible to surface pollution. Finally, a number of water supply systems use two or more aquifers that may have different susceptibilities. These supplies may find it advantageous to prioritize their efforts to protect the source water area that is most susceptible. A checklist for your community's susceptibility ranking is on***. Worksheet 2.2.***

SWP Plan Components that should result from this step:

- Source water area map
- Zone of control map
- Active well table

Source Water Plan Checklist for Step 2:

- ☐ Source Water area delineation map
- ☐ Source Water area susceptibility

Step 3. Inventory of well and contaminant sources.

Besides implementing the plan, collecting a proper inventory of land use, wells, and potential contaminant sources can be the most time intensive of the seven steps. A full potential contaminant and well inventory identifies all contaminant sources, conduits, and land uses within the source water area. Inherent in the inventory is a map showing the location for each site, and a table that identifies the owner, type of facility, chemicals stored, and if needed, history of the site. Many of the potential contaminants are listed in the phase 1 assessment, but there will no doubt be plenty of changes to the list as you get involved with updating and personalizing your source water inventory. Feel free to use the embedded tables given in the phase 1 report as a template for updating your potential contaminant source list.

Before you start your inventory, you need to know what are considered potential contamination sources and the land uses that they might be associated with. Most drinking water contaminant sources are from activities or objects that contain a chemical, or a mix of chemicals, that can be harmful to ingest. Please look at ***. Worksheet 3.1*** for a list of the more common potential sources of groundwater contamination. These sources include both point (i.e. gas tanks) and nonpoint (i.e. row-crop) inputs. This list is not an all inclusive list for every potential source of contamination to your drinking water. There are many other sources of contamination, too numerous to list in one document. If you have any questions about potential contaminant sources, feel free to contact the Iowa Source Water Protection Program.

In addition to the identification of direct pollution sources, identifying pathways for contaminants to enter the groundwater is also very important. Worksheet 3.1 also lists the structures that can act as conduits that accelerate contaminant entry into the groundwater.

Of particular concern are improperly abandoned wells, as they can provide direct access from the surface to your drinking water source. During the field inventory, any structure that might act as a pathway for contaminants should be identified. This information is essential to developing proper management strategies for the source water protection area.

In Iowa, nonpoint sources of contamination are a prevalent concern for drinking water quality. Fertilizers, chemicals, and manure spread on row-crop agricultural land can infiltrate to your water source, especially in a highly susceptible or shallow aquifer. If a majority of your source water area is in row-crop, or if you've had a history of nitrate contamination in your drinking water, be certain to investigate nonpoint sources as possible contaminants.

Online resources for conducting your contaminant source inventory

Often there is information available on the web from different federal, state and local entities. The Iowa DNR has a number of online resources that list potential contaminants and conduits. Below are some of the more useful online sources. A checklist of the resources below is available on ***. Worksheet 3.2.***

- **Iowa Source Water Mapper** application is designed to show spatially, an online version of your community's phase 1 report, including the inventory of wells and contaminants listed in the tables. The website lists most major programs and contaminants, with detailed location information throughout the state and links to existing databases. The application also has direct links to many of the online databases listed below.

- **Facility Explorer** is an online, spatial data warehouse that brings together core information in one place for easy access by the public. Information in Facility Explorer ranges from contaminant sources, wells, Field Offices, to parks and recreation areas.

Other online databases for specific potential contaminant sources in your source water area:

- **Contaminated Sites online database** connects to online documents and historical information for many of Iowa's point sources of contamination. You can search by city, program, and county to find specific sources in your area.

- **Leaking Underground Storage Tanks** for gas and diesel fuels have been a major concern for contamination of drinking water supplies. Many of these sites can be found on the DNR's link.

Links for potential wells and pathways:

- **GEOSAM** application houses well construction, geologic and hydrogeologic information for wells drilled in Iowa with well cutting samples that were submitted to the Iowa Geological Survey.

- **Private Well Tracking System** allows County Sanitarians to enter private well construction, pump test, and geologic data into an online application.

