TUSCARAWAS COUNTY METROPOLITAN SEWER DISTRICT

WATER AND SEWER DEPARTMENT

July 2, 2018

Mr. Jeff Patzke, Source Water Protection Program Manager

Ohio EPA, Division of Drinking and Ground Waters
Lazarus Government Center
50 W. Town Street, Suite 700
P.O. Box 1049
Columbus, OH 43215-1049

Re: Source Water Protection Plan
Dundee Public Water System – PWS ID OH7902012

Dear Mr. Patzke:

Submitted for your review and approval, we have enclosed the "Final Draft" of the Dundee Source Water Protection Plan. If you have any questions or need additional information, please contact me. Thank you.

Regards,

Michael Jones, P.E.
Director/Sanitary Engineer

Copy: Steven J. Saines , OEPA-SEDO

DRINKING WATER SOURCE PROTECTION PLAN

for

Dundee Public Water System
PWS ID# OH7902012

Water System Owner:
Tuscarawas County Board of Commissioners

System Managed, Operated and Maintained by:
Tuscarawas County Metropolitan Sewer District

June 2018

Prepared by:

Tuscarawas County Metropolitan Sewer District
Source Water Protection Team

With assistance from

Ohio EPA

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1.0 INTRODUCTION

The Tuscarawas County Metropolitan Sewer District ("District") was formed by the Tuscarawas County Board of Commissioners in 1973 for the purpose of managing, operating and maintaining public water and sewer systems in unincorporated areas of Tuscarawas County, as well as several municipal corporations.

The District is responsible for operation of four (4) public water systems in Tuscarawas County: Dundee PWS, Ridgewood PWS, Wainwright PWS, and Wilkshire Hills PWS. In total, the District provides service to 2,508 customers with an estimated equivalent population of 7,667 people. The Dundee PWS serves approximately 400 people.

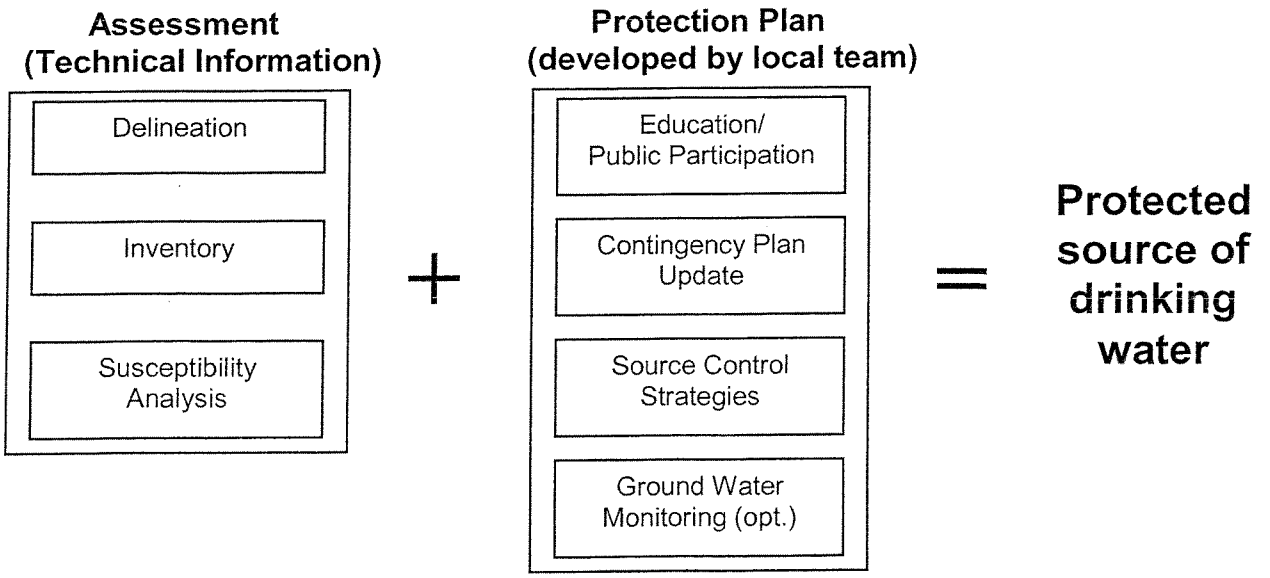
The District has developed a Source Water Protection Plan ("Protection Plan") to document the strategies that will be implemented to protect the aquifer that supplies the Dundee Public Water System's ("Dundee PWS") drinking water from land-based contamination. Components of the Protection Plan include: contaminant source control strategies, education and outreach strategies, contingency plan updates, and an evaluation of ground water monitoring needs, if any.

This Protection Plan builds on the Source Water Assessment Report that was completed for the Dundee PWS in July 2003 (and revised in September 2017) by Ohio EPA. This assessment (see Appendix A) includes delineation of the one year and five year time of travel areas, a potential contaminant source inventory and a susceptibility analysis. The potential contaminant source inventory was updated in September 2017 by Ohio EPA & the District to ensure the protective strategies documented in this Plan are based on currently existing contaminant sources.

1.1 BENEFITS OF A PROTECTION PLAN

A Protection Plan:

- Helps the District provide the safest and highest quality drinking water to its customers at the lowest possible cost;
- Helps to plan for future expansion, development, zoning and emergency response issues; and
- Can provide more opportunities for funding in order to improve infrastructure, purchase land in the protection area, and other improvements to the well field.



1.2 SOURCE WATER ASSESSMENT SUMMARY - TCMSD-DUNDEE PWS

The Dundee PWS well field consists of 3 groundwater wells. The average daily production of the facility is currently 26,000 gallons of water per day; the wells withdraw groundwater from a moderately productive bedrock aquifer (water-rich zone). This average daily production is based upon 2017 operating data. Average daily production in prior years is unreliable due to excessive non-revenue water loss that was corrected in the latter portion of 2016.

The drinking water source protection area for the Dundee wells is illustrated in the Drinking Water Source Assessment report prepared by Ohio EPA in July 2003 (and revised in September 2017). The source water protection area includes two zones, one inside the other. The "inner protection zone" around each well is the area that provides ground water to the wells within one year of pumping. The "outer protection zone" is the area that contributes water when the wells are pumped for five years.

Based on relevant databases and a field inspection of the area in September 2017, the following types of potential sources of contamination were identified within or directly adjacent to the protection area. These include: 1) agricultural fields; 2) single-home septic (wastewater) treatment systems; and 3) local roads (SR 93 and Walnut Creek Bottom Rd, NW).

2.0 FORMING A PROTECTION TEAM

Developing a Source Water Protection Plan was initiated by District staff and Ohio EPA following the installation of well #3 at the Dundee well field in Wayne Township in the summer of 2017. Following the installation of a new well or major modification to a well field, OAC 3745-91-10 requires public water supply systems to develop and implement a Source Water Protection Plan within two years of the installation.

District staff form the core of the Protection Team. Assistance from local educators and community members was sought near the end of the plan development process. Current team membership is reflected in Section 2.2 on the next page.

2.1 BUY-IN BY DECISION MAKERS

District staff and Ohio EPA met several times between February and April 2018, to prepare a source water protection plan. The Tuscarawas County Board of Commissioners passed a resolution on April 25, 2018 that acknowledges the importance of source water protection and commits the District to developing and implementing a drinking water source protection plan.

A copy of the resolution is included as Appendix B.

Tuscarawas County Board of Commissioners Decision Makers Meeting

Date of presentation to decision makers: April 25, 2018.

Was a resolution passed? X Yes _____No

Person in charge of oversight of the protection plan development:

Michael Jones, PE
Director / Sanitary Engineer
Tuscarawas County Metropolitan Sewer District

2.2 PROTECTION TEAM MEMBERS

Date Protection Team was formed: February 2018

Table 2-1. List of Protection Team Members			
Name	**Organization / Title**	**Phone Numbers**	**(E-mail address)**
Michael Jones	Director, Sanitary Engineer	330 874-3262, ext 302	mjones.tcmsd@gmail.com
Justin Angel	Superintendent	330 874-3262, ext 310	jangel.tcmsd@gmail.com
Todd Tacy	Lead Water Operator	330 874-3262, ext 306	ttacy.tcmsd@gmail.com
Shari Herbert	Billing Clerk	330 874-3262, ext 307	sherbert.tcmsd@gmail.com
Educational Contacts			
Marissa Lautzenheiser	Huff Run/Mud Run Watershed Coordinator	330-859-1050	marissa@ruralaction.org
Danell Bennett & Caroline Terakedis	Tuscarawas County Health Department Sanitarians	330-343-5550	dbennett@tchdnow.org cterakedis@tchdnow.org

4.0 EDUCATION AND OUTREACH

The purpose of the Protection Team's education and outreach efforts is to inform people who live and work in the drinking water source protection area for the Dundee PWS about where their drinking water comes from and why it is important to protect this valuable resource. Education and outreach efforts will also inform the community how their activities can potentially impact groundwater and what they can do to prevent contamination.

Table 4-1. Educational Strategies

Education and Outreach Strategies	Target Audience	Time line for Implementation	Who (name and title) will implement this strategy?
Distribute Source Water Protection Brochures to customers in the Dundee PWS	Customers in the Dundee PWS	Fall 2018, then every 3 years.	District staff as designated by the Director
School Intervention Program at Dundee Elementary School about source water protection. Rural Action will lead this effort. Contact: Marissa Lautzenheiser	School Children, Parents and Teachers	By December 2018, then annually as requested by the District/Dundee Elementary School.	Rural Action +/or District staff as designated by the Director. Ohio EPA is willing to do a presentation and/or activity with the students if requested and time permits.
Poster Display of Source Water Protection Area at TCMSD office, web site or other public space.	Local/Area Residents	2018. Rotate according to the discretion of District.	Director or someone with delegated authority.

UPDATE OF CONTINGENCY PLAN

The District maintains a comprehensive Contingency Plan that covers all of their public water systems. The Contingency Plan enables the District to prepare for, respond to, and recover from crisis conditions without wasting time on futile or unnecessary efforts, or spending funds unnecessarily. The Contingency Plan defines the duties, responsibilities, and functions of all District personnel with respect to each specific emergency condition. The District has developed procedures to address specific situations that can be expected to arise, and these are documented below and in the Contingency Plan.

The following are issues that are specific to drinking water source protection. Most of this information is included in the Water Supply Contingency Plan for the District.

5.0 DRINKING WATER SHORTAGE – SHORT TERM LOSS OF SOURCE

If the Dundee PWS experiences a short-term loss of its drinking water source (such as through a short-lived emergency in the well field, collapse of a well, etc.), it will acquire water from another District water source (i.e., Wilkshire Hills) via truck transport. Please refer to Appendix C of the Contingency Plan, which contains an Ohio Department of Health list of approved potable water haulers.

The TCMSD-Dundee PWS can provide water from existing storage for more than 4 days, provided it is not necessary to flush out the entire distribution system.

Current storage (118,000 gal) / Avg Daily Use (26,000 GPD) = # of days of storage = ~4+ days

5.2 DRINKING WATER SHORTAGE – LONG-TERM LOSS OF SOURCE

In the event of a complete loss of the current well field, the Dundee PWS would most likely:

- Explore the possibility of moving its well field to another area in/near Wayne Township.

5.3 FUNDING FOR WATER EMERGENCIES

The District maintains five (5) separate funds that support the management, operation, maintenance and depreciation of the District's water systems: Operating Fund, Short Lived Asset Fund, Debt Payment Fund, Debt Reserve Fund, and Capital Improvement Fund.

Each year, as part of the annual budget process, the Director/Sanitary Engineer evaluates user charges to determine if adjustments are necessary to meet the short and long-term financial needs of the District.

As a general rule of thumb, the District has a goal to maintain a minimum of 2.5% of the prior year expenditures in reserve for the purpose of repair and replacement, as well as 25% of the prior year expenditures in reserve for a contingency / emergency reserve.

The District also evaluates Key Financial Performance Indicators ("KPFI"), such as Operating Ratio (with and without depreciation) and Debt Service Coverage. These KFPIs are illustrated in the following data from the 2018 budget:

Operating Ratio (not including Depreciation): 1.58 (Goal = 1.5)

Operating Ratio (including Depreciation) = 1.31 (Goal = 1.2)

Debt Service Coverage = 1.31 (Goal = 1.2)

If additional funds are required outside of the emergency fund, the District will attempt to utilize the Ohio Public Works Commission Emergency Program, the Ohio Water Development Authority, and if no other reasonable alternatives are available, the District could potentially request a loan from the Tuscarawas County Board of Commissioner's General Fund or a local financial institution, such as Huntington Bank.

