PROTECTION OF POTABLE WATER SUPPLIES IN TENNESSEE WATERSHEDS

2009 Report

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		Page
1.0	**INTRODUCTION**	**1**
2.0	**TENNESSEE WATERSHEDS**	**3**
2.1	Defining Watersheds	3
2.2	Watershed Approach	4
2.3	Watershed Planning	4
3.0	**POINT AND NONPOINT CHALLENGES TO WATERSHED PROTECTION**	**6**
3.1	Point Sources	6
	3.1.A. Issues of Concern	6
	3.1.B. Restoration Programs and Tools	7
3.2	Nonpoint Sources	9
4.0	**DRINKING WATER**	**10**
4.1	Drinking Water Sources	10
4.2	Threats To Water Sources	10
	4.2.A Drought Impact	10
	4.2.B. Emerging Contaminants	11
	4.2.C. Disinfection By-Products	11
	4.2.D. Cryptosporidium	11
	4.2.E. Radon Risk	12
	4.2.F. Special Concerns	12
5.0	**WATER QUALITY MONITORING**	**14**
5.1	Surface Water	14
5.2	Ground Water	17
5.3	Source Water Assessment Program	18
6.0	**CITIZEN INVOLVEMENT**	**18**
7.0	**RECOMMENDATIONS**	**19**

FIGURES

		Page
Figure 1	Group 5 Watersheds	2
Figure 2	Watershed Groups in Tennessee	3
Figure 3	Watershed Approach Cycle	4
Figure 4	Karst areas of Tennessee	13
Figure 5	Water Quality Status of Streams as Illustrated in the 2008 305(b) Report	15
Figure 6	Relative Impacts of Pollution on Impaired Streams	17

APPENDICES

A. WATER SYSTEMS BY WATERSHED

B. SUSCEPTIBILITY AND THREATS BY WATERSHED: WATER SYSTEMS IMPACTED BY THE DROUGHT IN 2008

1.0 INTRODUCTION

This report was prepared to fulfill the requirements of Tennessee Water Quality Control Act, T.C.A. 69-3-107(24) as amended in 2006:

> *69-3-107. Duties and authority of the commissioner.*
>
> *In addition to any power, duty, or responsibility given to the commissioner under this part, the commissioner has the power, duty, and responsibility to:*
>
> *(24) "Perform a thorough and ongoing study of, and prepare recommendations regarding options for, the protection of watersheds and the control of sources of pollution in order to assure the future quality of potable drinking water supplies throughout the state. The department is authorized to use information and studies from state, federal and local governments and other sources of reliable scientific data. Initial findings and recommendations shall be presented to the governor and the general assembly no later than February 1, 2007, and annually thereafter."*

This report presents a summary of activities of the watershed program and the drinking water program that the Tennessee Department of Environment and Conservation (TDEC) uses in protecting water quality. As this report illustrates, TDEC: 1) updates its Watershed Water Quality Management Plans annually, 2) reports on the status of water quality biennially, and 3) updates its water quality standards triennially. These three documents describe the condition of Tennessee's 55 watersheds and establish the criteria used to assess water quality in the state.

This report draws from information found in these documents and summarizes TDEC's efforts to protect watersheds and control sources of pollution. And, through a series of maps, illustrates the threats to drinking water due to drought in Tennessee's watersheds. Finally, as required by the 2006 amendment, several recommendations are presented for further protection of potable water supplies.

A more thorough description of the items contained in the report may be found on the department's web site:

Division of Water Pollution Control Page:
http://www.state.tn.us/environment/wpc/

Division of Water Supply Page:
http://www.state.tn.us/environment/dws/

and specifically:

Watershed Approach Page:
http://www.state.tn.us/environment/wpc/watershed/

Watershed Water Quality Management Plans Page:
http://www.state.tn.us/environment/wpc/watershed/wsmplans/

Source Water Assessments Page:
http://www.state.tn.us/environment/dws/dwassess.shtml

Drinking Water Program Page:
http://www.state.tn.us/environment/dws/DWprogram.shtml

Activities related to watershed protection since the last Watershed Protection Report (2008) include:

- The Department signed a Memorandum of Understanding to protect and restore the Clinch and Powell Rivers in Virginia and Tennessee with the Virginia Department of Environmental Quality, the Virginia Department of Mines, Minerals and Energy, and EPA Regions 3 and 4. These five agencies are responsible for administering the Clean Water Act and water pollution laws in Tennessee and Virginia. There are also a number of other agencies, academics, and non-governmental organizations who are working on the Clinch and Powell, and who will be partners in the efforts to accomplish common goals. So a larger group, including the MOU agencies and those other entities who have demonstrated an interest in these rivers, has also organized as the "Clinch-Powell Clean Rivers Initiative." In meetings in 2008, this group identified its mission as restoration of a balanced, indigenous population of aquatic life, including native mussels in that portion of the Clinch and Powell River system found upstream of Norris Lake. A science plan was developed and assignments distributed to team members to accomplish a common understanding of aquatic species populations, viability, trends, stressors, and sources of stress in the Clinch-Powell watershed upstream of Norris Lake, with particular emphasis and focus on freshwater mussels.

- A Water Resource Technical Advisory Committee (WRTAC) was established in 2007 and is composed of experts from many agencies, water suppliers, universities, and conservation groups. The WRTAC originates from requirements of the Tennessee Water Resources Information Act, 69-7-309. The WRTAC will serve as an advisory group to TDEC to recommend means to address water resources issues by responding to specific queries from the Department. In 2008, the focus of the group was on developing the elements of regional water plans that consider both the needs of communities and protection of Tennessee rivers. The Department received input from the Advisory Committee on a Drought Management Plan, which is currently being finalized and in the near future the Department will have also finalized a guidance document for local communities in developing their drought management plans.

- Established a two year pilot program during which local communities who are receiving a Clean Water State Revolving Fund loan may obtain additional funds at no cost for watershed enhancement projects.

- Group 5 watershed plans have been prepared and public meetings have been held to review the plans with stakeholders. Group 5 watersheds are:

WATERSHED NAME	HUC-8
Cheatham Lake	05130202
Lake Barkley	05130205
Upper French Broad River	06010105
Pigeon River	06010106
Lower French Broad River	06010107
Nolichucky River	06010108
Sequatchie River	06020004
Guntersville Lake	06030001
Mississippi River	08010100
North Fork Obion River	08010203
South Fork Obion River	08010202

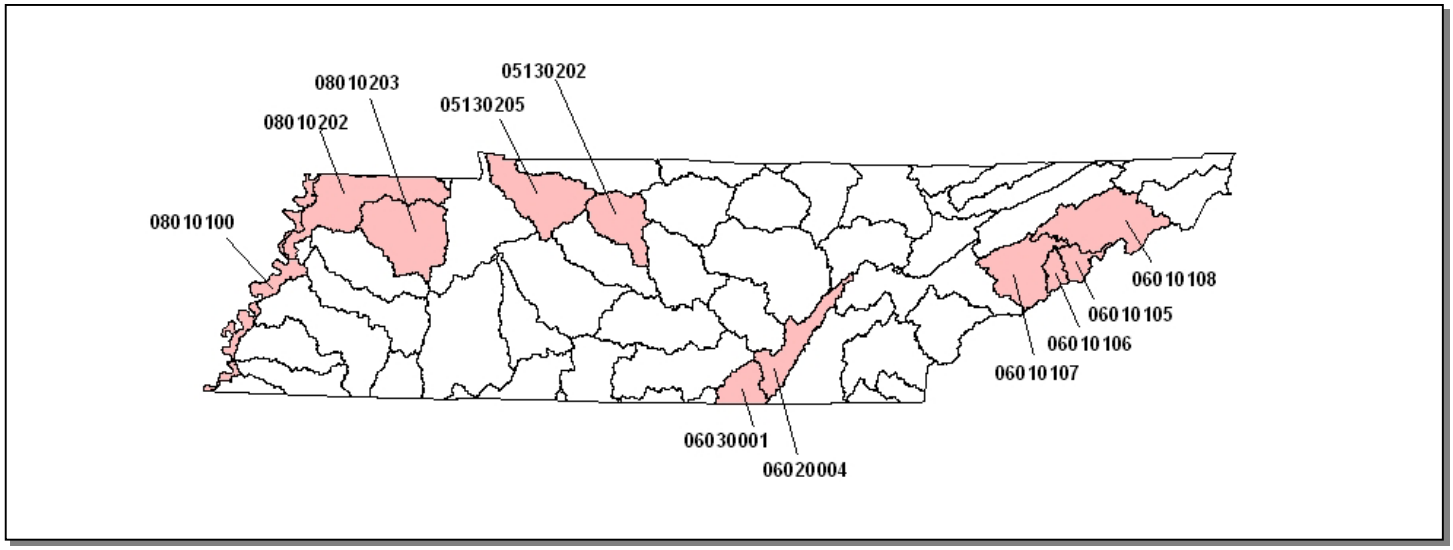


Figure 1. Group 5 Watersheds.