The links above are useful tools in starting to inventory the potential contaminant sources and wells in your source water area. However, these online resources do not represent a complete listing of every well and contaminant source. Be sure to check with your community and people that know the history of your area to get a more complete understanding of all the potential contaminant sources. Local, county government offices often have paper files concerning facilities which could provide data on historical or current potential contaminant sources. These data can be found in documents such as construction permits, Material Safety Data Sheets (MSDS), environmental spill files, environmental impact studies, city or county assessor files, zoning records, business licenses, maps and plats, disposal permits, emergency plans, Natural Resources Conservation Service and Farm Service Agency records, and other historical records. Most of these records are readily available in your city hall and can help describe and locate possible contaminant sources.

Verification of the data by the SWP Team is essential. Locations of all known potential contaminant sources should be entered onto the source water map in the back of the Phase I report before the inventory process begins. The map will be the major source of information for known potential contaminants that the SWP Team will have available to them during the inventory process. After the SWP Team feels confident that the list is complete, inventory all available wells and potential contaminant sources. In addition to the maps, all available information pertaining to known potential contaminant sources within the source water area should be collected. This information will be very helpful in conducting a field survey on each of the potential contaminant sources.

Conducting a field survey

Although online resources and government databases are an important tool that can save time and effort on searches, one of the best ways to get information about potential contaminants in your source water area is to get out and do a field survey. For this reason a Field Survey Form is included in ***. Worksheet 3.3.*** The purpose of the field survey is to identify high-risk land uses and activities within the source water protection area, confirm the location and type of potential contaminant sources that were previously identified, find additional potential contaminant sources, and identify all potential pathways for contaminants to enter the aquifer.

Depending on your community, the field survey can be done by the entire SWP Team, or just a few knowledgeable individuals on the team. In general the Local Fire Department may be of great help in determining the location of some of the major contaminants. The members of the team all bring different expertise to the inventory process. You will want to develop a strategy to take advantage of this diversity. For example, persons with historical information about certain sections of a community might be assigned to those areas. Members of the business community might be better utilized in areas zoned for business purposes. Persons in the agricultural sector might be better at identifying risks in that setting than would some other people. You should design your inventory to take advantage of the diverse background of your SWP Team and maximize the available resources.

The intent of the field survey is to get details about potential contaminants. It's designed to provide enough information to make informed decisions about ranking the potential contaminant sources and the best management practices needed to address them. To do this, the field survey forms should be filled out as completely as possible. A unique number should be assigned to each site, the location of that site identified on the field survey form and the map; owner name, if known; description of the site including a sketch map; and any unusual conditions that can be easily observed (for example: leaking barrels, bare soil, oil spills, etc.). These forms, along with historical information and information in the phase 1 report will be used in the next step to assess and rank the sites for best management practices and implementation for the SWP Program. Properly completed field survey forms make the prioritization process easier and more effective.

It is important that the top businesses, farms, schools, etc. that form the potential contaminant source (PCS) list are included in the Source Water Planning Process. They are a vital component in addressing

what can be done for implementation efforts later on in the process. For this reason, ***. Worksheet 3.4*** is a form for the list of PCS stakeholders.

SWP Plan Components that should result from this step:

- Source water potential contaminant source inventory
- Source water well and conduit inventory
- Source water landuse inventory
- Source water field surveys
- Map of potential contaminants/wells
- Table of potential contaminants and wells

Source Water Plan Checklist for Step 3:

- ☐ Inventory of contaminant sources and wells
- ☐ Map of contaminant sources and wells
- ☐ Map of recent landuse in the source water area

Step 4. Assess and rank contaminant sources

Once all the wells, land uses, and potential contaminant sources in your source water area are identified and inventoried, the next step is to estimate the risks posed to your water supply from each source. A systematic evaluation of the relative risk of contamination from each source identified in the inventory will allow the team to determine which potential threats are greatest and which source water implementation efforts should be considered first. A good risk assessment is the best basis for setting priorities to manage your source water area and protect your water supply.

In Iowa, the source water program has designed a statewide source water assessment and ranking system that is included in the phase 1. Your community may choose to use this ranking system, but is under no obligation to do so. The statewide source water program ranking system includes the following factors:

1) location of the potential contaminant source in the source water area,
2) susceptibility ranking of the aquifer to contamination, and
3) type of contaminant source.