5.4 PLANNING FOR THE FUTURE

A. Current average daily pumpage = 26,000 gallons per day
B. Current design capacity = 72,000 gallons per day (based on 50 gpm treatment capacity)
C. Wellfield capacity (the maximum amount the 3 wells can pump, based on the capacity of the well/pumps) is approximately 172,800 gallons per day.

The Dundee PWS is currently pumping about 36% (A/B) of its water treatment facility's design capacity and 15% (A/C) of its well field capacity.

Population figures indicate that the Wayne Township area has undergone a mild population increase in recent years. Low growth in the local population is anticipated.

Based on these factors, the District does not anticipate the need to expand the Dundee PWS well field or significantly increase pumpage within the next 5-10 years.

5.5 EMERGENCY RESPONSE TO A TOXIC SPILL/RELEASE IN THE PROTECTION AREA

Appendix A of the District's Contingency Plan provides an emergency services phone number list in the case of an accidental chemical spill and release in the protection area. Some of these phone numbers are also listed in the following section.

Accidental Chemical Spill or Release within the Protection Area

1. ( ) Determine the following information:
   Who made the first observation? What is their phone number and location?
   When did it happen?
   What is it?
   Where is it? Is it isolated to one area or is it wide spread?
   Has the spill been reported to Ohio EPA?
   Has the fire department or hazardous materials response team been notified?
   Has the property owner been notified?

2. ( ) If no notifications have been made, immediately contact emergency personnel and agencies (i.e. fire dept., Ohio EPA, etc.) using the phone number(s) found in Appendix A of the Contingency Plan. Notify them of the situation. Three of these numbers are listed below:

   Ohio EPA's 24-hour emergency response phone number is **1-800-282-9378.**

   The **Tuscarawas County EMA** should be contacted at **911 or 330-308-6670**.

   The Wayne Township Fire Department should also be called through **911** or **330-852-3361**.

3. ( ) Contact the following work personnel, District employees, and/or contractors using the phone number(s) found on page 1 of the Contingency Plan. Four of these numbers are listed below:

Michael Jones, Director/Sanitary Engineer: **(330) 704-6916**
Justin Angel, Superintendent: **(330) 401-4959**
Todd Tacy, Lead Water Operator: **(330) 401-1797**
Tuscarawas County Sheriff: **330-339-7743**

4. ( ) If it is safe to do so, visit the scene to make contact with on-scene emergency personnel and agencies. The local fire department is generally the lead response agency.

5. ( ) Complete the following activities as soon as possible:

   a. ( ) Perform a physical check of the Dundee PWS and its structural integrity (check wells for damage, etc.).
   b. ( ) If it is determined that the spill resulted in the probable introduction of contaminants into the wells, proper precautions must be taken during sampling to prevent exposure to the contaminant and/or daughter products.
   c. ( ) If repairs are needed, coordinate with the lead response agency and Ohio EPA to ensure the safety of the repair crew. Proper precautions must be taken to prevent exposure to the contaminant and/or daughter products.
   d. ( ) If the Dundee PWS needs to be temporarily shut down as a result of the spill, procedures can be found in the contingency plan. Plans for short term loss of source can be found on page 8 of this Source Water Protection Plan.

6. ( ) If the wells are secure, coordinate with the lead response agency and Ohio EPA on actions being taken to mitigate the spill. At a minimum, obtain the following information:

   Who is responsible for the cleanup? What is their phone number and other contact information?
   What contractors or consultants have been sent by the responsible party?
   What actions have they taken?
   How long is clean-up expected to take? How long must water use be stopped or reduced? (If greater than one week, options for long-term loss of source may be initiated. See page 9 of this Source Water Protection Plan.) The Contingency Plan does not address long-term loss of source water.

7. ( ) Follow-up with the on-scene responders and contractors to determine if additional, long-term actions (such as ground water treatment and/or additional raw water monitoring) are required or recommended. If so, determine:

   - What kind of monitoring is needed, at what frequency?
   - What levels will trigger return to normal operations?
   - What kind of additional treatment may be needed?

6.0 Ground Water Monitoring

The District's source water protection team has decided not to incorporate ground water monitoring in its Source Water Protection Plan for the Dundee PWS. The source water protection area has low susceptibility to contamination (see Appendix A, Source Water Assessment Report). The District believes that ongoing visual monitoring and inspection of activities within the protection area will serve as a substitute for the chemical warning given by a ground water monitoring program. Also, since the establishment of the well field, no historical contamination has been detected. No local plume within the capture zone of the well field is believed to be present. If such contamination became known or highly suspected, the District would re-consider the option of a ground water monitoring program for this system.

7.0 Periodic Review

A protection plan is not a static document. Over time many issues related to protection planning will change- wells will be added or removed from the well field, existing potential contaminant sources will close, new education and outreach opportunities will become available, new partners in protecting the drinking water source will be identified. The protection plan needs to anticipate these and other events.

The District commits to reviewing the Drinking Water Source Protection Plan every 3 years, beginning in June 2021. Whenever necessary, the District will update its Protection Plan with Ohio EPA notification.

7.1 Updating the SWAP Assessment

Delineation Updates

- Has the amount of pumping increased or decreased since the date Ohio EPA provided the Drinking Water Source Assessment report?
- Have any wells been added or removed?
- Has a new well field been added or are there any plans for a new well field?
- Is there new hydrogeologic data to refine the delineation model (e.g., flow direction, pump tests, new well logs etc.)?

If the answer to any of the above questions is yes, the District will contact Ohio EPA's Source Water Assessment and Protection Program staff in the Southeast District office to determine whether the protection area should be re-delineated.

Potential Contaminant Source Inventory

- Has the extent of the protection area changed?
- Has the community developed rapidly?
- Have land uses in and around the protection area changed?
- Has management of businesses in the protection area changed?

If the answer to any of the above questions is yes, the District will update the inventory or conduct a new inventory. The District may contact Ohio EPA's SWAP staff in the district office for guidance or assistance in conducting the inventory.

Other

- Is the list of Protection Team members and contact numbers current?

7.2 Evaluating the Effectiveness of the Protective Strategies

In order to evaluate if the protective strategies in this Source Water Protection Plan are achieving the desired outcomes, the District will consider the following types of questions and write any changes into the Protection Plan.

- *[If local protection area ordinances are in place]:* Has the ordinance achieved its purpose? (If not, why not?) Should it be revised to be more effective?
- *[If local protection area ordinances are not in place]:* Do we have reason to be concerned about how the drinking water source protection area may be used in the future? Should we consider trying to better protect it through a local ordinance? Would such an ordinance need to be enacted and implemented by another jurisdiction?

Pollution Source Control Strategies:

- Have we followed our own schedule of implementation/timeline (Section 2, Table 2-1) for each of the pollution source control strategies?
- Are there new potential contaminant sources that need to be addressed with new pollution source control strategies?
- Have we implemented any new protective strategies that are not documented here?
- Did any of our strategies result in removal or elimination of a potential source?
- Did any of our strategies result in business owners or individuals modifying practices to decrease the risk of contaminating the drinking water source?
- Did our coordination with other groups (SWCDs, county EMAs, local health department., local watershed groups, etc.) contribute to the implementation of protective strategies?
- Have the partnerships developed during plan implementation been productive?

Education and Outreach:

- Have we followed our own schedule of implementation/timeline (Section 3, Table 3-1) for each of the educational strategies?
- Are there any new groups in the population that we need to target with education and outreach strategies?
- Have we implemented any new educational strategies that are not already documented here?
- Has education and outreach targeting any specific group resulted in actions that reduced or could potentially reduce the risk of contaminating the drinking water source, farmers using best management practices, etc?
- Have we received additional funding to continue any particular education and outreach strategy?

- Have we received any accolades, awards or recognition from outside entities or organizations for our educational efforts?
- Have we had any unsolicited requests for SWAP-related education (such as requests for plant tours, requests for presenters/speakers at events, etc.)?
- Did our coordination with other groups (SWCDs, SWEET Team, local health dept., local watershed group, etc.) contribute to the successful development and dissemination of SWAP-related information?
- Did we have sufficient staff and resources to complete all the planned educational efforts?
- Have educational efforts been cost effective? Efficient? (Consider level of attendance, attentiveness and participation by audience, comments received, etc., vs. the cost to facilitate the event). Should the frequency of the outreach be increased, decreased, or remain the same?
- Have the partnerships developed during plan implementation been productive?
- Have any of the target groups contacted the public water system for additional information about something they saw or heard about through these activities?

Drinking Water Shortage/Emergency Response:

- Are there any updates to the Drinking Water Shortage/Emergency Response Plan?
- Did our coordination with emergency responders at the local and county level result in better communication and handling of spill incidents that could impact our drinking water?

Ground Water Monitoring:

For systems that are NOT monitoring raw ground water quality:

- Have there been any significant changes to our water quality?
- Are there new water quality, potential contaminant source or land use issues that may make it necessary to develop and implement a ground water monitoring program?

7.3 Revising the Plan

Upon review, if any revisions of the SWAP Assessment Report are needed, the District will contact Ohio EPA's Southeast District Office for guidance. Also, if the local planning team makes any substantial changes to the Protection Plan for the Dundee PWS, a copy will be forwarded to Ohio EPA for concurrence. The revision will be documented on the front cover by adding "Revised [date]" beneath the date at the bottom of the page.

Appendix A

Ohio EPA's Drinking Water Source Assessment Report

for

TCMSD-Dundee PWS

(revised September 2017)

DRINKING WATER SOURCE ASSESSMENT for TCMSD - Dundee PWS ID #OH7902012

Protecting Ohio's Drinking Water Sources

September 2017
(Revised from July 2003)

INTRODUCTION. The 1996 Amendments to the Safe Drinking Water Act establish a program for states to assess the drinking water source for all public water systems. Ohio's Source Water Assessment and Protection Program is designed to help public water systems protect their sources of drinking water from becoming contaminated. This assessment:

- identifies the drinking water source protection area, based on the area that supplies water to the well(s),
- inventories the potential contaminant sources in the area,
- evaluates the susceptibility of the drinking water source to contamination, and
- recommends protective strategies.

The purpose of the assessment is to provide information that the Tuscarawas County Municipal Sewer District (TCMSD) can use to help protect its source of drinking water (near the Village of Dundee) from contamination.

SYSTEM DESCRIPTION & GEOLOGY. TCMSD-Dundee is a community public water system serving approximately 395 people in northwestern Tuscarawas County, Ohio. The system operates 3 wells that are operated on a regular basis. The wells pump approximately 27,600 gallons of water per day from a bedrock aquifer (water-rich zone) consisting primarily of sandstone and shale. The bedrock from which these wells draw water is covered by more than 100 feet of low to moderately permeable rock, which provides significant protection from surface contamination. Depth to water in the aquifer is more than 100 feet below the ground surface.

Soils in the area are silty loams which are moderately well-drained, meaning that much of the rainfall and snowmelt will infiltrate into the soil, instead of running off or ponding. The topography is gently sloping. Ground water in this area is replenished by the gradual flow of water underground from higher to lower elevations and by approximately 4 inches per year of precipitation that infiltrates through the soil. The precise direction of ground water flow near Dundee is unknown, though a northwestern direction was inferred based on regional surface water drainage patterns.

PROTECTION AREA. The drinking water source protection area for TCMSD – Dundee's wells is illustrated in Figure 1. This figure shows two areas, one inside the other. The "inner management zone" is the area that provides ground water to the wells within one year of pumping. A chemical spill in this zone poses a greater threat to the drinking water, so this area warrants more stringent protection. The "source water protection area" is the additional area that contributes water when the wells are pumped for five years. Together, they comprise the drinking water source protection area.

Method Selection

An analytic element model computer program called GFLOW was used to determine the areal extent of the protection area. Protection areas based on computer modeling can be significantly more credible than those produced by simpler methods, especially in areas with complex geology. The time and effort required to develop a computer model are warranted when the wellfield is located in a complex hydrogeologic setting, and the hydrogeologic data needed to run the program are available for the area. Both criteria were met for the TCMSD - Dundee source water assessment.

Model Set-up

The GFLOW model for the TCMSD – Dundee wellfield was designed to simulate the characteristics of an interbedded sandstone and shale bedrock aquifer. Figure 2 shows that the

bedrock aquifer was modeled as an area of different flow properties than the Sugar Creek Valley alluvium (called an "inhomogeneity"). The South Fork of Sugar Creek and its tributaries were modeled as lines along which ground water enters or leaves the aquifer (called "line sink strings").