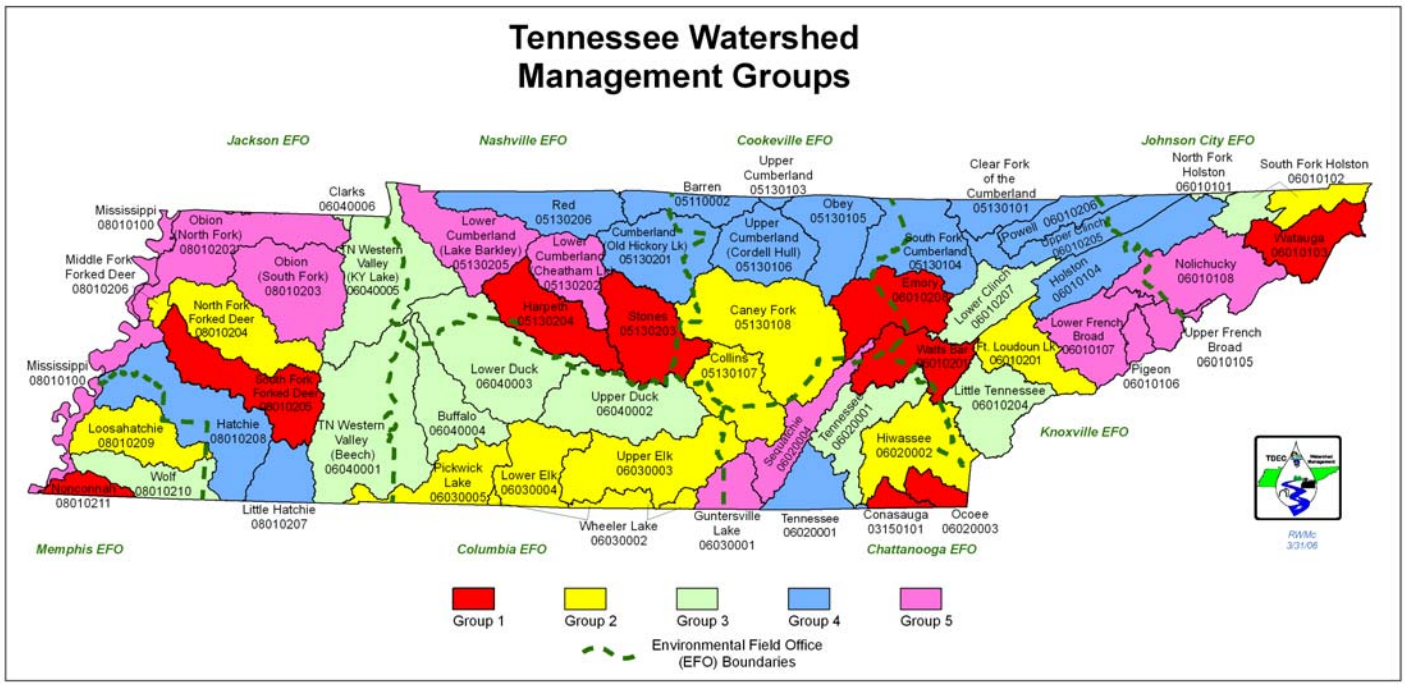
- The Division of Water Supply participated substantially in Group 5 Watershed meetings. Water Supply and Water Pollution Control Divisions complemented each other's programs by helping stakeholders in the watershed understand surface water and ground water threats to potable water.

2.0 TENNESSEE WATERSHEDS

2.1 Defining Watersheds

A watershed can be defined as the entire land area that ultimately drains into a particular watercourse or body of water. Watersheds vary in shapes and sizes. Everyone lives in a watershed. Watersheds are appropriate as organizational units because they are readily identifiable landscape units with readily identifiable boundaries that integrate terrestrial, aquatic, and geologic processes. Focusing on the whole watershed helps reach the best balance among efforts to control point source pollution and polluted runoff as well as protect drinking water sources and sensitive natural resources such as wetlands (EPA-840-R-98-001).

In the early 1970's, the USGS delineated 55 hydrologic watershed boundaries within Tennessee. Proper names, as well as a unique grouping of numbers, are used to identify watersheds. For each watershed, this



number is called the watershed's Hydrologic Unit Code, or HUC. The HUC can range from 2 to 16 digits long, more digits indicating that a smaller and smaller portion of the watershed is represented.

Figure 2. Watershed Groups in Tennessee. *Tennessee's watersheds are organized into five groups in the watershed approach. More information can be found at: http://www.tennessee.gov/environment/wpc/watershed/*

2.2 The Watershed Approach

By viewing the entire drainage area or watershed as a whole, the department is able to address water quality monitoring, assessment, permitting, and stream restoration efforts, and to control sources of pollution. The watershed approach has three main components: 1) geographic focus, 2) sound management techniques based on strong science and data, and 3) partnership/stakeholder involvement (EPA 833-B-07-004).

Typically, the Watershed Approach meets the following description (EPA841-R-95-003):

- Features watersheds or basins as the basic management units
- Targets priority subwatersheds for management action
- Addresses all significant point and nonpoint sources of pollution
- Addresses all significant pollutants
- Sets clear and achievable goals
- Involves the local citizenry in all stages of the program
- Uses the resources and expertise of multiple agencies
- Is not limited by any single agency's responsibilities
- Considers public health issues

Traditional activities like permitting, planning, and monitoring are coordinated in the Watershed Approach. The Watershed Approach utilizes features already in state and federal law, such as Water Quality Standards, the permits program (National Pollutant Discharge Elimination System, or NPDES), Total Maximum Daily Loads (TMDLs), Nonpoint Source Program and Groundwater Protection. More information on the watershed approach can be found at:
http://www.tennessee.gov/environment/wpc/watershed/.

2.3 Watershed Planning

The watersheds in Tennessee have been organized into five groups based on the year of implementation in a five-year cycle. The Division of Water Pollution Control bases its activities for each group by the group's position in the cycle. The cycle also coincides with the issuance and duration of discharge permits.

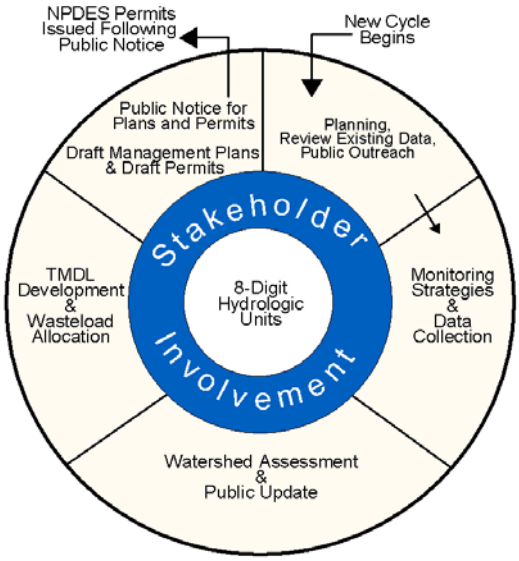


Figure 3. Watershed Cycle. *Tennessee uses a five-year watershed cycle for watershed protection.*

The six key activities that take place during the cycle are:

1. Planning and Existing Data Review. Existing data and reports from appropriate agencies and organizations are compiled and used to describe the current conditions and status of rivers and streams. Reviewing all existing data and comparing agencies' work plans guide the development of an effective monitoring strategy.

2. Monitoring. Field data are collected for streams in the watershed. These data supplement existing data and are used for the water quality assessment.

3. Assessment. Monitoring data are used to determine the status of the stream's designated use supports.

4. Wasteload Allocation/TMDL Development. Monitoring data are used to determine nonpoint source contributions and pollutant loads for permitted dischargers releasing wastewater to the watershed. Limits are set to assure that water quality is protected.

5. Permits. Issuance and expiration of all discharge permits are synchronized based on watersheds. Currently, 1,700 permits have been issued in Tennessee under the federally delegated National Pollutant Discharge Elimination System (NPDES).

6. Watershed Management Plans. These plans include information for each watershed including general watershed description (Chapter 2), recent water quality assessment results (Chapter 3), inventory of point and nonpoint source contributions in the watershed (Chapter 4), activities of federal, state, and local agencies and organizations in the watersheds (Chapter 5), and point and nonpoint source management strategies in the watershed (Chapter 6).