The general equation for 'risk' to your source water area is:

(location) + (susceptibility) + (contaminant risk) = source water risk ranking

Points are assigned for each category and a cumulative score calculated for each potential contaminant source using the scores for each of the three components. ***An important caveat for the phase 1 assessment is that 'nonpoint' source contamination, and conduits such as abandoned wells and sinkholes are excluded from the ranking system in the report.**** This was due to the low precision of information used for the statewide GIS coverages (e.g., 2002 landuse is a 30*30 m grid, larger than many source water areas). To have an accurate assessment in your SWP Plan, your community will, more than likely, need to include those constituents in the ranking system.

1) Location of potential contaminant sources

Potential contaminant sources are ranked from 1-3 based on the source water area that they are located in, with the higher number associated nearest the well/intake. Source water areas were given greater weight based on proximity to the well. Fixed radius capture zones also received greater risk as they represent unknown or poorly known hydrogeologic conditions. The table below shows the risk score assigned for each source water area:

Delineation	Risk score
2-year time of travel	3
5-year time of travel	2
10-year time of travel	1
Hydrologic boundary	3
Surface runoff area	1
fixed radius (400;2,500-ft)	3
One-mile karst radius	3

2) Aquifer susceptibility to contamination

Due to the fact that many communities in Iowa use more than one aquifer as their water supply source, susceptibility was included as a way to prioritize changes for specific aquifers. Susceptibility rankings were given scores to give more priority to aquifers with less confining layers and therefore 'newer' water. Aquifer susceptibilities were given ranks of 1-4, from low susceptibility to highly susceptible.

3) Contaminant risk

Contaminant risk combines the potential for different facility classes or land uses to release contaminants with an estimate of the toxicity of the contaminants that may be released. Land-use risks are assigned values from 1 to 5 (least to greatest risk). . ***Worksheet 4.1*** shows the risk score used in the Iowa phase 1 assessments, from the Iowa Source Water Protection Program.

If your community doesn't want to use the Iowa statewide list, a very general approach to estimating risk can be based on a simple grouping of potential contaminant sources into categories of low, moderate or high risk. While this kind of approach is fairly broad, it may give a reasonable basis for initial prioritization in situations where detailed background information and technical expertise is lacking. If you choose to make your own contaminant risk guide, . ***Worksheet 4.2*** can be used to estimate risk using whichever method best fits your community.

There are more sophisticated systematic risk assessment methods available to evaluate the various risk factors and arrive at a numeric score for each pollution hazard. Some methods are better suited for assessing the risks posed by a variety of sources; others focus on evaluating risks from a single source. For information on contaminants that may be found in drinking water, visit the Environmental Protection Agency.

Whichever method your SWP Team decides to use, a final ranking of each contaminant should be the last step in this process. This ranking will determine where to focus your "action plan" efforts, and can help determine the extent and location of outside funding. . ***Worksheet 4.3*** is a form you can use for determining your communities priorities.

SWP Plan Components that should result from this step:

- Assessment and ranking of potential contaminant sources within source water area
- Process used for assessment and ranking of potential contaminant sources

Source Water Plan Checklist for Step 4:

- ☐ Ranking for all potential contaminant sources, including nonpoint and conduits

Step 5. Develop an action plan

In steps 3 and 4 the SWP Team completed a potential contaminant source inventory and ranked them according to the risk each poses to the community's drinking water supply. In this step, the SWP Team will develop an action plan that determines methods for handling the threats posed by each major potential contaminant source. The action plan will vary widely for each community based on the source water area, contaminants, and the level of risk they pose to the drinking water source. However, if the overall goal to reduce or mitigate the potential of the identified sites to contaminate the community's drinking water supply is kept in mind, this step should fall into place relatively simply.

Your community can use a number of strategies to manage and protect the source water area in the action plan. These include both regulatory and non-regulatory (voluntary) controls. Regulatory controls often include local ordinances, zoning and subdivision restrictions such as requirements for 'low impact' or green development around drinking water sources. Voluntary controls often include community education and outreach, household hazardous waste collection, stream watch programs, best management practice implementation and conservation efforts (e.g. – CRP enrollment), land easements, or even local public purchase of property. Communities may also choose to monitor the compliance of certain regulated potential contaminant sources with federal and state requirements.