Model Values

Information needed to run the model includes, at a minimum, **pumping rate** of the wells, **hydraulic conductivity** of the aquifer (that is, the ease with which water moves through it), **aquifer thickness**, and **aquifer porosity**. For this model, a pumping rate of 31,740 gallons per day was used for modeling purposes. This figure represents the average pumping rate plus 15% additional pumping (to be conservative). An aquifer thickness of 200 feet was used, based on well logs for the TCMSD – Dundee wells. Site specific information on the porosity and hydraulic conductivity of the bedrock and alluvial aquifers was not available. In these cases, the values used in the model were based on values typically found in these kinds of rock and sediments. They were: 10% porosity and 10 feet per day hydraulic conductivity for the bedrock aquifer; 20% porosity and 500 feet per day hydraulic conductivity for the Sugar Creek alluvial aquifer. See Table 1 for a summary of model parameters.

The protection area was determined based on the best information available at the time of the assessment. If you would like to have more information about how this protection area was derived, or if you would like to collect additional information and revise your protection area, please contact the Ohio EPA staff listed at the end of this report. Also, a more detailed discussion of the technical aspects of modeling drinking water source protection areas can be found in the *Delineation Guidelines and Process Manual* (Ohio EPA, 2010) on Ohio EPA's Source Water Assessment and Protection Web page (www.epa.ohio.gov/ddagw/swap.aspx).

INVENTORY. In September 2017, an update to the inventory of potential contaminant sources located within the drinking water source protection area was completed by Ohio EPA. Several potential sources of contamination were identified both within and outside of the protection area (See Figure 1). Table 2 provides additional information about these types of potential contaminant sources.

A facility or activity is listed as a potential contaminant source if it has the **potential** to release a contaminant, based on the kinds and amounts of chemicals typically associated with that type of facility or activity. It is beyond the scope of this assessment to determine whether any specific potential source is **actually** releasing (or has released) a contaminant to ground water. Also, the inventory is limited to what Ohio EPA staff were able to observe on the day of the site visit. Therefore, TCMSD – Dundee staff should be alert to the possible presence of potential sources of contamination that are not on this list.

GROUND WATER QUALITY. A review of TCMSD – Dundee's water quality record currently available in Ohio EPA's drinking water compliance database did not reveal any evidence of chemical contamination at levels of concern in the aquifer. Please note that this water quality evaluation has some limitations:

- the data evaluated are mostly for treated water samples only, as Ohio EPA's quality requirements are for the water being provided to the public, not the water before treatment.

- sampling results for coliform bacteria and naturally-occurring inorganics (other than arsenic) were not evaluated for this assessment, because they are not a reliable indicator of aquifer contamination.

Current information on the quality of the treated water supplied by TCMSD – Dundee's public water system is available in the Consumer Confidence Report for the system, which is distributed annually. It reports on detected contaminants and any associated health risks from data collected during the past five years. Consumer Confidence Reports are available from TCMSD - Dundee.

SUSCEPTIBILITY ANALYSIS. This assessment indicates that TCMSD – Dundee's source of drinking water has a **low** susceptibility to contamination due to the:

- presence of a relatively thick protective layer of shale overlying the aquifer,

- lack of significant potential contaminant sources in the protection area,

- no evidence to suggest that ground water has been impacted by any significant levels of contaminants,

The risk of future contamination can be minimized by implementing appropriate protective measures.

PROTECTIVE STRATEGIES. Protective strategies are activities that help protect a drinking water source from becoming contaminated. Implementing these activities benefits the community by helping to:

- protect the community's investment in its water supply.
- protect the health of the community residents by preventing contamination of its drinking water source.
- support the continued economic growth of a community by meeting its water supply needs.
- preserve the ground water resource for future generations.
- reduce regulatory monitoring costs.

Ohio EPA encourages TCMSD – Dundee to develop and implement an effective Drinking Water Source Protection Plan. The plan can be developed from the information provided in this Drinking Water Source Assessment Report. The potential contaminant source inventory provides a list of facilities or activities to focus on. Table 3 lists protective strategies that are appropriate for the kinds of facilities/activities listed in the inventory. Finally, a document titled *Developing Local Drinking Water Source Protection Plans in Ohio* is available from Ohio EPA. This document offers comprehensive guidance for developing and implementing a municipal Drinking Water Source Protection Plan. Ongoing implementation of the plan will help protect TCMSD – Dundee's valuable drinking water resources for current and future generations.

For further technical assistance on drinking water source protection, please contact the Ohio EPA Southeast District Office at (740) 385-8501 or toll free at (800) 686-7330, or visit the Ohio EPA Source Water Assessment and Protection Web page at: www.epa.ohio.gov/ddagw/swap.aspx.

This report was written by Kevin O'Hara, Ohio EPA, Division of Drinking and Ground Waters, Southeast District Office.

BIBLIOGRAPHY.

Ohio EPA public drinking water files.

Ohio DNR Well Logs.

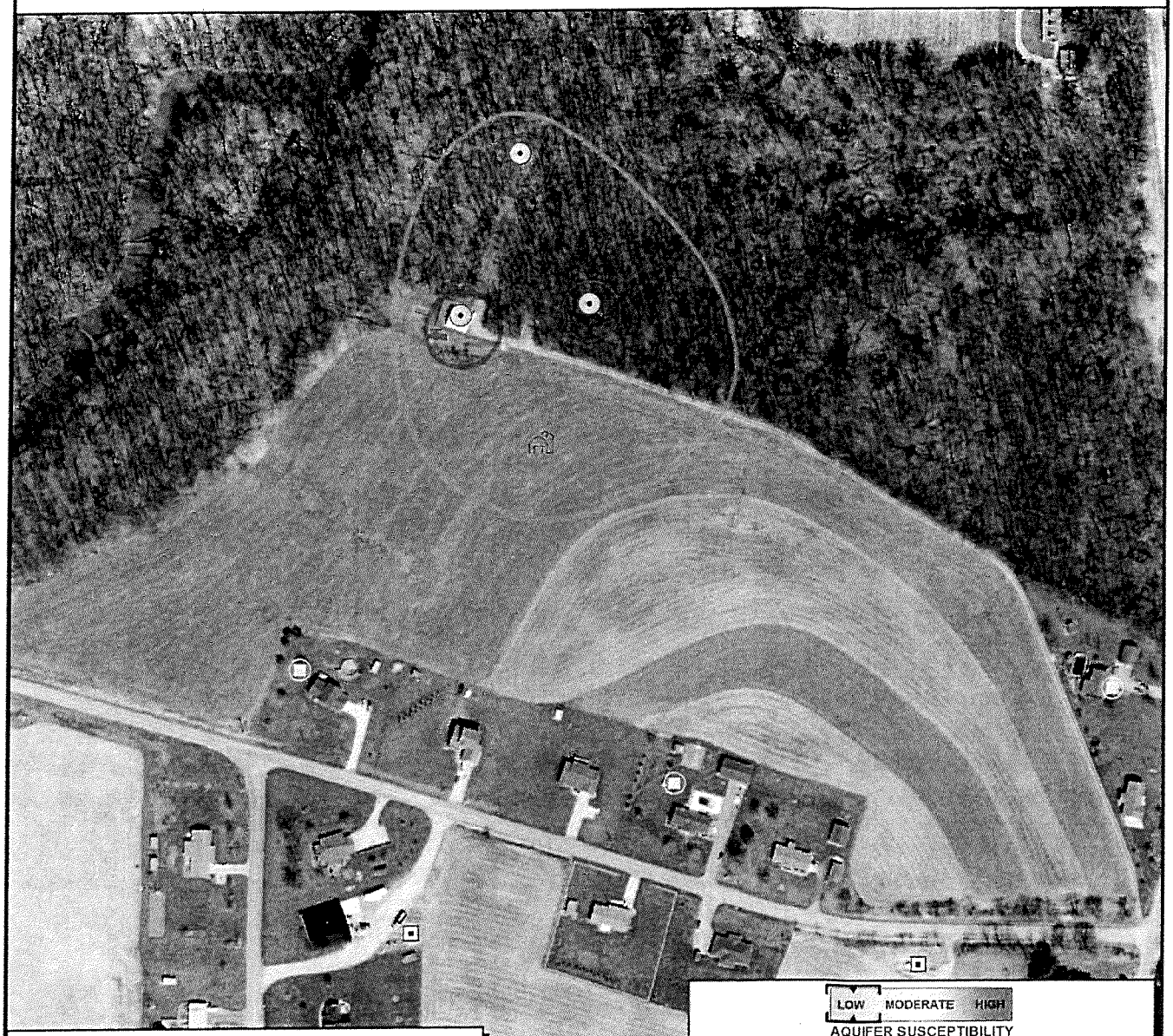
Ohio Department of Natural Resources, 2000, Glacial Aquifer Map (digital).

Ohio EPA, 2010, *Drinking Water Source Protection Area Delineation Guidelines & Process Manual.*

Table 1. Data Used in Construction of Ground Water Flow Model

Type of Information	Value Used	Source of Information
Pumping rate	31,740 gallons per day	Average daily rate plus 15%, Ohio EPA public drinking water files
Aquifer porosity	10%	Ohio EPA default value for bedrock
Aquifer thickness	200 feet	Well logs for area, filed at Ohio Department of Natural Resources, Division of Water
Hydraulic conductivity of bedrock	10 feet per day	Ohio EPA default value for interbedded sandstone and shale.
Hydraulic conductivity of alluvium	500 feet per day	Value for similar settings in Sugar Creek Valley.

TCMSD-Dundee, PWS ID#OH7902012
Tuscarawas County, Wayne Township



LOW MODERATE HIGH
AQUIFER SUSCEPTIBILITY

Legend
- PWS Active Wells
- Inner Management Zones (groundwater)
- Source Water Protection Areas (groundwater)
- Above Ground Storage Tank
- Crops: corn, soybean, wheat
- Drinking Water Treatment Plant
- Septic System

Protection Area Data
Number of Wells = 3
Pumping Rate = 31,740 gallons per day
Porosity = 10%
Aquifer Thickness = 200 feet
Hydrogeologic Setting = Sandstone/Shale
Land Use = Agricultural/Residential

Ohio Environmental Protection Agency

September 21, 2017

Drinking Water Source Protection Area

N

0 150 300
Feet

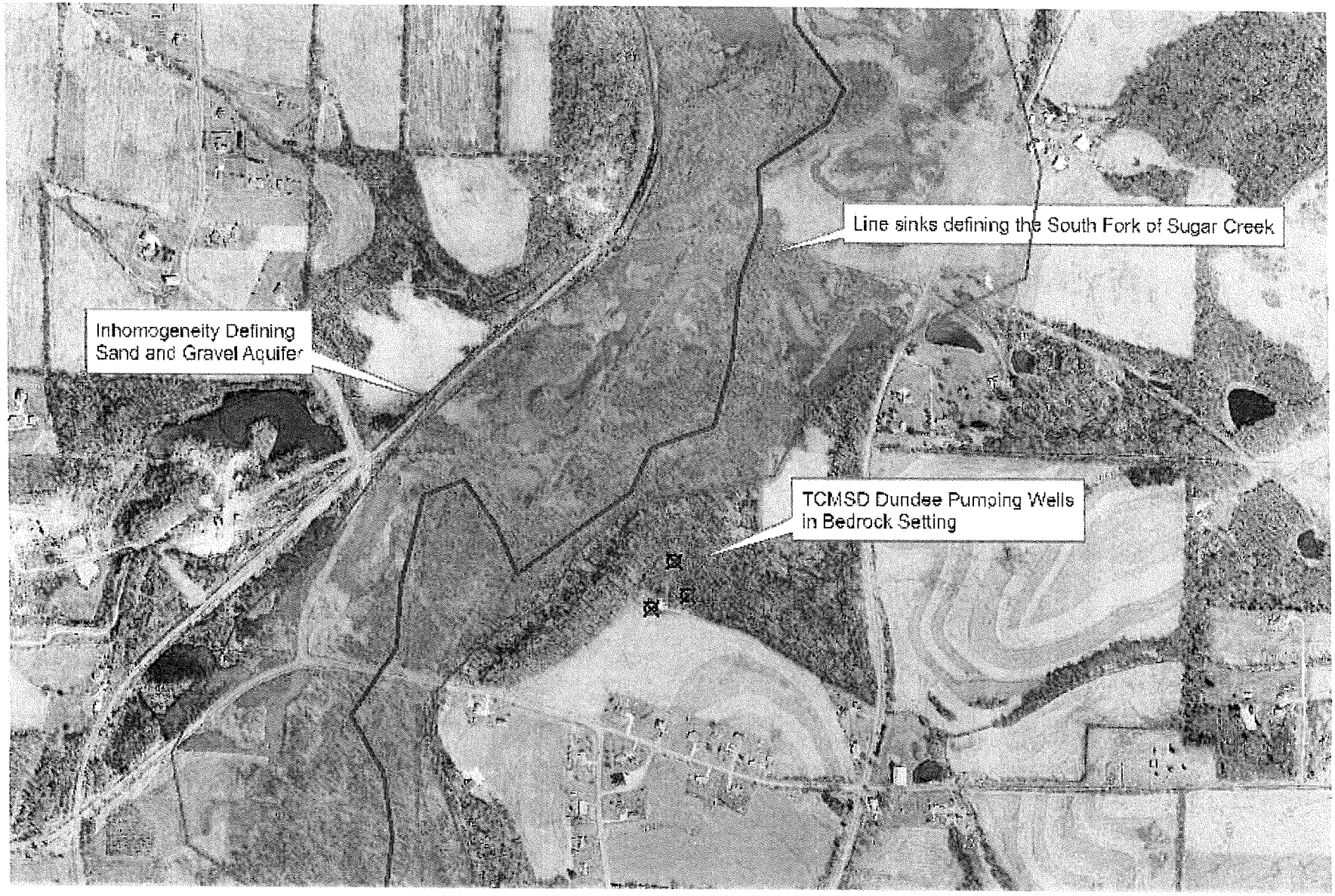


Figure 2. GFlow Model Setup

Table 2. Potential Contaminant Sources Located in TCMSD – Dundee's Drinking Water Source Protection Area