Public participation opportunities occur throughout the entire five-year cycle. Participation in Years 3 and 5 is emphasized, although additional meetings are held at stakeholder's request.

Tennessee's Watershed Approach, Watershed Water Quality Management Plans, updates and public participation opportunities, may be found on the web at:

http://www.tennessee.gov/environment/wpc/watershed/

3.0 POINT AND NONPOINT CHALLENGES TO WATERSHED PROTECTION

Water quality is impacted by both point and nonpoint pollution. Tennessee uses the watershed approach to integrate point and nonpoint contributions in order to understand the challenges and identify the solutions necessary to improve water quality.

3.1. Point Sources

Point Source pollutants are typically discharged through a discreet conveyance like a pipe or ditch. In the Clean Water Act, a point source is defined as any discernible, confined, and discrete conveyance including, but not limited to, any pipe, ditch, channel, conduit, tunnel, well, discrete fissure, container, rolling stock, Concentrated Animal Feeding Operation (CAFO), landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural stormwater runoff.

The Division of Water Pollution Control has authority to regulate this type of discharge through its permit program and its National Pollutant Discharge Elimination System (NPDES) program. Permits issued to municipalities, industries, and some agricultural operations, are based on the protection of criteria set out in the state's water quality standards. More information can be found at:

http://www.state.tn.us/environment/permits/#wpc.

3.1.A. Issues of Concern.

303(d) List. The 303(d) List is a compilation of the streams and lakes in Tennessee's watersheds that are water quality limited or expected to exceed water quality standards in the next two years and need additional pollution controls. Water quality limited streams are those that have one or more properties that violate water quality standards. They are considered impaired by pollution and not fully meeting designated uses.

Once a stream has been placed on the 303(d) List, it is considered a priority for water quality improvement efforts. These efforts include traditional regulatory approaches such as permit issuance, but also include efforts to control pollution sources that have historically been exempted from regulations, such as certain agricultural and forestry activities.

TDEC uses its regulatory authority to control point sources that are causes of impairment in watersheds. TDEC's EPA-approved 303(d) List can be found at:

http://www.state.tn.us/environment/wpc/publications/303d2008.pdf.

Stormwater Issue. Over the past 30 years, EPA and state water quality agencies have realized the severe impact that rain water runoff from urban and urbanizing areas has on surface waters. Rain water falling on industrial sites, urban areas, and construction sites can become contaminated with runoff loaded with sediments, bacteria, suspended solids, nutrients (phosphorous and nitrogen), metals, pesticides, organic material, and floating trash. These pollutants are then carried to surface waters. Unlike sanitary wastewater and industrial wastewater, most stormwater is not treated prior to entering streams. Pollution of stormwater runoff must be prevented at the source.

Federal, state and local governments have passed laws and regulations to address the problem of polluted runoff. EPA initiated a national stormwater permitting program in the early 1990s that applied to industrial activities, construction sites of five acres or more, and urban runoff from larger cities (Phase I). Phase II regulations later addressed additional urbanized areas, certain cities with a population over 10,000, and construction activities of one acre or more. In Tennessee, TDEC implements the Phase I and Phase II programs through authorization from EPA.

Under the NPDES stormwater program, approximately 90 operators of large, medium, and other regulated Municipal Separate Storm Sewer Systems (MS4s) are required to develop and implement programs for control of stormwater runoff. The success of these programs will determine to a large extent the degree to which clean water goals are achieved in urban municipal areas.

Mining Issue. Mining activities discharge wastewater and stormwater runoff and often involve disturbance of water features such as streams and wetlands. Controlling these sources is critical to protecting waters and watersheds in our state.

Coal mining has a long history of economic importance to the Cumberland Plateau and East Tennessee communities, and a legacy of environmental impact as well. Silt, acid, and metals from improper mining practices and controls can impact streams. While wastewater discharges are regulated under the NPDES program in Tennessee, coal mining in Tennessee is regulated under federal law by the US Department of Interior, Office of Surface Mining (OSM). Because of widespread concerns over the impacts of coal mining in Tennessee, Governor Bredesen asked OSM to update its Environmental Impact Statement for this regulatory program. OSM did not not agreed to such a review. Governor Bredesen also wrote to Administrator Johnson of the EPA asking that they not approve the OSM rule removing the stream buffer zone from the federal mining regulations, but EPA gave its approval and the rule was finalized in December.

Operators who engage in mineral mining and surface disturbances related to mining require a state mining permit, which is obtained from the Tennessee Division of Water Pollution Control, Mining Section. In all counties mining of the following minerals requires a permit: clay, stone, phosphate rock, metallic ore and any other solid material or substance of commercial value found in natural deposits on or in the earth. This does not include limestone, gravel, sand, chert, marble, coal or dimension stone. In Shelby County, a permit is also required for mining gravel and sand. In all cases, the NPDES permit requires permittees to conduct their activities consistent with the protections offered by the state's water quality standards. More information can be found at http://state.tn.us/environment/permits/wqmine.shtml.

3.1.B. Restoration Programs and Tools.

Total Maximum Daily Loads (TMDLs). Section 303(d) of the Clean water Act establishes the TMDL program which: 1) quantifies the amount of a pollutant in a stream, 2) identifies the sources of the pollutant, and 3) recommends regulatory or other actions that may need to be taken in order for the stream to cease being polluted. Some of the actions that might be taken are:

- Re-allocation of limits on the sources of pollutants documented as impacting streams. It might be necessary to lower the amount of pollutants being discharged under NPDES permits or to require the installation of other control measures, if necessary, to ensure that water quality standards will be met.
- For sources the Division does not have regulatory authority over, such as ordinary agricultural or forestry activities, provide information and technical assistance to other state and federal agencies that work directly with these groups to install appropriate Best Management Practices (BMPs).

Tennessee's EPA-approved TMDLs can be found on the TDEC web site:
http://www.state.tn.us/environment/wpc/tmdl/approved.shtml

Abandoned Mine Reclamation Program. Abandoned coal mines pose serious threats to public health, safety and welfare as well as degrade the environment. The programs of the TDEC/WPC Tennessee Land Reclamation Section accomplish three important things: (1) They remove dangerous health and safety hazards that threaten the citizens of Tennessee; (2) They improve the environment; and (3) They restore resources to make them available for economic development, recreation, and other uses. Problems typically addressed by the Land Reclamation Section include open or improperly filled mine shafts, dilapidated mine buildings and equipment, toxic mine refuse and drainage, landslides, mine fires, highwalls and subsidence. Tennessee Code Annotated (59-8-324) authorizes the program. Although current mining operations often reclaim some scars

from old mining operations, this represents a small portion of the abandoned mine land and it rarely addresses the more serious threats to human health and safety.

State Revolving Fund Loan Program. Failing or insufficient water treatment plants and wastewater treatment plants threaten the safety of Tennessee's watersheds and water supplies. A useful tool to address these problems is the Clean Water State Revolving Loan Fund, which TDEC uses to provide low interest loans for water quality improvement projects.

The State Revolving Loan Fund Program (SRF Loan Program) administers Tennessee's Clean Water State Revolving Fund (CWSRF) Program. An amendment to the Federal Clean Water Act in 1987 created the CWSRF Program in order to provide low-interest loans to cities, counties, and utility districts for the planning, design, and construction of wastewater facilities. The U.S. Environmental Protection Agency awards annual capitalization grants to fund the program, and the State of Tennessee provides a twenty-percent funding match. The SRF Loan Program has awarded CWSRF loans totaling over $960 million since the creation of Tennessee´s CWSRF Program in 1987. Loan repayments are returned to the program and used to fund future CWSRF loans. Tennessee's Clean Water SRF Intended Use Plan can be found at:

http://tennessee.gov/environment/srf/pdf/cwiup.pdf

The SRF Loan Program also administers Tennessee´s Drinking Water State Revolving Fund (DWSRF) Loan Program. An amendment to the Federal Safe Drinking Water Act in 1996 created the DWSRF Program in order to provide low-interest loans to cities, counties, and utility districts for the planning, design, and construction of drinking water facilities. The U.S. Environmental Protection Agency awards annual capitalization grants to fund the program, and the State of Tennessee provides a twenty-percent funding match. The SRF Loan Program has awarded DWSRF loans totaling over $122 million since the creation of Tennessee´s DWSRF Program in 1996. Loan repayments are returned to the program and used to fund future DWSRF loans. Tennessee's Drinking water SRF Intended Use Plan can be found at:

http://tennessee.gov/environment/srf/pdf/dwiup.pdf

This year the Department, working with the Local Development Authority, has initiated a two year pilot program under which communities receiving a Clean Water SRF loan may obtain additional funds at no additional cost (because of a reduced interest rate) in order to fund watershed enhancement projects. This would benefit local governments in the following ways:

- The community could benefit from a project by:
  - Restoration of an impaired section of a stream within the watershed;
  - Acquisition of conservation easements that protect riparian buffer areas;
  - Source water protection;
  - Completion of low impact development projects resulting in greater stormwater infiltration or filtration in public buildings and spaces such as green roofs, permeable pavement, vegetated swales and rain barrels; and
  - Any effective "green infrastructure" project that improves the management of wet weather runoff;
- Because of a reduction in the interest rate for the total loan for these projects to offset the additional capital amount, the cost of the enhancement project up to $500,000 will not add to the total amount to be paid back;
- Including a watershed enhancement project as part of a CWSRF proposal can increase the criteria points and consequently increase the priority with which the inclusive project can be eligible for funding.