You should keep three points in mind when developing an action plan. First, it's best to start with the most urgent problems or highest risks on your inventory. Second, an entirely voluntary approach may work, but a completely regulatory approach will rarely be successful. Third, not every approach will work in every town or region. To be successful, your community's approach should fit the local natural, social, economic and political landscape.

Fortunately there are numerous nonprofit, state, federal and local entities available to help a community out with almost any major problem you find in your source water area. These people and resources are available to help you decide how to address a specific problem. Below are the program areas in the major groupings designed to help with your action plan:

Assistance for water system infrastructure/design changes:

- **Proposed Well Reports** are available for systems that would like to pre-plan a well location from the Iowa DNR- Water Supply Engineering and Iowa Geological Survey. These reports are designed to help with well construction and well siting issues that commonly arise.
- **Drinking Water State Revolving Fund (SRF) low-to-zero-interest loans** are available for helping water systems pay for changes to their system. The State Revolving Fund loans fund changes that are usually upgrades to infrastructure or new wells. However, there are funds available for soil erosion control practices, land easements, manure management, etc.

Assistance for water monitoring

- **Water quality monitoring** projects are often funded by the Watershed Monitoring and Assessment Section of the DNR. These projects often include surface water, but can include groundwater studies for nitrates, pesticides, etc., if the need arises.
- **Water quantity/well interference** issues are handled by the Iowa Geological Survey of the University of Iowa. Questions such as drought management of well pumpage, and potential well interference issues are commonly considered.

Assistance for nonpoint source contaminant issues

- **Section 319 nonpoint source projects** are designed to reduce pollutants from nonpoint sources, typically row crop agriculture. The Watershed Improvement program often funds 3-5 year water quality projects.
- **Mississippi River Basin Initiative** (MRBI) If you have nonpoint source issues and are in one of four selected river basins (Upper Cedar, Upper Raccoon, Des Moines, Maquoketa) your community might be eligible for nonpoint source funding through the Mississippi River Basin Initiative funds.
- **The Watershed Improvement Review Board (WIRB)** was recently established by the Iowa Legislature to provide grants to watershed and water quality projects. The WIRB board has a grant review process for funding different projects throughout Iowa.
- **The conservation reserve program (CRP)** is administered by the Farm Service Agency (FSA), and includes additional funding support for land within a 2,000 ft. radius of a public well (often called wellhead CRP). The program will pay farmers to leave the land in native vegetation instead of farming or renting it out.

Assistance for point source contaminant issues

- **Underground Storage Tanks (leaking and non-leaking)** section of the Iowa DNR is responsible for the regulation and monitoring of underground storage tanks used for regulated substances (typically petroleum products). The program works on the detection, prevention, and remediation of leaks, and has a long history of working with public water systems.
- **Contaminated Sites S**ection of the Iowa DNR deals with a wide range of hazardous chemicals that have been released into the environment, commonly involving groundwater. This program works with the EPA on "Superfund" cleanup situations when the contamination is serious enough.

Assistance for plugging wells

- **Well Plugging/abandonment** programs exist in the state that will pay for the proper abandonment of private wells that are no longer used. In addition, wells can be tested for common problems such as nitrates and bacteria at no cost to the water system through this program. Contact the Iowa Department of Public Health for more information.

In addition to these known resources, staff from Pheasants Forever, Ducks Unlimited and your local Natural Resource Conservation Service (NRCS) office can provide much needed assistance with finding the best funding opportunities and grants that best fit your local needs. Many of the staff in these organizations have had years of experience and have a passion for prairie and wetland vegetation and wildlife.

If you have a local issue that you feel doesn't fall into any one of these broad categories, feel free to contact the SWP Program at 515-725-8343. In addition, more resources will be added and provided online from the Iowa Source Water Protection Program.

. Worksheet 5.1 is a template for the action plan, to be filled in once you have a strategy and target completion dates for each of the major potential contaminant sources determined in Step 4.