Potential Contaminant Source	Number of Sources	Environmental Concerns	Protection Area
AGRICULTURAL SOURCES			
Crops: Corn, Soybean, Wheat	1	Potential contaminant sources that may be associated with pastures include sludge application, fertilizer, and pesticide use. Cropland may be associated with nitrates, ammonia, pesticides, and pathogens in drinking water sources.	Within inner and outer protection areas
MUNICIPAL SOURCES			
Drinking Water Treatment Plant	1	Among the potential contaminant sources related to these facilities are: underground storage tanks; aboveground storage tanks; storage of chemicals used in water treatment and testing.	Within inner protection area
WIDESPREAD SOURCES			
Septic systems	Multiple	If poorly maintained, may be a source of household chemicals, excess nutrients, viruses, and bacteria in drinking water sources.	Outside protection area
Highway/Transportation Route	2	Accidents on transportation routes pose the threat of leaks and spills of fuels and chemicals. Weed killers used to control vegetation can elevate levels of pesticides in drinking water sources. Runoff may contain oil, metals, and deicers.	Outside protection area
Aboveground Storage Tanks (ASTs)	Multiple	Tanks may contain petroleum products or other chemicals.	Outside protection area

Table 3. Protective Strategies for Consideration by TCMSD - Dundee

Potential Contaminant Source	Protective Strategies To Consider
General	➢ Purchase additional property or development rights ➢ Provide educational material to members of the community on topics regarding the drinking water source protection area. ➢ Include drinking water source protection into the local school curriculum. ➢ Provide education (material/meetings) to local businesses and industries on topics relating to drinking water source protection. ➢ Encourage 'ground water friendly' development. ➢ Develop/enact/enforce a local ordinance which may include any of the following: changing zoning; requiring registration of existing facilities; banning certain new types of activities; dictating chemical handling procedures; maintaining/filing a chemical inventory; facility spill/contingency planning; engineering controls for existing/new facilities; paralleling existing federal or state requirements.
Agricultural Sources	➢ Assess the use of best management practices and recommend additional practices. ➢ Encourage road safety with agricultural chemicals. ➢ Provide education (material/meetings) to local farmers and agribusinesses on appropriate topics. ➢ Plan/design/implement methods to control impacts to surface water.
Septic systems	➢ Provide education (material/meetings) to home owners on use/maintenance of septic systems. ➢ Develop a centralized wastewater collection/treatment system ➢ Develop/enact/enforce a local ordinance which may include any of the following: changing zoning; requiring registration of existing facilities; banning certain new types of activities; dictating chemical handling procedures; maintaining/filing a chemical inventory.
Aboveground Storage Tanks	➢ Place tanks on paved surfaces within secondary containment structures (berms, dikes, liners, or vaults that can hold 110% of the contents of the largest tank) or use double walled tanks. ➢ Perform preventive maintenance on the storage tanks and piping systems to detect potential leaks before they occur.. ➢ Install spill and overflow protection. ➢ Use dry clean-up methods rather than hosing fueling and loading areas down. ➢ Store absorbent cleaning materials in a readily accessible location. ➢ Inspect storage areas (fueling and loading areas) to detect problems before they occur. ➢ Keep storage areas secure against unauthorized entry. ➢ Locate ASTs as far as possible from wells, surface water bodies and storm drains.
Transportation	➢ Create hazardous materials routes around the protection area and require/encourage transporters to use them. ➢ Work with local transporters on protection area awareness. ➢ Encourage road safety with chemicals. ➢ Post signs indicating the extent of the protection area.

Appendix B

Resolution of the Board of Commissioners, Tuscarawas County, Ohio

(Establishing/Authorizing a Source Water Protection Team)

April 25, 2018

A RESOLUTION AUTHORIZING THE ESTABLISHMENT OF A SOURCE WATER PROTECTION PLAN FOR THE DUNDEE PUBLIC WATER SYSTEM

Resolution Number 356-2018

WHEREAS, the Board of Commissioners of Tuscarawas County ("Board"), pursuant to a Resolution adopted by said Board on March 19, 1973, did establish the Tuscarawas County Metropolitan Sewer District ("District") pursuant to Ohio Revised Code ("ORC") 6117; and

WHEREAS, the District is responsible for managing, operating and maintaining the Dundee Public Water System for the purpose of preserving and protecting the public health and safety; and

WHEREAS, the Board realizes the importance of safe water and intends to support the efforts of developing a Source Water Protection Plan.

NOW THEREFORE, BE IT RESOLVED by the Board:

Section 1: The Board hereby authorizes the Tuscarawas County Sanitary Engineer, Michael Jones, to establish a Source Water Protection Team for the purpose of working with the Ohio Environmental Protection Agency to develop a Source Water Protection Plan for the Dundee PWS.

Adopted by the Board of Commissioners of Tuscarawas County, Ohio, this 25th day of April, 2018.

Chris Abbuhl

Absent
Kerry Metzger

Joe Sciarretti

Attest:

Adam Stilgenbauer, Clerk

Approved as to Form:

D. Brad Zimmerman
Special Counsel to the
Tuscarawas County Metropolitan Sewer District

Appendix C

Recommended Best Management Practices

Fact Sheets

- *Agricultural Best Management Practices*
- *Septic System Operation & Maintenance*

EPA
United States
Environmental Protection
Agency

Source Water Protection Practices Bulletin

Managing Agricultural Fertilizer Application to Prevent Contamination of Drinking Water

If improperly managed, elements of fertilizer can move into surface water through field runoff or leach into ground water. The two main components of fertilizer that are of greatest concern to source water quality (ground water and surface water used as public drinking water supplies) are nitrogen (N) and phosphorus (P). This fact sheet focuses on the management of agricultural fertilizer applications; see the fact sheets on managing agricultural pesticide use, animal waste, and storm water runoff for other prevention measures that relate to agriculture.

Inside this issue:

Fertilizer and Fertilizer Use Facts:

- The Nitrogen and Phosphorus in fertilizer are the greatest concern to source water quality.
- 25% of all preplant N applied to corn is lost through leaching or dentrification.
- 60-90% of P moves with the soil.
- Consumption of nitrates can cause "blue baby syndrome".
- Nitrate has a drinking water MCL of 10mg/l.
- Nutrient management abates nutrient movement by minimizing the quantity of nutrients available for loss.
- Fertilizer applied in the fall causes ground water degradation. Partial application in the spring can improve N uptake.
- Ammonium N fertilizers are not subject to immediate leaching, but convert to nitrate.

1 - Fertilizer tractor.

Fertilizer Use in Agriculture

Fertilizer application is required to replace crop land nutrients that have been consumed by previous plant growth. It is essential for economic yields. However, excess fertilizer use and poor application methods can cause fertilizer movement into ground and surface waters. While fertilizer efficiency has increased, Colorado State University estimated that about 25 percent of all preplant nitrogen applied to corn is lost through leaching (entering ground water as nitrate) or denitrification (entering the atmosphere as nitrogen gas).

Why is it Important to Manage Fertilizer Use Near Sources of Drinking Water?

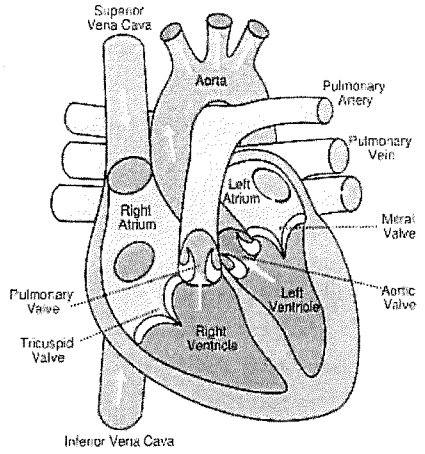
Improper or excessive use of fertilizer can lead to nitrate pollution of ground or surface water. Nitrogen fertilizer, whether organic or inorganic, is biologically transformed to nitrate that is highly soluble in water. In this soluble form, nitrate can readily be absorbed and used by plants. On the other hand, soluble nitrate is highly mobile and can move with percolating water out of the soil, thus making it unavailable for plant uptakes. Crop producers, therefore, need to match nitrogen applications to crop uptake to minimize nitrate leaching and maximize efficiency.

Use of nitrogen-containing fertilizers can contribute to nitrates in drinking water. Consumption of nitrates can cause methemoglobinemia (blue baby syndrome) in infants, which reduces the ability of the blood to carry oxygen. If left untreated, methemoglobinemia can be fatal for affected infants. Due to this health risk, EPA set a drinking water maximum contaminant level (MCL) of 10 milligrams per liter (mg/l) or parts per million (ppm) for nitrate measured as nitrogen.

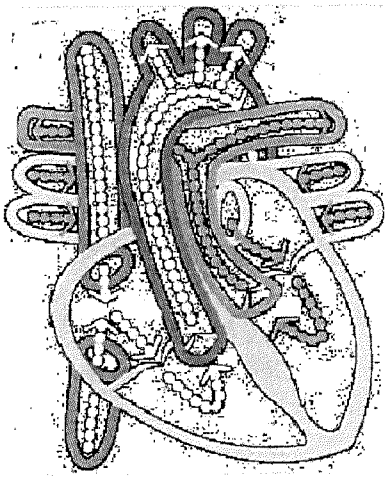
Another major component of fertilizer is phosphorus. Under certain conditions phosphorus can be readily transported with the soil. In fact, 60 to 90 percent of phosphorus moves with the soil. Phosphorus is the major source of water quality impairments in lakes nationwide. Even though regulations that affect the taste and odor of water are not Federally enforceable under the Safe Drinking Water Act, municipalities often must treat their drinking water supplies for these aesthetic reasons.

The use of organic nutrient sources, such as manure, can supply all or part of the nitrogen, phosphorus, and potassium needs for crop production. However, organic fertilizers can also cause excessive nutrient loads if improperly applied.

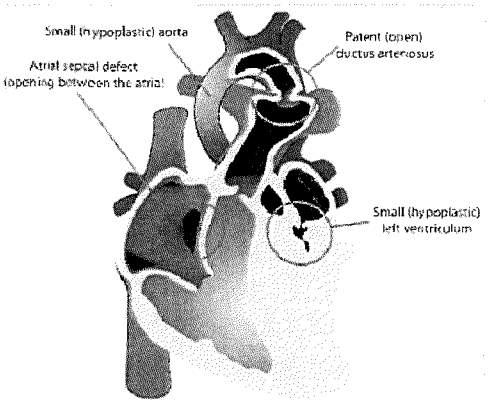
Blue Baby Syndrome Effects



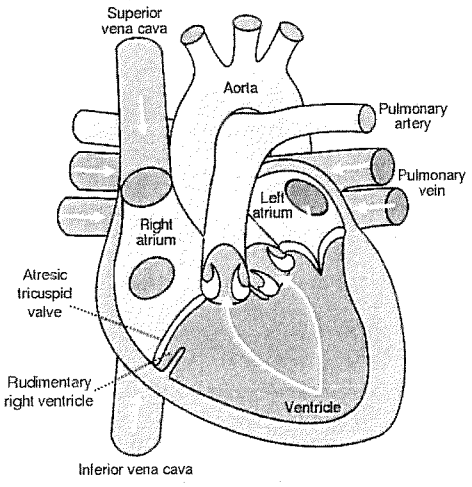
2 - Healthy hearts.