The federal economic stimulus proposal currently under consideration by Congress may provide additional funding for the SRF programs, possibly including a provision for loan forgiveness.

3.2. Nonpoint Sources

Nonpoint sources are diffuse pollution sources (i.e., without a single point of origin or not introduced into a receiving stream from a specific outlet). The pollutants are generally carried off the land by stormwater. The Division of Water Pollution Control works with the Tennessee Department of Agriculture (TDA) and the Natural Resources Conservation Service (NRCS) to encourage farmers to install Best Management Practices (BMPs). The installation of these BMPs is voluntary because of the agriculture exemption in the Water Quality Control Act and there are often cost-share opportunities for farmers.

Two grant programs make up TDA's Water Resources Section: the Nonpoint Source Program (TDA-NPS) and the Agricultural Resources Conservation Fund (TDA-ARCF). Both fund proposals from agencies, non-profit organizations (watershed groups), and universities that will reduce water pollution.

The TDA-NPS is non-regulatory, promoting voluntary, incentive-based solutions. It funds three types of programs:

1. **BMP Implementation Projects.** Improve an impaired waterbody, or prevent waters from becoming impaired.
2. **Monitoring Projects.** Up to 20% of the available grant funds assist water quality monitoring efforts in Tennessee streams, both in the state's watershed monitoring program, and also in performing before-and-after monitoring following BMP installation, so that water quality improvements can be verified.
3. **Educational Projects.** Funded through TDA-NPS, these educational projects raise public awareness of practical steps that can be taken to eliminate nonpoint sources.

The Agricultural Resources Conservation Fund provides cost-share assistance to Tennessee landowners to install BMPs that eliminate agricultural nonpoint source pollution. This assistance is provided through Soil Conservation Districts, Resource Conservation and Development Districts, Watershed Districts, universities, and other groups. In addition, a part of the TDA-ARCF is used to fund educational projects statewide, with a focus on landowners, producers, and managers of farms and forests.

More information can be found at:
http://www.tennessee.gov/agriculture/nps/index.html

The NRCS provides technical advice and money to landowners willing to install BMPs in accordance with programs described in the federal Farm Bill. Local District Conservationists (approximately one per county) work with landowners to identify voluntary projects that qualify for funding.

NRCS employees provide technical assistance based on sound science and suited to a landowner's specific needs. The agency provides financial assistance for many voluntary conservation activities. The Conservation Technical Assistance (CTA) program provides voluntary conservation technical assistance to land-users, communities, units of state and local government, and other federal agencies in planning and implementing conservation systems. More information can be found at: http://www.nrcs.usda.gov/.

Point and nonpoint sources are addressed in Tennessee's Watershed Water Quality Management Plans, which can be found at: http://www.state.tn.us/environment/wpc/watershed/wsmplans/. The information for 1/5 of Tennessee's 55 watersheds is updated each year.

4.0. DRINKING WATER

Safeguarding human health by ensuring safe drinking water for the people of Tennessee is a primary mission of TDEC. The Division of Water Supply is responsible for administering the provisions of the *Tennessee Safe Drinking Water Act,* while the Division of Water Pollution Control is responsible for administration of the Tennessee Water Quality Control Act of 1977 (T.C.A. 69-3-101). The Tennessee Water Quality Control Board administers the Tennessee Safe Drinking Water Act and the Water Quality Control Act.

4.1. Drinking Water Sources

TDEC's Division of Water Supply has responsibility for regulating public water systems and ensuring that Tennessee's citizens have safe drinking water. As a part of this responsibility, the division has developed a Source Water Protection Program for public water systems through a coordinator who works with other agencies within TDEC as well as other state, federal, local agencies and non-governmental organizations.

An important step toward prevention of contamination of public water supplies was the Federal Safe Drinking Water Act Amendments of 1986. At that time, each state was required to develop a wellhead protection program to protect the water source of public water systems relying on ground water (wells or springs). The new Source Water Assessment provisions of the Federal Safe Drinking Water Act 1996 Amendments expanded the scope of protection beyond ground water systems to include protection of the waters supplying surface water systems.

Water sources for Tennessee's public drinking water supplies vary considerably across the state. The predominant source of water for West Tennessee is ground water whereas the dominant source for Middle Tennessee is surface water. East Tennessee relies on both ground water and surface water, with the ground water sources frequently being springs. Appendix A contains a listing of water systems and their water sources, sorted by watershed.

Approximately 2/3 of the community public water systems using ground water in Middle and East Tennessee have had at least one source determined under the direct influence of surface water. This means that these sources of groundwater are located close enough to a source of surface water to receive direct surface water recharge and are thus considered at risk from surface water contaminates and pathogens.

4.2. Threats to Water Sources

As the sources for our drinking water vary across the state, so do the types of threats those water sources may be subject to.

Typical ground water threats are chemical contaminants such as petroleum products and derivatives. These would include gasoline constituents and chlorinated solvents. For ground water impacted by surface water, surface water contaminants play a role as well. Typical surface water concerns include siltation/sedimentation, pathogens, and nutrients.

4.2 A. Drought Impact. In recent years, Tennessee had a number of water systems influenced by the drought which caused some systems to institute water restrictions. Many of these water systems were impacted—not by their diminishing water—but by hydraulic or treatment capacity issues due, in large part, to the amount of irrigation of lawns, gardens, and car washing. In some cases, assimilative capacity is the major determining factor in setting minimum flow/discharge rates for streams. This, in turn, has an effect on the amount of water that can be drawn by water treatment plants.

Over thirty ground water systems felt the effects of the drought. Very few West Tennessee water systems had these problems due to the fact that they rely on wells drilled into sand aquifers that are not impacted from the drought. Water systems on the large rivers across the state such as the Cumberland, Tennessee, Holston, and Clinch did not have supply problems.

Significant rainfall occurred in late 2008 and early 2009. As of late January 2009, the National Weather Service reports that "The severe to extreme drought conditions that plagued much of the middle and east portions of the state have been alleviated." A list of all systems affected by the drought and the measures taken by the water systems and reasons for the actions is presented in Appendix A

4.2.B. Emerging Contaminants. Community water systems are required to test for both chemical contaminants and biological pathogens.

In recent years, “emerging contaminants” such as human and veterinary pharmaceuticals, industrial and household wastewater products, and reproductive and steroidal hormones in water resources have become more of a focus (USGS Fact Sheet FS-027-02, Pharmaceuticals, Hormones and Other Organic Wastewater Contaminants in U. S. Streams; June 2002). Potential environmental pollutants include pharmaceutical, veterinary and illicit drugs, as well as active ingredients in personal care products (collectively referred to as PPCPs). These potential pollutants include prescription drugs and biologics, as well as diagnostic agents, fragrances, sun screen agents, ingredients in cosmetics, food supplements and numerous others. The introduction of PPCPs into the environment is not just by sewage treatment plants, but also by nonpoint runoff. A recent study by the Toxic Substances Hydrology Program of the U. S. Geological Survey shows that a broad range of chemicals found in residential, industrial, and agricultural wastewaters commonly occurs in mixtures at low concentrations downstream of areas of intense urbanization and animal production. (None of the sampling locations were in Tennessee). The chemicals analyzed included human and veterinary drugs (including antibiotics), natural and synthetic hormones, detergent metabolites (break down products), plasticizers, insecticides, and fire retardants.

Evidence suggests that environmental exposure to some man-made chemicals may cause the disruption of endocrine (hormonal) systems in human and wildlife populations. Determining the extent of the impact of endocrine disruptors on humans, wildlife, and the environment is a matter of national importance that will require considerable research. Information of the Endocrine Disruptors Research Initiative can be found at: http://www.epa.gov/endocrine.