SWP Plan Components that should result from this step:

- An action plan that addresses how your community will handle each major potential contaminant source

Source Water Plan Checklist for Step 5:

- ☐ Action plan accurately filled in and complete

Step 6. Construct or update your emergency response plan

The goal of SWP planning is to protect the drinking water supply by reducing or mitigating the impact of human contamination of your drinking water. Unfortunately, even with the best plans in place, occasional disruptions in supply may occur. They may be in the form of natural disasters, accidental spills, power outages, and vandalism. The most effective way to ensure the community continues to receive safe, reliable drinking water is to be prepared for such events with an emergency response plan.

In Iowa communities with populations over 3,300 are required to have an approved emergency response plan under the Federal Bioterrorism Act of 2002. Though that is a Federal requirement, the Iowa Source Water Protection Program requires completed emergency response plans for an approved SWP Plan, independent of community size. This is because emergency planning is one of the most valuable tools for any public system. An updated, accurate emergency response plan answers many of the 'what if' scenarios that can enable a system to react speedily and thoughtfully to a problem instead of reacting haphazardly in a crisis. For example "What if a flood removed our low-lying alluvial wells from production?", or "What if a drought decreased water below the pump on our active well?" These and other disaster scenarios have been common in recent Iowa history. The communities with the better emergency response plan invariably end up better prepared for such disaster scenarios.

Other common scenarios that an emergency response plan can help you with are:

- Threats to your well or intake.
- Plans for contaminant spills near your well or intake.
- Alternate sources of water in an emergency (either from system sources or from somewhere else).
- Emergency funding for projects.

First, be sure to consult your local public water supply to determine if a plan has already been prepared. Where emergency management planning has been established, consult with your local emergency planning committee for input and review of any SWP-related emergency response procedures. Consult with national organizations such as the American Water Works Association and the National Rural Water Association for access to additional emergency response guidance related to protecting source water. In addition, the Iowa DNR has a Water Security plan for emergency preparedness. Furthermore, the Environmental Protection Agency has many documents on water security designed for large, medium, and small communities.

The SWP Team should consider both short-term and long-term contingencies. Short-term contingencies include power loss, line breaks, mechanical failures or other emergency situations that last less than 48 hours. Long-term contingencies include drought, well degradation, or source contamination that requires a temporary or permanent alternate supply.

Developing a contingency plan can be done in a series of steps. First, set some priorities based on knowledge of the water system, possible disruptions (contamination or other) and community needs – both short-term and long-term. Second, determine what procedures will be necessary to respond to the most serious threats. Third, inventory the resources available to you, including services, expertise, funding and equipment. Next, determine if additional resources are needed. Finally, define procedures and responsibilities to determine who will do what in an emergency.
Each of these steps is explained below.

A good place to start is the contaminant source inventory from Step 3. Add potential sources of disruption, such as rail car spills, truck accidents, power outages, vandalism, floods, etc. Make judgments about probabilities of these threats occurring, and the severity of disruption caused. Then, rank risks and set priorities accordingly. Setting priorities allows the greatest threats to receive the most urgent attention. Regardless of how priorities are established, the Team's first priority should be to protect the health of those who drink the water.

The purpose of contingency planning is to make sure that proper personnel, equipment, technical and financial resources will be available when needed. The contingency plan should enable local officials and water system managers to rapidly identify and coordinate resources in an actual emergency. Resources to consider include:

Personnel Resources

- Existing utility staff.
- Technical assistance that may include local contractors willing to enter into an agreement to provide emergency services.
- Existing state and federal emergency responders, depending on mobilization time required for the event.
- Existing local and county emergency response agencies (e.g., police, fire, EMS).

Financial Resources

- Existing local revenues dedicated for water system maintenance and source water protection.
- Local long-term and emergency financial reserves.
- Financial, equipment and personnel resources available through existing agreements with neighboring localities, state or federal agencies like mutual aide agreements for equipment and services.
- Local, state and federal grants and funds. Examples include state and federal Superfund programs and Federal Emergency Management Agency funds.
- Organizations that can provide in-kind (non-monetary) assistance. Examples include Iowa Association of Municipal Utilities and Iowa Rural Water Association.
- Drinking Water State Revolving Fund provides funding for infrastructure improvements to reduce disruption due to infrastructure failure.