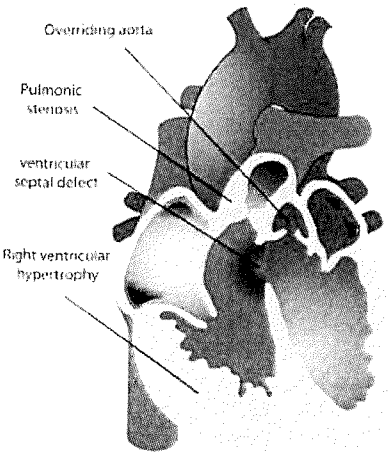
3 - dextro-Transposition of the great arteries, dTGA. Oxygenated blood shown in dark pink (above left)



4 - Hypoplastic left heart syndrome.



5 - Tricuspid atresia



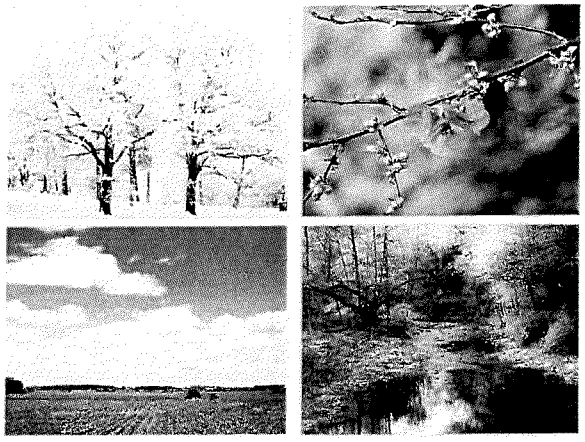
6 - Tetralogy of Fallot.

Available Prevention Measures to Address Agricultural Applications of Fertilizer

This section discusses some of the most often used prevention measures, but is not an exhaustive list of all known measures. For information on additional prevention measures, see the documents referenced in the last section of this fact sheet. Please keep in mind that individual prevention measures may or may not be adequate to prevent contamination of source waters. Most likely, individual measures should be combined in an overall prevention approach that considers the nature of the potential source of contamination, the purpose, cost, operational, and maintenance requirements of the measures, the vulnerability of the source water, the public's acceptance of the measures, and the community's desired degree of risk reduction.

The goal of these prevention measures is to minimize nutrient losses from agricultural lands occurring by edge-of-field runoff and by leaching from the root zone. Effective nutrient management abates nutrient movement by minimizing the quantity of nutrients available for loss. This is achieved by developing a comprehensive nutrient management plan and using only the types and amounts of nutrients necessary to produce the crop, applying nutrients at the proper times and with proper methods, implementing additional farming practices to reduce nutrient losses, and following proper procedures for fertilizer storage and handling.

Comprehensive Nutrient Management Plans include soil sampling, crediting other sources of nutrients and limiting fertilizer use.



7, 8, 9, 10 - Seasons.

Application Rates and Fertilizer Types

One component of a comprehensive nutrient management plan is to determine proper fertilizer application rates. The goal is to limit fertilizer to an amount necessary to achieve a realistic yield goal for the crop. Soil sampling and crediting other sources are also parts of the concept.

Yearly soil sampling is necessary for determining plant nutrient needs and to make accurate fertilizer recommendations. Many factors must be considered when determining sampling methods and frequency.

Calculating the optimal rate of application also includes crediting other sources that contribute nitrogen and phosphorous to the soil. Previous legume crops, irrigation water, manure, and organic matter all contribute nitrogen to the soil, while organic matter and manure contribute phosphorus.

Along with soil samples and fertilizer credits from other sources, nitrogen fertilizer recommendations are based on yield goals established by the crop producers. Yield expectations are established for each crop and field based on soil properties, available moisture, yield history, and management level.

Applying the appropriate form of nitrogen fertilizer can reduce leaching. Nitrate forms of nitrogen fertilizer are readily available to crops, but are subject to leaching losses. Nitrate fertilizer use should be limited when the leaching potential is moderate to high. In these situations, ammonium nitrogen fertilizers should be used because they are not subject to immediate leaching. However, ammonium nitrogen transforms rapidly into nitrate when soils are warm and moist. More slowly available nitrogen fertilizers should be used in these conditions. Nitrification inhibitors can also delay the conversion of ammonium to nitrate under certain conditions.

Phosphorus fertilizer is less subject to leaching, but loss through surface runoff is more common. To minimize losses of phosphorus fertilizer, applications should only be made when needed (determined through soil testings) and at recommended rates.

Fertilizer Application Timing

Nitrogen fertilizer applications should be timed to coincide as closely as possible to the period of maximum crop uptake. Fertilizer applied in the fall has been shown to cause ground water degradation. Partial application of fertilizer in the spring, followed by small additional applications as needed, can improve nitrogen uptake and reduce leaching. Reasons to alter nitrogen amounts include abnormal weather or crop quality.

Fertilizer Application Methods

Fertilizer application equipment should be inspected at least once annually. Application equipment must also be properly calibrated to insure that the recommended amount of fertilizer is spread.

Correct fertilizer placement in the root zone can greatly enhance plant nutrient uptake and minimize losses. Subsurface applied or incorporated fertilizer should be used instead of a surface broadcast fertilizer. The most efficient application method for many crops, especially in erosive soils, is to place dry fertilizer into the ground in bands. Band or drilled row fertilizers are applied closer to the seed and can be recovered by the crop more efficiently. All surface-applied fertilizers should be mechanically incorporated into the soil to reduce losses through surface runoff and volatilization. Fertilizer should never be applied to frozen ground, and also should be limited on slopes and areas with high runoff or overland flow.

Irrigation water should be managed to maximize efficiency and minimize runoff or leaching. Irrigated crop production has the greatest potential for source water contamination because of the large amount of water applied. Both nitrogen and phosphorus can leach into ground water or run off into surface water when excess water is applied to fields. Irrigation systems, such as sprinklers, low-energy precision applications, surges, and drips, allow producers to apply water uniformly and with great efficiency. Efficiency can also be improved by using delivery systems such as lined ditches and gated pipe, as well as reuse systems such as field drainage recovery ponds that efficiently capture sediment and nutrients. Gravity-controlled irrigation or furrow runs should be shortened to prevent over-watering at the top of the furrow before the lower end is adequately watered.

Correct fertilizer placement in the root zone can greatly enhance plant nutrient uptake and minimize losses. Subsurface applied or incorporated fertilizer should be used instead of a surface broadcast fertilizer.

11 - Crop bands.

Additional Farming Practices

A complete system is needed to reduce fertilizer loss. Components of this system often include farming practices that are not strictly related to fertilizer, such as conservation tillage and buffers.

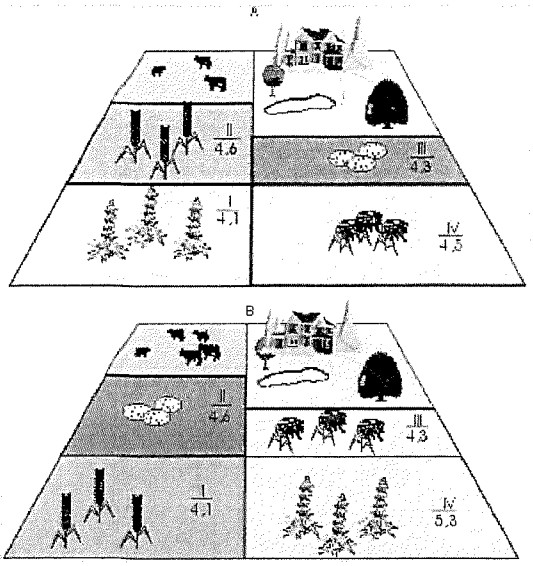
Conservation Tillage

Conservation tillage is another field management method used to reduce runoff. In conservation tillage, crops are grown with minimal cultivation of the soil. When the amount of tillage is reduced, the plant residues are not completely incorporated and most or all remain on top of the soil. This practice is critical to reducing phosphorus losses because the residue provides cover and thereby reduces nutrient runoff and erosion by water.

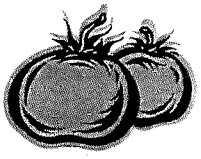
12 - Conservation tillage.

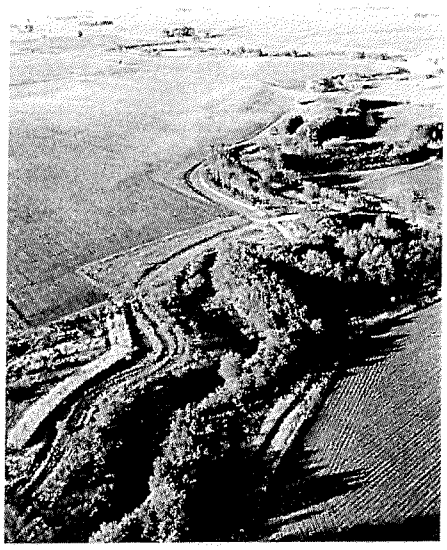
Crop Rotation

Crop rotation can often yield crop improvement and economic benefits by minimizing fertilizer and pesticide needs. Planting legumes as part of a crop rotation plan provides nitrogen for subsequent crops. Deep-rooted crops can be used to scavenge nitrogen left in the soil by shallow-rooted crops. Cover crops stop wind and water erosion, and can use residual nitrogen in the soil.



13 - Crop rotation.





Buffer Strips

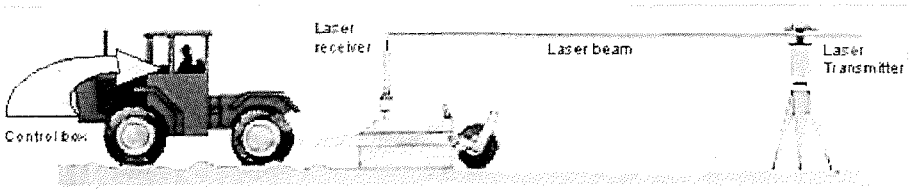
Creating buffer strips or filter strips can impede runoff and help filter nitrogen and phosphorus from runoff. Buffer strips and filter strips are created by planting dense vegetation near surface water bodies. The root systems of these plants hold soil in place, thereby decreasing the velocity of runoff and preventing erosion. The vegetation and soils strain and filter sediments and chemicals. For more information on buffer strips and filter strips see the fact sheet on storm water runoff.

14 - Buffer strip.

Irrigated crop production has the greatest potential for source water contamination because of the large amount of water applied.

Field Leveling

A high-tech way to level or grade a field is to use laser-controlled land leveling equipment. Field leveling helps to control water advance and improve uniformity of soil saturation in gravity-flow irrigation systems. This improves irrigation efficiency and reduces the potential for nutrient pollution through runoff.



15 - Laser-controlled land leveling.

Fertilizer Storage and Handling

Follow label directions for storing and mixing fertilizer and for disposing empty containers. Lock or secure storage container valves when the container is not in use.

Protect permanent fertilizer storage and mixing sites from spills, leaks, or storm water infiltration. Storage buildings should have impermeable floors and be securely locked. Impermeable secondary containment dikes can also be used to contain liquid spills or leaks. Do not store fertilizer in underground containers or pits.

To prevent accidental contamination of water supplies, mix, handle, and store fertilizer away from wellheads and surface water bodies. Installing anti-backflow devices on equipment can also prevent spillage. Ideally, mix and load fertilizers at the application spot.

Immediately recover and reuse or properly dispose of spills. Granular absorbent material can be used at the mixing site to clean up small liquid spills.

Additional Information

These references have information on agricultural fertilizer use and best management practices. All of the following documents are available for free on the internet. You should also contact the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), Conservation District, and Agricultural Extension Service representatives in your area for more information on nutrient management and cost-share programs, such as the Environmental Quality Incentives Program (EQIP), the Conservation Reserve Program (CRP), and the Conservation Reserve Enhancement Program (CREP), to assist in financing source water protection measures.