A variety of chemicals have been found to disrupt the endocrine systems of animals in laboratory studies, and compelling evidence shows that endocrine systems of certain fish and wildlife have been affected by chemical contaminants, resulting in developmental and reproductive problems. Information on the Endocrine Disruptor Screening Program can be found at http://ww.epa.gov/scipoly/oscpendo/index.htm.

Emerging contaminants are not a known source of impairment for any streams in Tennessee.

4.2.C. Disinfection Byproducts. Disinfection byproducts (like haloacetic acids and total trihalomethanes) are chemical compounds that can form during a reaction of a disinfectant with naturally present organic matter in the water. Disinfectants are an essential element of drinking water treatment because of the barrier they provide against waterborne disease-causing microorganisms.

4.2.D. Cryptosporidium. Cryptosporidium is a protozoon, a single-celled parasite that can live in the intestines of wildlife, livestock, and people and can be responsible for serious water-borne diseases. Cryptosporidium is not affected by chlorine disinfection, so water treatment of surface water or ground water under the direct influence of surface water generally requires the filtration of the pathogen to remove it. Treatment for cryptosporidium has been the driving force for the Long Term Surface Water Treatment Rule (parts 1 and 2) as well as the requirement for states to develop Source Water Assessment Programs in the 1996 Safe Drinking Water Act Amendments.

The dormant (inactive) form of cryptosporidium, called an oocyst, is excreted in the feces of infected humans and animals. The tough-walled oocysts survive under a wide range of environmental conditions. Oocysts are present in most surface water bodies across the United States. They are more prevalent in surface waters when heavy rains increase runoff of wild and domestic animal wastes from the land or when sewage treatment plants overflow. Drinking untreated surface water or swallowing even a small amount of water when swimming can cause cryptosporidiosis. The parasite also can be spread in uncooked foods, beverages or ice prepared with contaminated water.

In the spring of 1993 in Milwaukee, Wisconsin, municipal drinking water was contaminated with cryptosporidium and led to an estimated 400,000 people becoming ill and the disease contributed to the deaths of some immune-deficient individuals. This outbreak focused the attention on the risk of waterborne cryptosporidiosis and the need for stricter drinking water standards. Water systems are now beginning to

monitor for cryptosporidium. Based on the amount of oocysts found, additional treatment at water plants may be required.

In Tennessee, no drinking water supplies are currently known to be compromised by the high levels of cryptosporidium. Tennessee's drinking water providers are in the process of doing the first round of source water sampling under the Long Term Surface Water Treatment Rule Part 2.

4.2.E. Radon Risk in Tennessee. Radon is a naturally-occurring radioactive gas that may cause cancer and may be found in drinking water with a ground water source. Radon is considered to be the second-leading cause of lung cancer and therefore is a serious public health problem. There was some testing for radon in public water systems across the state in 1999, which indicated that the radon in some water systems was well above the 300 picocuries/liter (pCi/liter) proposed E.P.A. standard. Further radon testing was needed because some of those systems were not in the expected geologic setting typical of high radon levels. The 1999 testing also appeared to indicate that lower flow volume wells and springs tend to have higher levels of radon, possibly due to there being less "flushing" of the relatively volatile radon gas. This trend of smaller systems having the higher radon readings consistently held true in the 2001 follow up sampling.

4.2.F. Special Concerns

Tennessee has variable and complex geology.

- The limestone aquifers that are prevalent in Middle and East Tennessee allow rapid movements of contaminants and more complex flow paths.
- East Tennessee faulting and folding associated with the Appalachians is a further complicating factor.
- Unconfined sand aquifers are also vulnerable to contamination, particularly from chlorinated solvents and degreasers.

Contamination is not obvious or easily monitored.

- Ground water, and ground water contamination, cannot be seen.
- Contamination plumes are commonly limited in size (hundreds to thousands of feet), irregular in shape, and not evenly distributed within aquifers.
- Variations in the physical and chemical characteristics of contaminants can also cause the contaminants to take widely different flow paths through the aquifer.

Sampling a well is significantly different from sampling a stream.

- Upstream and downstream are not obvious when sampling ground water.
- There are no aquatic indicators to reveal the health of the ground water.
- Locating the stream is not an issue, locating the ground water can be.

Contamination in ground water tends to be from a different suite of chemicals and of much longer duration than in surface water.

- Surface water is subject to more natural attenuation of contamination, with both physical and biological breakdown of the contaminants.

An accurate picture of the health of Tennessee's aquifers does not exist.

- Tennessee does not have a statewide ground water contamination data base.
- There has not been a systematic study of Tennessee's aquifers.
- There is no ambient (naturally-occurring, or background) ground water quality monitoring program.
- Public water systems sample the treated water served to their customers, not raw ground water.
- There is no private well or spring sampling program in Tennessee.
- In 2008 a limited requirement that ground water contamination be reported was enacted.
- There is not a monitoring well registration or tracking program.

Ground water was once thought to be safe from contamination, but there is an increasing awareness that ground water needs to be monitored and protected as a valuable resource. Ground water can be quite

vulnerable to contamination, particularly in limestone areas or in unconfined sand aquifers (water bearing zones). This vulnerability is particularly true for contamination from the highly mobile and widely used volatile organics (chlorinated solvents and gasoline components) and pathogenic microorganisms such as bacteria and protozoa.

Tennessee has an abundance of karst (Figure 4) which is highly susceptible to contamination. Karst is characterized by sinkholes, springs, disappearing streams and caves; as well as by rapid, highly directional ground water flow in discrete channels or conduits. Karst systems may be easily contaminated since the waters can travel long distances through conduits with no chance for natural filtering processes of soil or bacterial action to diminish the contamination. Transport times across entire karst flow systems may be as short as hours or weeks; orders of magnitude faster than that in sand aquifers.

Water in karst areas is not distinctly surface water or ground water. In unconfined or poorly confined conditions, karst aquifers have very high flow and contaminant transport rates under rapid recharge conditions such as storm events. This is a particular concern for public water systems using wells or springs in karst areas where pathogenic organisms that would not be present in true ground water can survive in ground water under the influence of surface water.

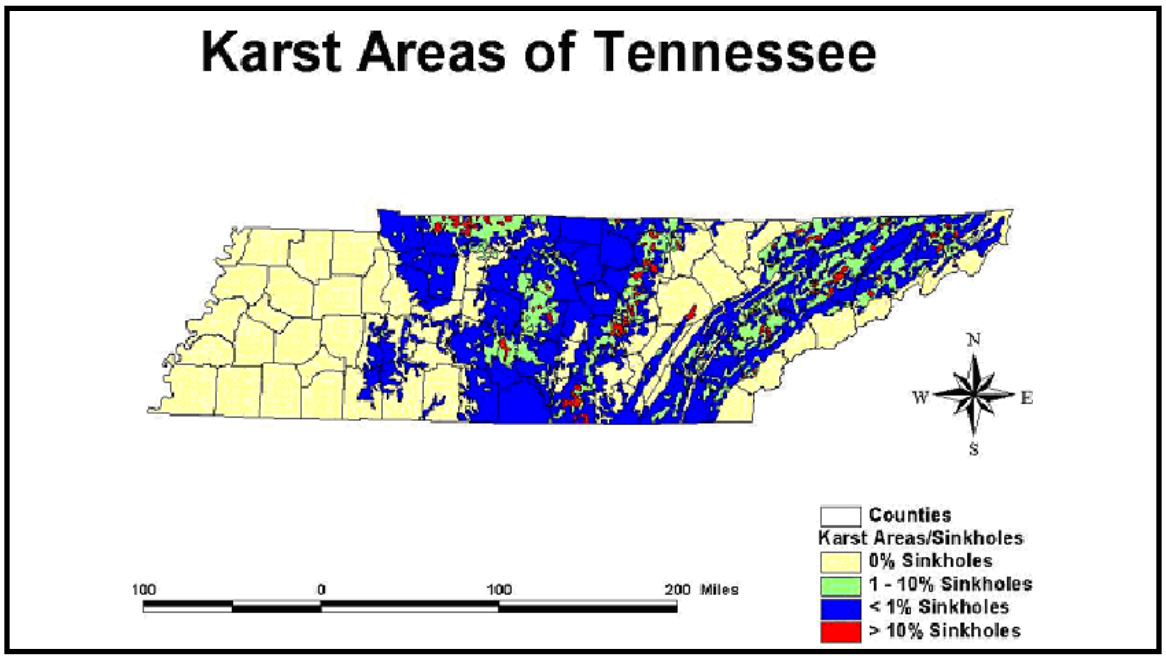


Figure 4. Karst Areas of Tennessee

On Dec. 22, 2008 a retaining wall failed at the TVA Kingston Fossil Plant in Roane County releasing more than 5.4 million cubic yards of coal ash from an on-site holding pond to surrounding land and waterways. TDEC is actively overseeing timely cleanup and safe disposal of recovered coal ash from the spill while also developing a comprehensive environmental monitoring plan to better inform citizens while ensuring full, complete cleanup. Private water wells are also being monitored as a result of the spill.