Essential services, equipment and supplies

- Alternative water sources.
- Supply from within the system. For example, emergency wells or surface intakes.
- Supply from outside the system. For example, mutual agreements for equipment and services with neighboring public water supplies and participation in the State of Iowa WARN network.
- Water sampling and analysis equipment and supplies.
- Portable pumps and generators.
- Chemical supplies.
- Treatment equipment.
- Repair facilities and spare parts.
- Alternative distribution equipment.
- Vehicles and equipment for emergency evacuation and transportation.
- Personnel protection equipment and supplies.
- Heavy equipment contractors.

Emergency Response Training

- Table top emergency response exercises.
- Real-world drills with local emergency responders.
- Volunteer and public water supply system personnel training.

In addition, there should be standard operating procedures for water supply employees and emergency responders.

SWP Plan Components that should result from this step:

- An emergency response plan

Due to many systems having previously prepared such a plan under the provisions of the 2002 Bioterrorism Act, the IDNR allows an affidavit in lieu of including a completed Contingency/Emergency Plan within the submitted SWPP/WHPP. Although public water supplies do not need to send IDNR completed plans, each must have an accessible and up-to-date plan in case a catastrophic event occurs within their system. It is necessary for the completed water supply Contingency/Emergency Plan to contain the following information, at a minimum:

- Contact information for the city's mayor, city clerk, water/wastewater operator.
- Contact information for the city's power company, a professional electrician, a professional plumber and an equipment repair company.
- System's critical users must be identified and a plan for immediate notification must be created. (i.e. hospitals, nursing homes, schools, etc.)
- Contact information for local media, including newspaper, radio and television.

- Contact information for a certified laboratory, local emergency contacts, state and local public health departments and the National Guard.
- Contact information for the IDNR's 24 hour emergency contact and the local IDNR field office.

An Emergency Response affidavit form is available on ***. Worksheet 6.1.***

Source Water Plan Checklist for Step 5:

- ☐ A written notification from Iowa DNR water supply section indicating a completed emergency response plan for your community.

Step 7: Submit and implement your SWP Plan

After steps 1-6 have been completed, now you can send in your SWP Plan for review. In Iowa, source water protection activities are monitored and promoted through the Source Water Advisory Group (SWAG). The SWAG will check your SWP Plan with the checklist items and determine whether or not your plan meets the requirements.

Currently, there are few specific requirements for a proper SWP Plan. The plan should start with a cover page that includes 1) System Name and ID (PWSID), 2) Date, and 3) Contact information. The plan should be organized into chapters for each of the above steps (1-6), plus maps, tables, ranking, and action plan. The checklist below details what is needed for a complete SWP Plan.

Step 1: Organize a source water team

- ☐ Source Water Team member names and affiliations
- ☐ Source Water Team member roles
- ☐ Source water team meeting times and locations
- ☐ Source water goals for your community

Step 2: Identify source water areas

- ☐ Source Water area delineation
- ☐ Source Water area susceptibility

Step 3: Inventory well and contaminant sources

- ☐ Inventory of contaminant sources and wells
- ☐ Map of contaminant sources and wells
- ☐ Map of recent landuse in the source water area

Step 4: Assess and rank contaminant sources

- ☐ Ranking for all potential contaminant sources, including nonpoint and conduits

Step 5: Develop an action plan

- ☐ Action plan accurately filled in and complete

Step 6: Construct or update your emergency response plan

- ☐ A written notification from Iowa DNR water supply section indicating a completed emergency response plan for your community.

Please submit the plan to:
Email:
Robert.Rowden@dnr.iowa.gov
Mail:
Bob Rowden
Wallace State Office Building
502 East 9th Street,
Des Moines, IA 50319

The time needed for the SWAG to review SWP plans depends heavily on your system and the number of plans to review at the time. You may be contacted with additional requests regarding the report. In addition to the report, often the SWAG will require a short presentation of your efforts during a meeting. Assuming that you have followed all the previous steps and checklists, your plan should be approved after minor revisions. Once approved, there are numerous benefits to your community such as monitoring waivers and funding sources that can be applied for.

After approval, however, work of the SWP Team is not over. In order for a SWP Plan to have any significant impact on the quality of water in your system you must 'implement' the plan.

If you need any assistance with the SWP Plan or implementation process, please contact any members of the Source Water Advisory Group. . ***Worksheet 7.1.***lists the names and contact information for all current members.