Contact local government authorities in your area to see if there are ordinances in place to manage fertilizer use. Numerous examples of local source water protection-related ordinances for various potential contaminant sources can be found at: http://www.epa.gov/r5water/ordcom/
http://www.epa.gov/owow/nps/ordinance/
http://www.epa.gov/owow/nps/ordinance/links.htm

The following documents provide more detailed information on prevention measures for fertilizer use on the farm

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U.S. Department of Agriculture, Natural Resources Conservation Service. Comprehensive Nutrient Management Planning – Technical Guidance. (2000, December). Retrieved April 30, 2001 from the World Wide Web:
http://www.nhq.nrcs.usda.gov/PROGRAMS/ahcwpd/ahCNMP.html

U.S. Department of Agriculture, Natural Resources Conservation Service. Conservation Practices Training Guide. (1999, August). Retrieved April 30, 2001 from the World Wide Web: http://www.ftw.nrcs.usda.gov/tech_ref.html

Virginia Cooperative Extension. Fertilizer Storage, Handling, and Management (442-906). (1996, June). Retrieved February 9, 2001 from the World Wide Web: http://www.ext.vt.edu/pubs/farmasyst/442-906/442-906.html

Image Credits

1 - Flickr Creative Commons, attribute only search. liquid fertilizer application uploaded by "eutrophication&hypoxia" on March 31, 2010. http://www.flickr.com/photos/48722974@N07/4478367887/

2 - Wikipedia. Diagram of the Human Heart: http://commons.wikimedia.org/wiki/File:Diagram_of_the_human_heart.svg

3 - Wikipedia, copyright image for any use. dextro-Transposition of the great arteries: http://en.wikipedia.org/wiki/File:D-TGA.jpg

4 - Wikipedia, public domain image. Hypoplastic left heart syndrome: http://en.wikipedia.org/wiki/Hypoplastic_left_heart_syndrome

5 - Wikipedia Tricuspid Atresia: http://en.wikipedia.org/wiki/File:Tricuspid_atresia.svg

6 - Wikipedia, public domain image. Tetralogy of Fallot: http://en.wikipedia.org/wiki/Tetralogy_of_Fallot

7 - Flickr Creative Commons, attribute only search. Just a reminder of the long cold winter we had....., uploaded by "Per Ola Wiber ~ Powi" on July 5, 2010. http://www.flickr.com/photos/powi/4762908073/

8 - Flickr Creative Commons, attribute only search. Spring Blossoms, uploaded by "Noel Zia Lee" on March 8, 2007. http://www.flickr.com/photos/noelzialee/414585445/

9 - Flickr Creative Commons, attribute only search. Oh Summer..., uploaded by "bark" on December 5, 2009. http://www.flickr.com/photos/barkbud/4160654917/

10 - Flickr Creative Commons, attribute only search. Autumn Stream, uploaded by "digitalART2" on December 8, 2007. http://www.flickr.com/photos/digitalart/2095802085/

11 - Flickr Creative Commons, attribute only search. Lettuce and fertilizer tanks, uploaded by "benketaro" on September 13, 2009. http://www.flickr.com/photos/misskei/3918032323/

12 - From original bulletin, 2001.

13 – Baltic Agricultural run-off Action Programme. http://www.baap.lt/codes_gap/lithuania/chapter_2.htm

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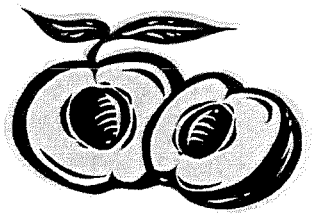
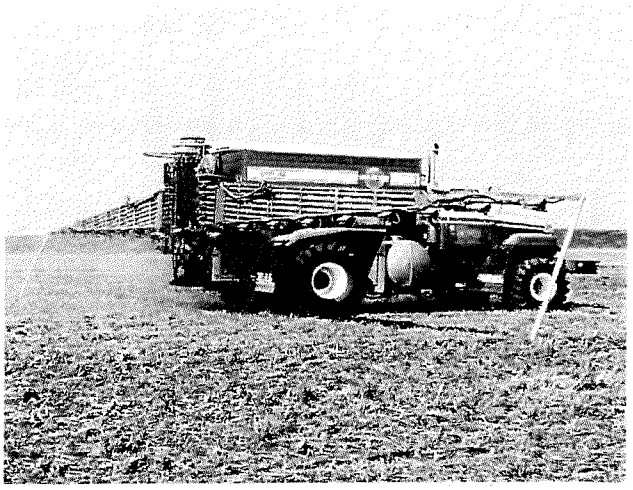
Back Cover - From original bulletin, 2001.





Source Water Protection Practices Bulletin

Managing Agricultural Fertilizer Application to Prevent Contamination of Drinking Water

The mission of EPA is to protect human health and to safeguard the natural environment -- air, water and land -- upon which life depends.

USEPA East (EPA East) [Old ICC Building]
1201 Constitution Avenue N.W.
Washington, DC 20004

EPA United States Environmental Protection Agency

SUMMER 2008
Vol. 10, No. 1

Pipeline

NESC

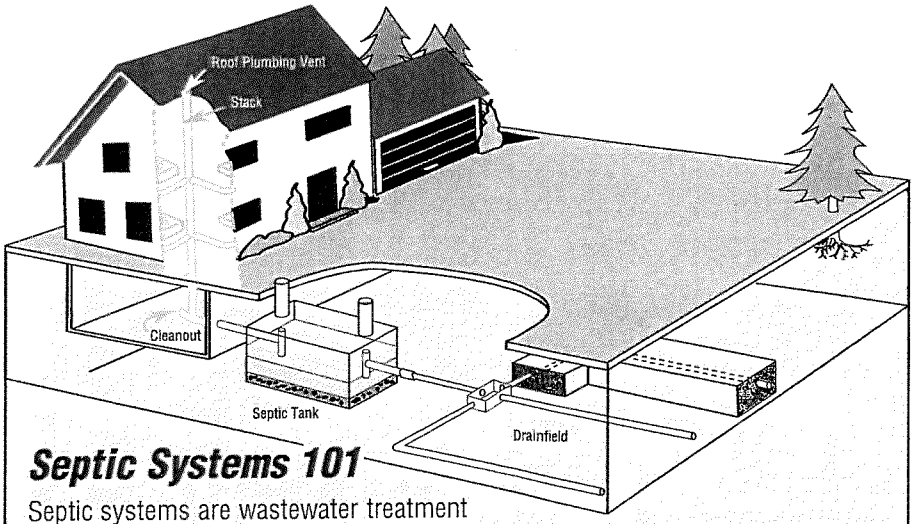
Small Community Wastewater Issues Explained to the Public

Septic Systems and Source Water Protection

Homeowners Can Help Improve Community Water Quality

If your home has a septic system, you are no doubt aware that this is a common way to treat residential wastewater. In fact, septic systems and related forms of treatment that experts call decentralized wastewater treatment systems (septic systems, private sewage systems, onsite sewage disposal systems) are some of the most common waste dispersal methods in the country.

According to the U.S. Environmental Protection Agency (EPA), decentralized wastewater treatment systems collect, treat, and release about four billion gallons of effluent per day from an estimated 26 million homes and businesses. The percentage of homes and businesses served by these systems varies from state to state, from a high of about 55 percent in Vermont to a low of about 10 percent in California. Nationwide, approximately 40 percent of the new homes being built will rely on some kind of onsite system to treat wastewater. (Ground Water Report to the Nation: A Call to Action, 2007)



Septic Systems 101

Septic systems are wastewater treatment systems that collect, treat, and disperse of wastewater generated by your home or business. The wastewater is treated onsite, rather than collected and transported to a centralized community wastewater treatment plant.

A typical septic system consists of two main parts: a septic tank and a soil absorption system, also known as a drainfield, leachfield, or disposal field. Underground pipes connect the entire system.

The septic tank is a buried, watertight container usually made of concrete, fiberglass, or polyethylene. It holds the wastewater long enough to allow the solids to settle out and the fats, oil, and grease to float to the surface. It also allows partial decomposition of the solid materials. Effluent from the middle layer flows out to the drainfield for further treatment in the soil.

Septic systems can contribute to source water contamination for various reasons including improper location of the system, poor design, faulty construction, incorrect operation, and poor or no maintenance of the system.

By following the basic recommendations previously mentioned, you can help ensure that your system continues to function properly.

As many of us migrate further from central cities and occupy homes served by decentralized treatment systems, septic system care is more important than ever. By keeping your onsite system in top working condition, you can save money, increase the value of your home, and also feel good that you've helped your community both now and for future generations.

As the owner of an onsite wastewater system, you may not be aware that you play an important role in protecting your community's water quality. Source water—streams, lakes, rivers, or groundwater—is, as the name suggests, the source of our drinking water, whether we get it from a local water district treatment plant or from a privately owned well. To maintain the most pristine water quality possible, we need to consider the activities that take place in the source water area and make sure that their environmental impacts on nearby waterways are minimal.

Unfortunately, EPA research shows that one of the biggest causes of pollution to our waterways is septic systems that are not working as they should.

When a septic system is not properly maintained or fails, untreated domestic wastewater can reach the source water. Bacteria and viruses from human waste can cause dysentery, hepatitis, and typhoid fever and the cumulative effect of numerous failing septic systems can become a major source of pollution. And, the more polluted the source water, the more costly it is to clean for human consumption.

Maintenance Pays

Of course, the best way to deal with a broken septic system is to not let it get broken in the first place. Since it can be difficult for homeowners to know if their systems are slowly failing (as defined by each state), you can greatly reduce that likelihood, and gain peace of mind, simply by having your system regularly pumped and inspected. This preventative measure costs thousands less than does the cost of repairing or replacing a non-functioning system. (See the sidebar on the next page for a suggested pumping schedule.)

The following tips will also help maintain a healthy septic system:

- Do not use caustic drain cleaners on clogged pipes. Instead, use boiling water or a drain snake to open clogs.
- Conserve water to avoid hydraulic overloading of the system. Repair leaky faucets and toilets. Use low-flow fixtures.
- Use bathroom cleaners and laundry detergent in moderation. (Find recommended cleaning products in the NESC brochure titled "Alternative Household Cleaners." Find how to order info on page 8.)
- Your septic system is not a trash can. Do not flush disposable diapers, tampons, condoms, paper towels, cat litter, or cigarettes into the system. These items quickly fill your septic tank with solids, decrease the system's efficiency, and will require it to be more frequently pumped. Trash flushed down the toilet can also clog the pipelines, causing wastewater to back up into your home.
- Avoid dumping grease or fats down the kitchen drain. They solidify and the accumulation may contribute to plumbing and system blockages.
- Keep paint, varnish, thinners, oil, photographic solutions, pesticides and other hazardous chemicals out of your system. Even in small amounts, these items can destroy the biological digestion taking place in your septic system. Do not flush unused medicines. Check with your local health department for disposal recommendations for your area.
- The use of garbage disposals is discouraged. If you have a garbage disposal, use it sparingly. Garbage disposals add unnecessary solids and nutrients to the system.

National Environmental Services Center
NESC
Pipeline

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SMART about WATER

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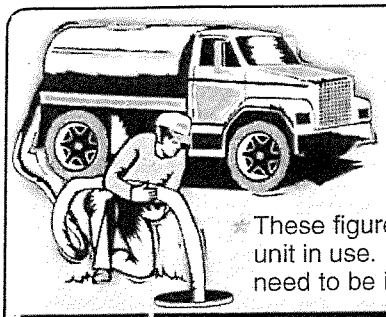


Estimated Septic Tank Pumping Frequencies In Years*

*These figures assume there is no garbage disposal unit in use. If one is in use, pumping frequency may need to be increased.

Tank Size (gals.)	Household Size (number of people)					
	1	2	3	4	5	6
500	5.8	2.6	1.5	1.0	0.7	0.4
750	9.1	4.2	2.6	1.8	1.3	1.0
900	11.0	5.2	3.3	2.3	1.7	1.3
1000	12.4	5.9	3.7	2.6	2.0	1.5
1250	15.6	7.5	4.8	3.4	2.6	2.0
1500	18.9	9.1	5.9	4.2	3.3	2.6
1750	22.1	10.7	6.9	5.0	3.9	3.1
2000	25.4	12.4	8.0	5.9	4.5	3.7
2250	28.6	14.0	9.1	6.7	5.2	4.2
2500	31.9	15.6	10.2	7.5	5.9	4.8

(Source: Pennsylvania State University Cooperative Extension Service.)

- Do not drive over the system or the drainfield. This can compact the soil and break the piping of the system.
- Redirect surface water flow away from your system.
- Plant a 'green belt' or grassy strip between the drainfield and the shoreline if near a water body.
- Periodically check for signs of system failure: areas in the yard that remain moist during dry weather or patches of lush grass or plant growth. If you see signs of failure, schedule an inspection immediately.

Most typical septic systems should be inspected every two to three years but, depending on the system size and the number of people in the home, this frequency could change. Any system with mechanical parts, such as pumps and filters, should be inspected annually. If your tank has never been pumped, or is not accessible, once it is uncovered, put a watertight riser on it for future accessibility.