5.0. WATER QUALITY MONITORING

5.1. Surface Water

The Division of Water Pollution Control monitors surface waters and compares results with the criteria set out in Tennessee's Water Quality Standards (T.C.A. 1200-4-3). A number of specific surveys are conducted, including studies of in-stream biological communities, probabilistic studies, and documentation of contaminant levels in sediment and fish flesh. The fish and bacteriological data generated by the division are used by TDEC to issue advisories to the public when levels of contaminants exceed those considered to be protective of public health.

Tennessee produces a document every two years called *The Status of Water Quality in Tennessee*. Also called the 305(b) Report (for the Section of the Clean Water Act describing it), the report summarizes the status of water quality and the leading causes of impairment in each of Tennessee's 55 watersheds.

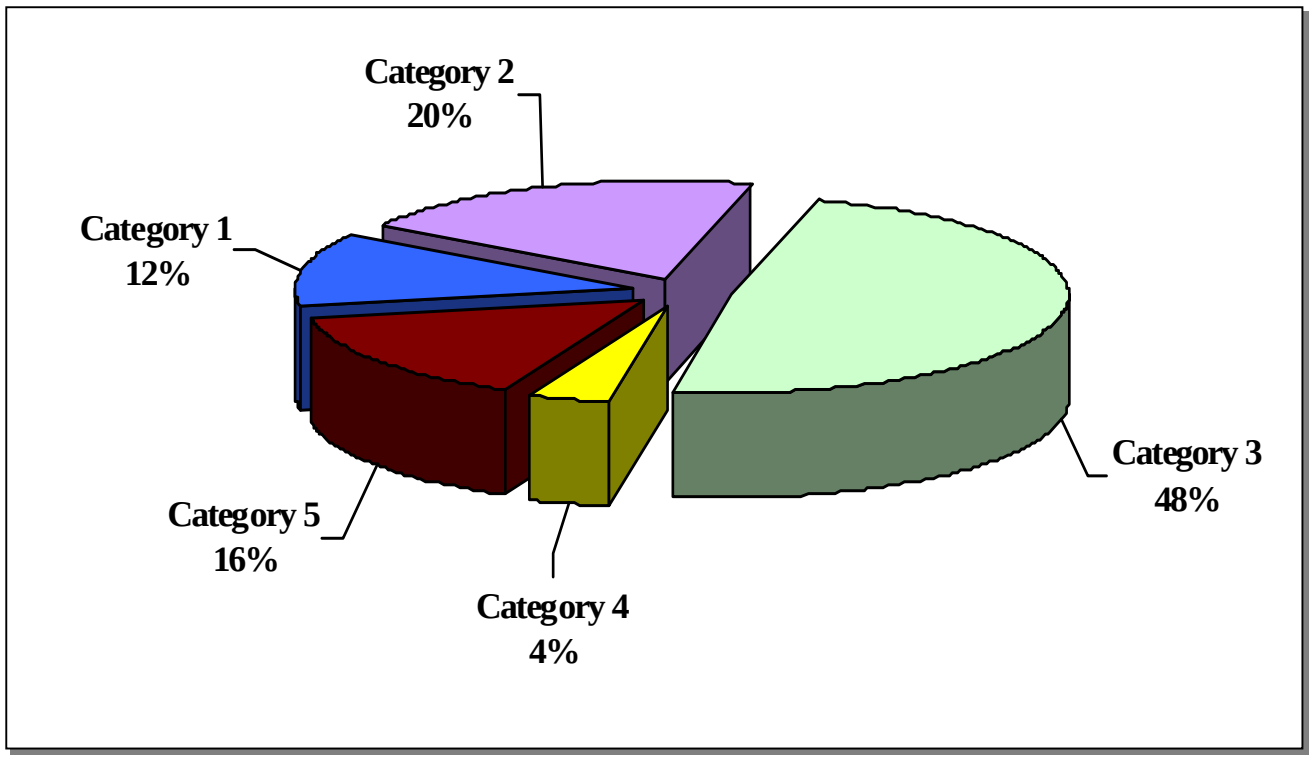


Figure 5. Water Quality Status of Streams as Illustrated in the 2008 305(b) Report.

Use Support Categories:

Category 1 waters are **fully supporting** of all designated uses. These streams, rivers, and reservoirs have been monitored and meet the most stringent water quality criteria for all designated uses for which they are classified. The biological integrity of Category 1 waters is favorably comparable with reference streams in the same subecoregion and pathogen concentrations are at acceptable levels.

Category 2 waters are **fully supporting** of some designated uses, but have not been assessed for all uses. In many cases, these waterbodies have been monitored and are fully supporting of fish and aquatic life, but have not been assessed for recreational use.

Category 3 waters are **not assessed** due to insufficient or outdated data. However, streams previously identified as impaired are not moved to this category simply because data are old.

Category 4 waters are **impaired**, but a TMDL has been completed or is not required. Category 4 has been further subdivided into three subcategories.

Category 4a impaired waters that have already had all necessary TMDLs approved by EPA.

Category 4b impaired waters do not require TMDL development since "other pollution control requirements required by local, State or Federal authority are expected to address all water-quality pollutants" (EPA, 2003). An example of a 4b stream might be where a discharge point will be moved in the near future to another waterbody with more assimilative capacity.

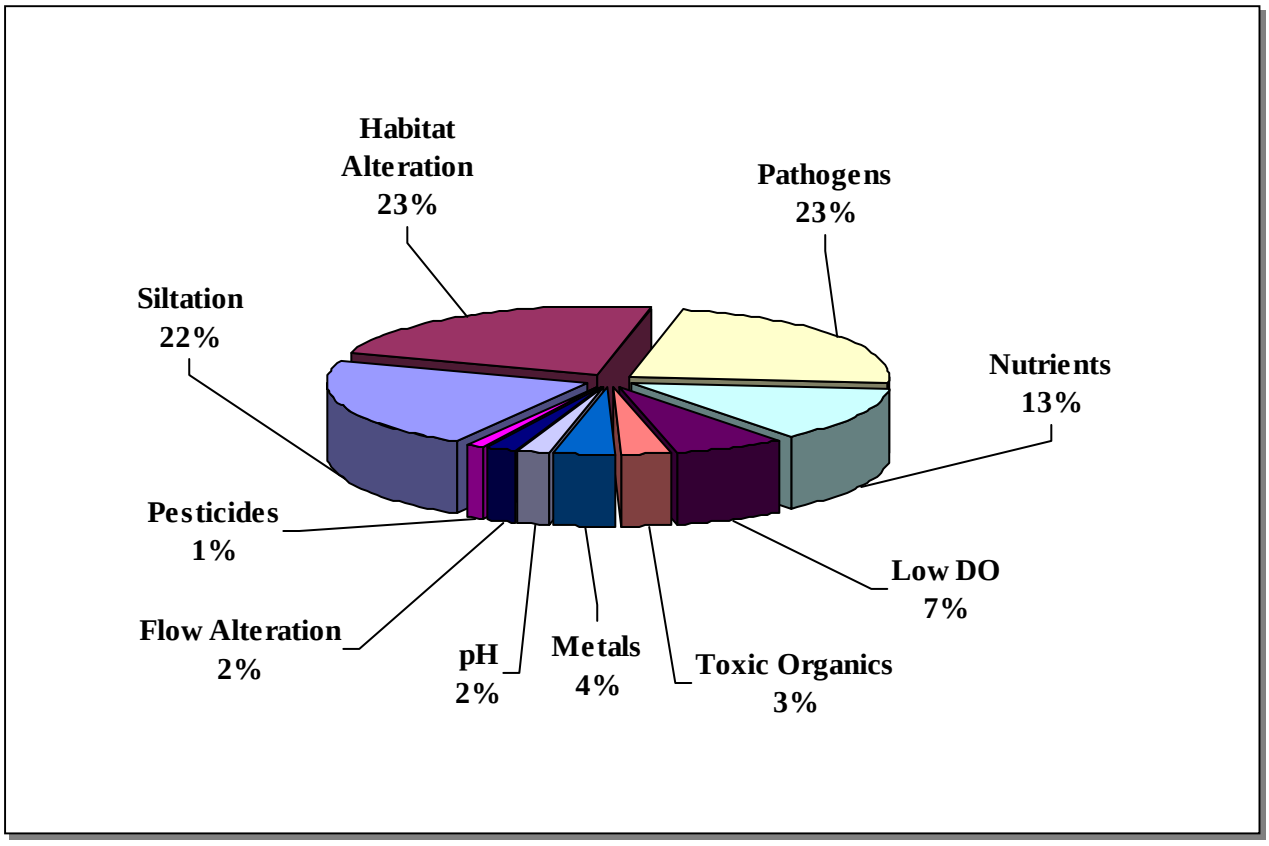
Category 4c impaired waters in which the impacts are not caused by a pollutant (e.g., flow alterations).