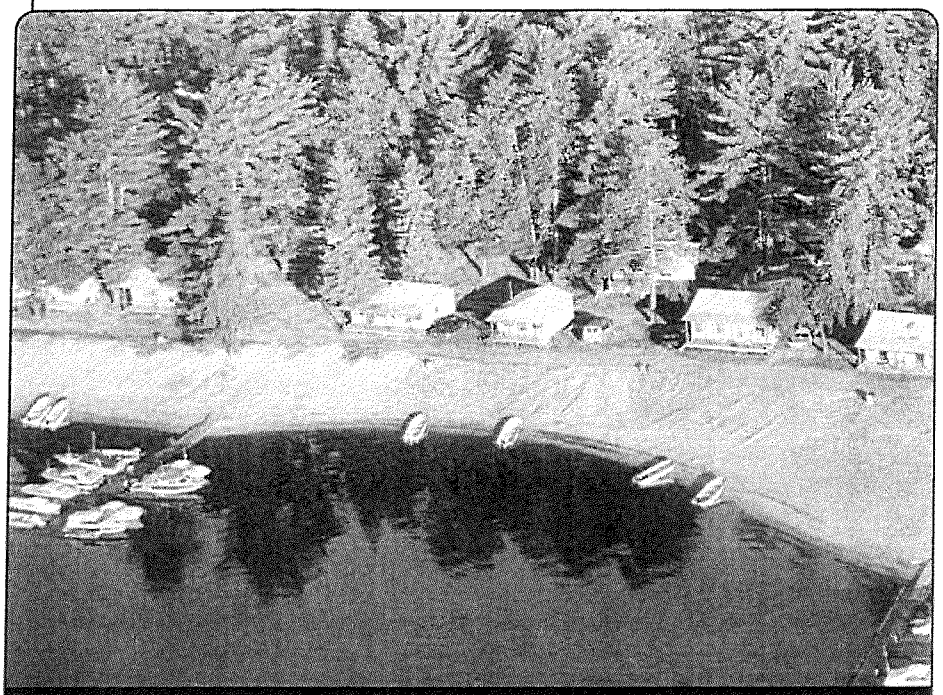
If your system is already failing, have it inspected by a professional and repaired or replaced as soon as possible.

A Healthy Septic System is an Investment

Your home represents a significant investment. For most of us, our house is the single biggest item we'll ever purchase and, consequently, represents a significant proportion of our net worth. Simply put: a failing septic system will lower your property value and may even make selling your home a problem. No one wants to buy a house with a stinky, soggy yard.

Functioning onsite systems, on the other hand, can add value to your home and good water quality will benefit your property value. This fact was borne out in a study conducted by Bemidji State University in Minnesota, where homes on lakes with good water quality were more valuable and had seen their value rise more quickly than those on lakes with marginal or poor water quality. (See the sidebar on page 4 for more information about water quality and land value in Minnesota.) As you would expect, people pay more for building sites and homes along clean stretches of water.

Another economic benefit of maintaining your onsite system is that it helps ensure the clean, safe drinking water, which is an essential ingredient of a healthy and viable community. Contamination of drinking water sources can cause a community significant expense and affect public health. Remember, it will cost you less in the long run if you can prevent contamination of your drinking water source rather than incur the high cost of treat-



Water Quality Adds Value to Lakefront Property

Minnesota's 10,000 fresh water lakes are essential to the economic well-being of the state – culturally, economically, and ecologically. They are assets worthy of environmental protection. The challenge is determining the best way to protect the lake water quality with the high rate of development along their shores. Good environmental policies are more effective and less expensive than restoration efforts.

While the overall quality of Minnesota lakes may be good, lakeshore development continues to degrade lake quality. A 2003 study, conducted by the Mississippi Headwaters Board and the Bemidji State University, investigated the effect of water quality on property values to help legislators formulate the best public policies. The quality of the surrounding water was shown to play a significant role in the price of property. Water quality was determined to have a positive relationship with property prices. In other words, the more pristine the water, the more potential homeowners were willing to pay to live there. The economic benefits of water quality were shown to be a good incentive for promoting effective protection policies.

ing the water or locating and developing alternate water sources. Reducing contamination to groundwater reduces the cost of drinking water.

Quality of Life

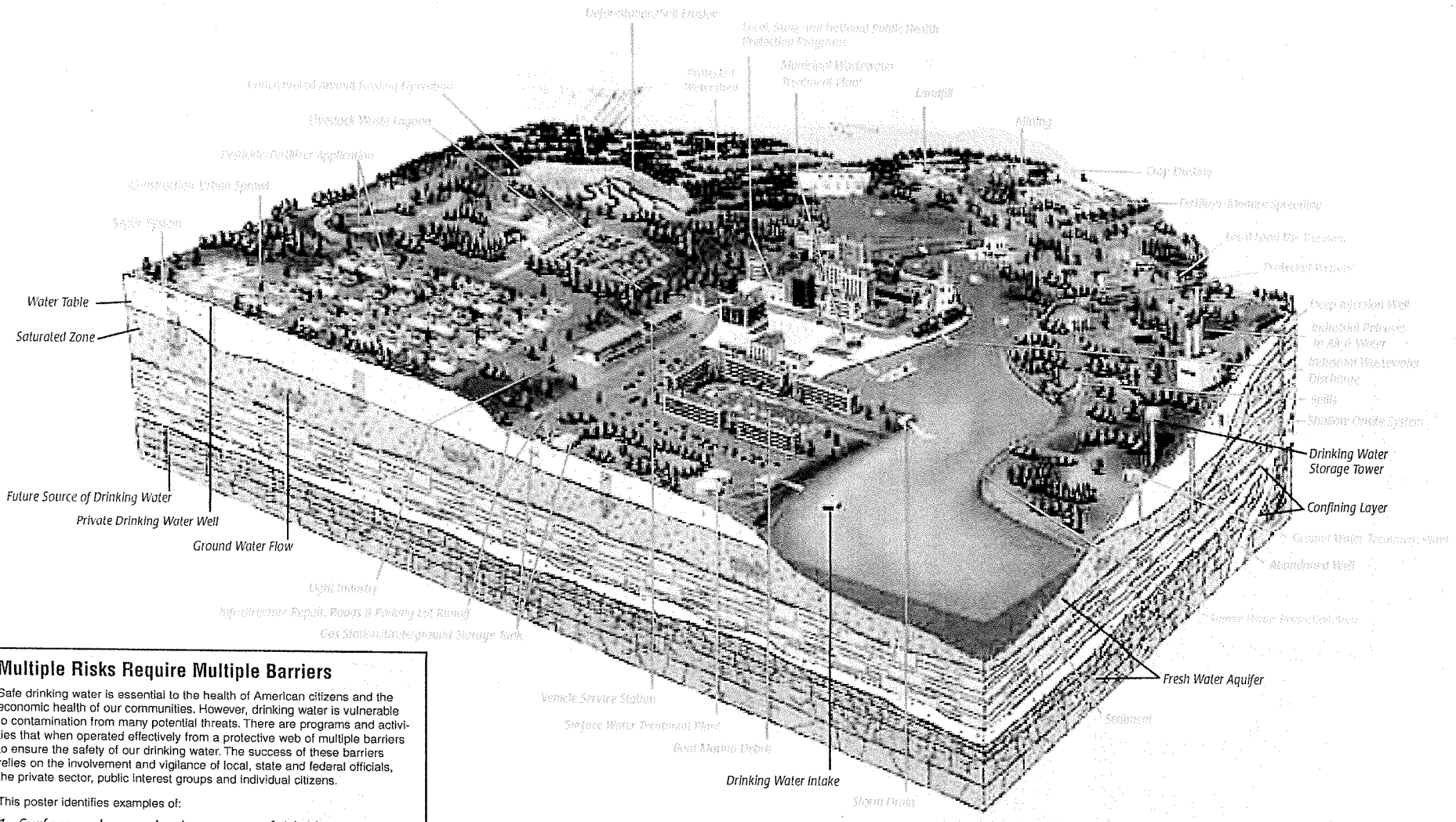
A non-working septic system can pollute your own yard and surrounding waters—like the lake where you like to put in your bass boat on a pretty Saturday morning or that rocky little creek where your grandkids like to catch crawfish. Imagine launching your boat onto a sea of green, foamy algae caused by excess nitrates in the water from a leaking septic tank. And you probably wouldn't want the kids splashing around in that creek if the water was murky from untreated sewage.

The following example describe how inadequate septic system maintenance can change the whole picture.

Shelburne Beach, Vermont, is a local swimming beach on a central portion of Lake Champlain in the town of Shelburne, Vermont. Bacteria leaking from residential septic systems caused excess E. coli in a nearby tributary, resulting in occasional beach closures. As a result, state officials placed the offending one-mile unnamed tributary on its section 303(d) list for E. coli in 1998. (Section 303(d) of the Clean Water Act requires states to develop a list of waters not meeting water quality standards or having impaired uses. Listed waters must be prioritized, and a management strategy or total maximum daily load must subsequently be developed for all listed.)

The town identified six residential septic systems along the stream as the most likely sources and local officials encouraged the homeowners to correct the deficiencies in their septic systems. Between 1998 and 2001, all six homeowners rebuilt their systems by installing new tanks and drainfields. Subsequent monitoring data showed that the stream and beach consistently met water quality standards, and the tributary was removed from the state's 303(d) list in 2004.

Safe Drinking Water Act – Protecting America's Public Health



Multiple Risks Require Multiple Barriers

Safe drinking water is essential to the health of American citizens and the economic health of our communities. However, drinking water is vulnerable to contamination from many potential threats. There are programs and activities that when operated effectively from a protective web of multiple barriers to ensure the safety of our drinking water. The success of these barriers relies on the involvement and vigilance of local, state and federal officials, the private sector, public interest groups and individual citizens.

This poster identifies examples of:

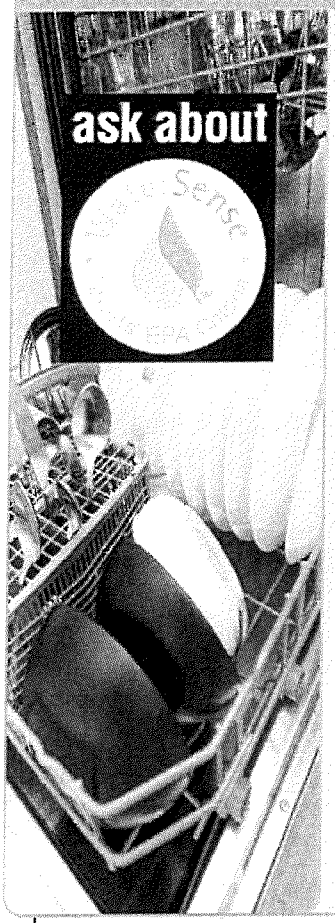
1. *Surface and groundwater sources of drinking water*
2. *Potential threats to these drinking water sources*
3. *The multiple barriers that together protect our nation's public health.*

Safe Drinking Water Hotline • (800) 426-4791 • Safewater Web Site • www.epa.gov/safewater

EPA

Adapted by the NESC from the *Safe Drinking Water Act – Protecting America's Public Health* Poster.
The original full-color poster an be downloaded or ordered from *www.epa.gov/safewater/publicoutreach/landscapeposter.html*

Conserving Water Prolongs Septic System Life



Overloading a septic system can cause it to malfunction. Here are some steps to reduce water consumption in the home:

1. Use dishwashers and clothes washers only when fully loaded.
2. Take short showers instead of baths and avoid letting faucets run unnecessarily.
3. Replace old water fixtures with new water-efficient showerheads, faucets, and toilets. Look for the new WaterSense rating given by the EPA. This rating system helps consumers identify high-performance, water-efficient products that can reduce water use in the home and help preserve the nation's water resources. You can find EPA's WaterSense rated products at *www.epa.gov/watersense/index.htm.*
4. Repair and replace any leaking fixtures immediately. (Nearly 14 percent of the water a typical homeowner pays for is never even used—it leaks down the drain.)

Untreated flow from your septic system has the potential to contaminate groundwater, too. Chris Swann, a watershed planner with the Center for Watershed Protection, warns, "Septic system failure delivers a significant amount of pollutants to local water bodies, especially in coastal and lake shoreline areas. The threat of bacterial contamination becomes very important. Many reports of disease outbreaks are linked to groundwater contamination by septic system effluent." Swann stresses that improved management protocols and tougher performance standards for new development are critical to reducing the negative effects of onsite systems.

The negligent homeowner who allows his or her onsite system to contaminate the local environment can affect the entire community. Increased bacteria levels in groundwater, lakes and streams can present a public safety issue. Any contact with untreated human waste can pose a significant risk to public health. Untreated effluent from failing systems in local water bodies adversely impacts wildlife and aquatic populations.

Everyone deserves to live in a healthy environment and having your septic tank routinely pumped and inspected can help achieve the goal of a clean community.

Related Pipeline Issues

Pharmaceuticals and Personal Care Products: An Overview, Winter 2007

Septic Systems–A Practical Alternative for Small Communities, Summer 2004

How to Keep Your Water 'Well,' Summer 2002

Watershed Management, Fall 2006

Maintaining Your Septic System-A Guide for Homeowners, Fall 2004

Archived issues of Pipeline can be downloaded at *www.nesc.wvu.edu/pipeline.cfm* or ordered from NESC. See back cover for details.