Category 5 waters have been monitored and found to not meet one or more water quality standards. These waters have been identified as **not supporting** their designated uses. Category 5 waterbodies are moderately to highly impaired by pollution and need to have TMDLs developed. These waters are included in the 303(d) List of impaired waters in Tennessee.

The current 305(b) Report may be viewed at:

http://www.state.tn.us/environment/wpc/publications/2008_305b.pdf

The 2008 305(b) Report also indicates that habitat alteration, siltation, pathogens and nutrients are the leading causes of impairment in Tennessee streams.



The 2008 305(b) Report can be found at: http://www.state.tn.us/environment/wpc/publications/2008_305b.pdf.

The Division of Water Pollution Control also prepares a 303(d) List, which is a list of streams, rivers, reservoirs, and lakes that do not meet water quality standards. The EPA-approved 2008 list provides pollutant information and it is available at: http://www.tennessee.gov/environment/wpc/publications/303d2008.pdf.

Additional information about surface water monitoring in Tennessee watersheds can be found in the Watershed Water Quality Management Plans. Each year, 1/5 of Tennessee's watersheds have their plans updated. These plans, which also describe the monitoring strategy used in Tennessee's watershed approach, can be found at http://www.tennessee.gov/environment/wpc/watershed/.

5.2. Ground Water

The Division of Water Supply's Ground Water Management Section is responsible for ground water protection strategy development, well-head protection, and underground injection of waste. This division also conducts an enforcement program which requires water suppliers to meet requirements of the Safe Drinking Water Act with respect to water quality and information reporting.

5.3. Source Water Assessment Program

Section 1453 of the 1996 Safe Drinking Water Act (SDWA) Amendments require that all states establish Source Water Assessment Programs (SWAP), and submit a plan to the Environmental Protection Agency (EPA) by February 6, 1999 detailing how they would:

- Delineate source water protection areas
- Inventory significant contaminants in these areas
- Determine the susceptibility of each public water supply to contamination

Tennessee's SWAP was approved in November of 1999. By April of 2003 the source water assessments of the community ground water systems and the source water assessments for the community and noncommunity surface water systems were completed. Shortly thereafter, they were mailed to the public water systems and made available on the TDEC website: http://www.state.tn.us/environment/dws. The source water assessments for the noncommunity ground water systems have recently been completed as well, and are included in this report.

The assessments were intended to enhance the protection of drinking water supplies within existing programs at the federal, state and local levels. Tennessee's SWAP efforts are being used to improve the existing source water protection efforts within Tennessee's Wellhead Protection Program and Watershed Management Program.

Source water protection areas for public water systems using surface water have been based on the portion of the watershed area upstream of the water intake using time of travel (the time it takes for water to travel a given distance) and a 1000-foot corridor on either side of the stream.

All water systems in Tennessee are to update these assessments on a regular basis as required by rule.

The complete Tennessee Source Water Assessment Report can be found at:

http://www.state.tn.us/environment/dws/dwassess.shtml

6.0 Citizen Involvement

There are many opportunities for citizens to be involved in activities that affect water quality:

- Attend watershed meetings. Meetings are conducted to inform the public about the most recent water quality assessment and to invite their input about water quality issues in their watershed. Meetings are also held to seek comments on the draft Watershed Water Quality Management Plans.
- Comment on proposed Water Quality Standards. Water Quality Standards are updated every 3 years, following a series of public hearings across the state. Public comments are considered before a final recommendation is made to the Water Quality Control Board for approval.
- Comment on draft permits during public comment period.
- Comment on proposed 303(d) List (list of impaired waters). Meetings are held across the state at convenient locations in order to seek public comment on the draft 303(d) list. Following the meetings, the Division of Water Pollution Control submits the 303(d) List to EPA for approval. This list is compiled every 2 years.
- Address the Water Quality Control Board. The Board has traditionally assigned April and October as the months for the public to make comments (oral or written) on any water quality issue.

Both the Division of Water Pollution Control and the Division of Water Supply have web sites that can be accessed through the TDEC home page: http://www.tennessee.gov/environment/, which allows the public to navigate through a list of public participation opportunities. Watershed public meetings are posted at http://www.tennessee.gov/environment/wpc/watershed/public.shtml.

Comments on any issue are welcome at any time and may be made by sending e-mail to ask.tdec@state.tn.us.

7.0 Recommendations

The 2006 amendment requires that recommendations be presented to the Governor and the General Assembly annually. TDEC's recommendations are:

- Tennessee's municipal wastewater collection, transport and treatment systems are critically important to the protection of public health and the environment. Now, many of these aging systems need major rehabilitation to restore capacity. The costs for this work can be very difficult for these systems to bear on their own. Federal support for water and wastewater infrastructure in Tennessee has contributed significantly over the years to water quality improvement, but needs still exceed available funds. Tennessee should take whatever action is necessary to take advantage of any funds for water and wastewater infrastructure or other changes to the State Revolving Loan Programs, including any loan forgiveness component that may occur as a result of the stimulus package currently being considered by Congress.

- The Department will continue to work with the Water Resources Technical Advisory Committee to further develop a model for regional water planning that can be used throughout the state to ensure that future needs for water are met while our streams and watersheds are protected. As that process continues, we will likely have a recommendation for the General Assembly.

- Consider opportunities for closer communication with Tennessee's congressional delegation on matters involving water resource management, clean water programs and funding.

- As a matter of public safety, and in order to identify and control sources of pollution, Tennessee should consider developing a funding source for annual well sampling and establishing a data base that tracks ground water contamination and shares the results with TDEC and the public. We recognize this may not be possible in the current financial conditions.

APPENDIX A

SUSCEPTABILITY AND THREATS BY WATERSHED: WATER SYSTEMS IMPACTED BY THE DROUGHT IN 2008

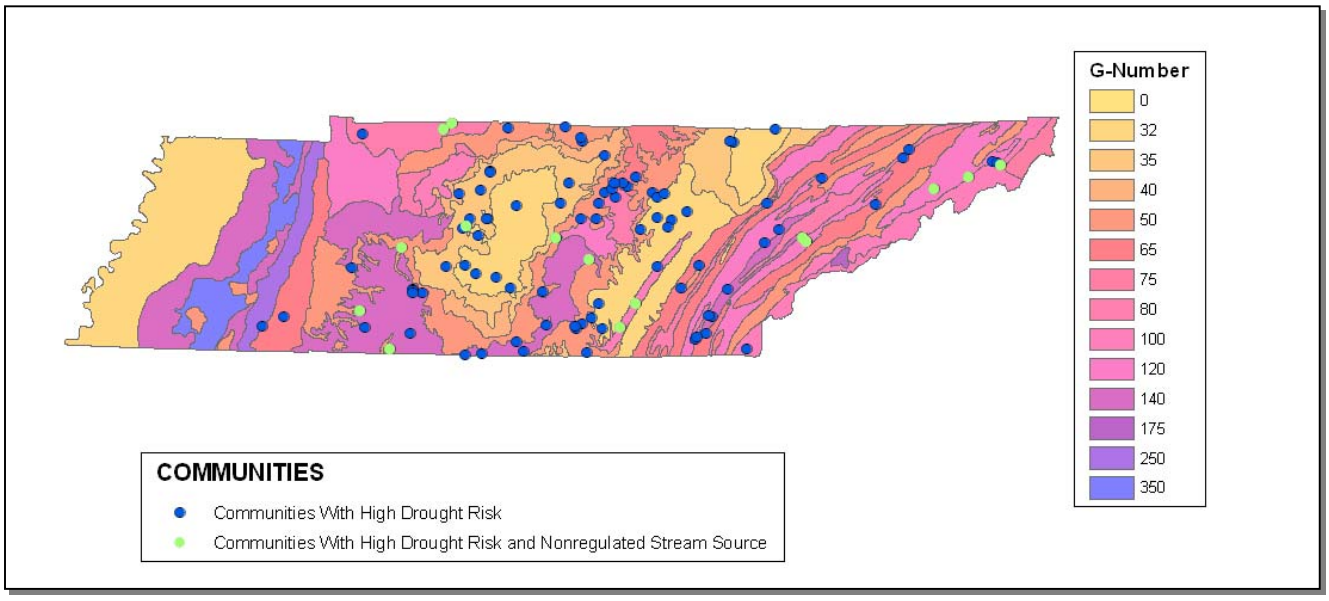


Figure B-1. Communities in Tennessee with Drought Impacts on Public Water Supplies. *These communities are addressing drought threats through emergency management plans in 2008.*