Additional Resources

"Protecting Your Groundwater Source," *On Tap,* Spring 06 *www.nesc.wvu.edu/pdf/dw/-groundwater/OT_SP06_PROTECT.pdf*

"Making an Impact: The Watershed Approach" by Caigan M. McKenzie, *Small Flows Quarterly,* Fall 2006, *www.nesc.wvu.edu/pdf/-ww/publications/smallflows/magazine/SFQ_FA06.pdf*

Groundwater Remediation Saving the Source by Kathy Jesperson, NESC Editor, *On Tap,* Fall 2003, *www.nesc.wvu.edu/pdf/dw/groundwater/remediation_OT_FA03.pdf*

"Ground Water Report to the Nation: A Call to Action," Ground Water Protection Council, 2007, *www.gwpc.org/-CallToAction/*

Readers are encouraged to reprint *Pipeline* articles in local newspapers or include them in flyers, newsletters, or educational presentations. Please include the name and phone number of the National Environmental Service Center (NESC) on the reprinted information and send us a copy for our files. If you have any questions about reprinting articles or about any of the topics discussed in this newsletter, please contact the NESC at (800) 624-8301.

SMART about WATER

NESC's Newest Project Helps Small Communities Protect Water

"An ounce of prevention is worth a pound of cure," Benjamin Franklin famously stated more than 250 years ago. This simple philosophy describes a new environmental project—SMART About Water—designed to protect drinking water quality.

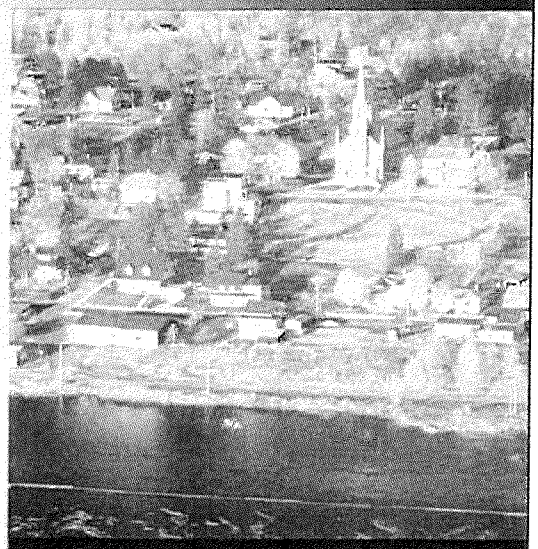
Funded by a $3 million grant from the U.S. Environmental Protection Agency (EPA), SMART About Water is being orchestrated by West Virginia University's National Environmental Services Center (NESC) in partnership with the Rural Community Assistance Partnership (RCAP). The program is designed to provide training and technical assistance about source water and wellhead protection planning to small and rural communities during 2008 and 2009 and will focus on untreated wastewater from failing septic and sewer systems, the largest contributor to water quality degradation.

According to EPA, communities derive several important benefits when they protect their source water:

- If source water is contaminated, it threatens public health.
- The better the water is when it reaches the treatment plant, the easier and cheaper it is to treat.
- The cost of dealing with contaminated groundwater ranges from 30 to more than 200 times the cost of wellhead protection.
- Clean water and healthy ecosystems are vital in terms of quality of life for both humans and animals.

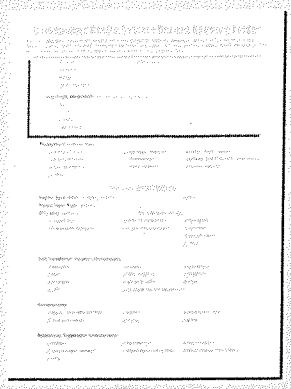
Although water quality has improved in the three decades since passage of the Clean Water and Safe Drinking Water Acts, pollution problems linger. Previous efforts concentrated on reducing point source pollution, such as from industrial sites. Water quality issues now are related to the cumulative effect of nonpoint source pollution—untreated wastewater, agricultural fertilizers and pesticides, stormwater runoff, and roadway pollutants—that impact the physical, chemical, and biological health of nearby waters.

Visit the SMART About Water Web site at: *www.nesc.wvu.edu/-SMART/* for more information about this project.



A Project of the National Environmental Services Center at West Virginia University, with the Rural Community Assistance Partnership, under a Cooperative Agreement of the U.S. Environmental Protection Agency, Office of Ground Water and Drinking Water

RELATED NESC PRODUCTS



This package is one of NESC's most popular products. Included in the package are homeowner septic tank information brochures, newsletters, and fact sheets. This information is packaged in a handy, onsite system record-keeping folder that the homeowner can use to track system maintenance, sketch the layout and position of the system, and record permit and local health department information.

WWHELPER $2.25

Homeowners Onsite System Recordkeeping Folder

Another useful product available from NESC. This folder provides a place to record and store information about your septic system and its maintenance. On the cover are sections for permit and local health department information. Inside are tips for locating your system, a safety checklist, and a section for recording the names, addresses, and certification numbers of your systems designer, installer, and pumper.

WWHELPER2 ..... $.45

Natural Household Cleaners and Home Improvement Tips

This fact sheet provides less-toxic alternatives for several cleaning and home improvement jobs around the house.

WWHELPER3 ..... $.45

Septic System Owner's Guide to Protecting Drinking Water Sources: Septic Systems and Ground Water Contamination

This fact sheet discusses ways to prevent septic systems from contaminating sources of drinking water. It can be downloaded at www.nesc.wvu.edu/pdf/ww/septic/epa_septicwater_protection.pdf or ordered from NESC.

WWHELPER4 ..... $.40

Groundwater Protection Starts at Home Poster

This poster shows how household hazardous waste can contaminate groundwater. The back of the poster contains notes about household hazardous waste and disposal, as well as information about how to set up a household hazardous waste disposal program.

WWPSTER ..... Free

How to Order NESC Products

To place an order, call us toll free at (800) 624-8301 or (304) 293-4191. or send email to info@mail.nesc.wvu.edu. *Be prepared to give the item number and title of the product you wish to order. Shipping charges will apply.*

NESC **Assistance. Solutions. Knowledge.**

NESC
National Environmental Services Center
WVU Research Corporation
West Virginia University
P.O. Box 6064
Morgantown, WV 26505-6064

Appendix D

Source Water Protection Brochure

For questions about Dundee's Drinking Water Source Protection Plan, contact:

Michael Jones, Director
Tuscarawas County Metropolitan Sewer District
9944 Wilkshire Bldvd. NE
Bolivar, OH 44612
(330) 874-3262

Did you know...

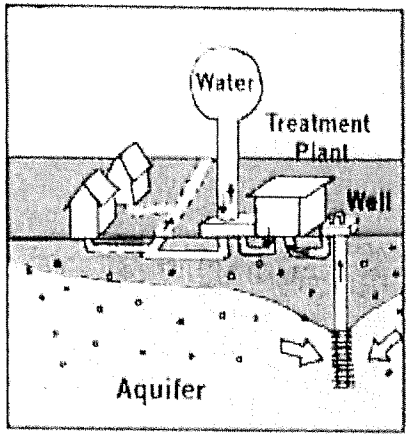
- *Only 3% of the water on earth is drinkable.*
- *Less than 1 gallon of gas can pollute 1 million gallons of water.*
- *You can avoid contaminating your source of drinking water by properly disposing of chemicals that have the potential to cause ground water contamination.*
- *Improper disposal methods include: pouring chemicals on the ground, down a sink or toilet, or down a storm drain (many storm drains lead directly to rivers).*

To Learn More about Drinking Water Source Protection in Ohio:

Ohio Environmental Protection Agency
Lazarus Government Center
P.O. Box 1049
Columbus, Ohio 43215-1049
(614) 644-2752
www.epa.ohio.gov/ddagw/swap.aspx

Protecting Dundee's Source of Drinking Water

Where does Dundee's drinking water come from?

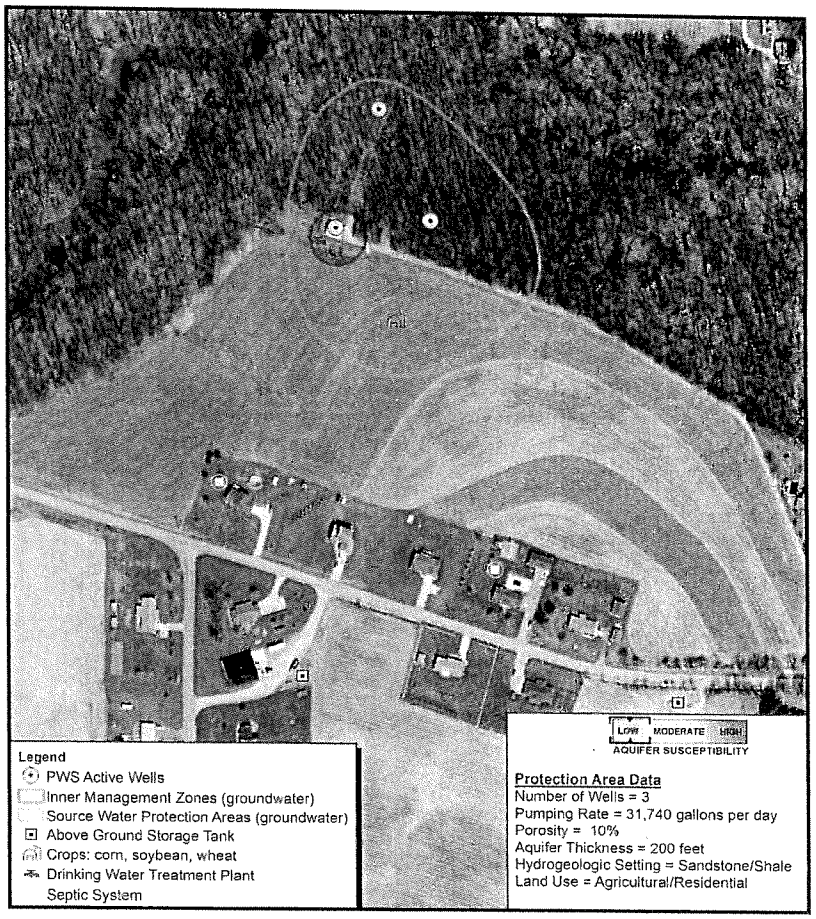


The Dundee Public Water Supply serves approximately 400 people and pumps about 30,000 gallons of water per day from an underground source of water (aquifer). Dundee's well field is operated by the Tuscarawas County Metropolitan Sewer District (TCMSD) and is located about one mile north of the Village of Dundee in Wayne Township. The well field has three wells which pump ground water to a water treatment plant, where the water is chlorinated, and treated to remove excess iron and manganese. From there, it is pumped through an underground network of pipes to homes and businesses near Dundee.

Where does the ground water come from? All ground water originally comes from rain or melted snow that has seeped into the ground. Water fills spaces between sand, gravel and fractured bedrock. Where underground water is abundant enough to provide an adequate source of water, the water-rich rocks (or sediments) are called an aquifer. Dundee's drinking water supply comes from a bedrock aquifer next to the South Fork of Sugar Creek.

Ground water does not stay in one place. The ground water supplying the Dundee's wells moves very slowly, sometimes following the gradient of nearby streams. Surface water flows primarily from south to north in the vicinity of Dundee; ground water flow directions are expected to be the same. If pollutants are spilled on the ground near Dundee's wells, or up gradient of the wells, the pollutants may eventually enter the ground water that you are drinking. Although the water plant provides treatment, it would be very expensive to treat for every type of possible pollutant. This is why everyone living near Dundee should know about ***Drinking Water Source Protection***.

What is Drinking Water Source Protection? Drinking Water Source Protection is a plan of action for protecting the water you drink from contamination at the source. Because of the moderate to deep depth below ground surface to the bedrock aquifer tapped by Dundee's wells, and the presence of some lower permeability soil and bedrock to protect the aquifer, Dundee's source of drinking water has a low susceptibility to contamination from land use activities.



To assist Dundee with its drinking water source protection efforts, Ohio EPA provided the TCMSD with a Drinking Water Source Assessment Report, revised in 2017. This report includes a map of the protection area (see above) based on calculations of how far water travels through the aquifer in one year (referred to as the "Inner Management Zone") and in five years (referred to as the "Drinking Water Source Protection Area"). The report also includes information on land uses and locations that may pose a contamination risk to the drinking water source. Potential risks are identified based on proximity to the well field and the kinds/quantities of chemicals that are typically handled at these properties.

The TCMSD has used the assessment to develop a drinking water source protection plan. If you would like to be more involved with Dundee's drinking water protection efforts, or if you would like to see a copy of the Drinking Water Source Protection Plan, please contact the TCMSD Offices at (330) 874-3262.