WATER SYSTEM	COUNTY	WATER SOURCE	PROBLEM	MEASURES	POPULATION
Adams-Cedar Hill	Robertson	Red River	S	V	4,774
Adamsville	McNairy	Wells	H		8,063
Advent Home	McMinn	Wells	S	M	65
Alcoa	Blount	Little River	S	M	25,001
Alexandria W.S.	Dekalb	Smithville and Smith U.D. #1	PD	FN5	2,233
Algood W.S.	Putnam	Cookeville	PD	FN5	6,457
Ardmore W.S.	Giles	Wells	S,P	V	1,519
Athens	McMinn	Wells and Springs	D	V	18,110
Bangham U.D.	Putnam	Cookeville	PD	FN5	6,672
Baxter W.D.	Putnam	Cookeville	PD	FN5	4,588
Bedford County U.D.	Bedford	Duck River	D	V	18,008
Big Creek U.D.	Grundy	Ranger Lake	S,C	V	8,001
Bon De Croft U.D.	White	Billy's Branch	N	V	3,234
Brentwood W.S.	Williamson	Harpeth Valley UD			22,606
Centerville	Hickman	Big Swan Creek	H	M	7,845
Cherokee Hills W.S.	Polk	Springs	S	M	295
Cleveland	Bradley	Waterville Spring	S	M	0
Cleveland	Bradley	Hiwassee River	S	M	71,348
Collinwood	Wayne	Well	S	V	1,902
Columbia	Maury	Duck River	D	V	56,739
Cookeville	Putnam	Center Hill Lake	D	FN5	32,466
Cookeville Boat Dock Road U.D.	Putnam	Cookeville	PD	FN5	5,880
Crab Orchard U.D.	Cumberland	Impoundment	S	V	16,907
Crossville	Cumberland	Holiday Hills Lake	D	M	25,961
Crossville	Cumberland	Meadow Park Lake	D	M	0
Dayton	Rhea	Tennessee River	H	V	18,974
Dekalb U.D.	Dekalb	Smithville	PD	FN5	13,403
DeKalb U.D. #4	DeKalb	Cookeville via Baxter			465
Double Springs U.D.	Putnam	Cookeville	PD	FN5	6,779
Duck River U. C.	Coffee	Normandy Lake	D	V	47,946
Dunlap	Sequatchie	Sequatchie River	S	N	5,645
Elizabethton	Carter	Big Spring	D	M	24,910
Elizabethton	Carter	McCathen Spring	D	M	0
Elizabethton	Carter	Valley Forge	D	M	0
First U. D. Knox County	Knox	Tennessee River	H	N	72,897
Foster Falls U.D.	Marion	Tracy City	PD	M	650
Franklin W. D.	Williamson	Harpeth River	S	V	51,061
Gladeville U. D.	Wilson	Wells	N	V	19,899
Greeneville	Greene	Nolichucky River	D	T	22,967
H.B. & T.S. U.D.	Williamson	Harpeth Valley & Spring Hill	L	V	14,977
Harpeth Valley U. D.	Davidson	Cumberland River	C	N	44,275
Hendersonville	Sumner	Cumberland River	H	V	37,786
Heritage Academy	Putnam	Wells	D	M	100
Jackson County U.D. #4	Jackson	Red Boiling Springs W.S.	PS	M	1,703
Jasper	Marion	Spring & Sequatchie River	S	V	8,805

Jellico	Campbell	Mine impoundment	D	M	0
Jonesborough	Washington	Nolichucky River	T	T	22,617
Lafayette	Macon	Adams Spring	D	M	14,657
Lenoir City	Loudon	Watts Bar Lake	H	V	19,191

Table B-1a.

WATER SYSTEM	COUNTY	WATER SOURCE	PROBLEM	MEASURES	POPULATION
Leoma	Lawrence	Wells	D	V	2,842
Lewisburg	Marshall	Duck River	D	V	14,953
Lincoln County Board	Lincoln	Flintville Wellfield	D	V	18,673
Lincoln County Board	Lincoln	Elora Wellfield	D	V	0
Lincoln County Board	Lincoln	Taft Wellfield	D	V	0
Linden	Perry	Buffalo River	S	V	4,950
Luttrell-Blaine-Corryton	Grainger	Springs	D	M	7,504
Mallory Valley U.D.	Williamson	Franklin	D	N	18,184
Maryville	Blount	Little River	S	V	34,599
Maryville	Blount	Little River	S	M	34,064
McMinnville	Warren	Barren Fork River	T	T	14,835
Milcrofton	Williamson	Harpeth Valley U.D.	PP	M	11,395
Monteagle	Grundy	Laurel Lake	S	M	3,399
Monterey	Putnam	City Lake	S	V	4,397
Monterey	Putnam	Meadow Creek Lake	S	V	0
Mount Pleasant	Maury	Williams Spring	S	M	6,339
Mount Pleasant	Maury	Kidd Spring	S	M	0
Mount Pleasant	Maury	Carpenter Spring	S	M	0
Nashville	Davidson	Cumberland River	H	N	406,245
Nolensville College Grove	Williamson	Wells	H	V	12,810
Nolensville College Grove	Williamson	Wells	H	V	0
North Stewart	Stewart	Wells and Spring	D	N	4,270
O"Connor U.D.	Putnam	Cookeville			7,389
Ocoee U. D.	Bradley	Carpenter Spring	FN4	N	14,863
Ocoee U. D.	Bradley	Wildwood Spring	FN4	N	0
Old Gainesboro Road U.D.	Putnam	Cookeville	PD	FN5	5,491
Oliver Springs Water Board	Roane	Bacon Spring	D	V	5,138
Oneida	Scott	City Lake	S	V	0
Oneida	Scott	Howard Baker Lake	S	V	0
Orme	Marion	Springs	S	M	87
Persia U.D.	Hawkins	Wells	D	N	3,985
Pikeville	Bledsoe	Wells	D	M	3,358
Portland	Sumner	City Lake	D	M	17,994
Red Boiling Springs	Macon	Saben Spring	S	M	4,894
Red Boiling Springs	Macon	McClellan Spring	S	M	0
River Road U.D.	Cheatham	Harpeth Valley UD			3,370
Rogersville	Hawkins	Well	D	N	8,134
Selmer	McNairy	Wells	H	V	17,276
Sewanee	Franklin	Lake Jackson	D	V	4,708
Sewanee	Franklin	Lake O'Donnell	D	V	0
Shelbyville W.S.	Bedford	Duck River	D	V	21,932
Smith U.D.	Smith	Caney Fork River	D		6,204
Smithville	Smith	Caney Fork River	D	FN5	5,387
Southside U.D.		Cookeville via Baxter			0
Spring Hill	Maury	Duck River	S	V	18,718

Springfield	Robertson	Red River	S	V	31,022
St Joseph	Lawrence	Spring	D	V	1,303
Summertown	Lawrence	Well	S	V	3,144
Tracy City	Grundy	Fiery Gizzard Impoundment	S	M	3,680

Table B-1b.

WATER SYSTEM	COUNTY	WATER SOURCE	PROBLEM	MEASURES	POPULATION
Watts Bar	Rhea	Wells & Hiwassee U.	S	V	9,574
Waynesboro	Wayne	Green River	D	M	3,549
West Cumberland	Cumberland	Bon De Croft	PD	V	3,674
West Overton U.D.	Overton	Livingston & Cookeville	PD	FN5	7,006
White House	Sumner	Old Hickory Lake	H	V	73,867
Whitwell	Marion	Sequatchie River	S	V	6,728
Winchester	Franklin	Tims Ford Lake	D	V	18,862
Witt Baneberry U.D.	Jefferson	Wells	D	N	3,554
Woodbury	Cannon	E. Fork Stones River	S	V	8,612

Table B-1c.

Tables B-1a-c. Susceptibility and Threats by Watershed: Water Systems Affected by the Drought in Summer 2008. Data compiled December 19, 2007. W.S., Water System; W.D., Water Department; U.D., Utility District.

WATER SYSTEM	COUNTY	WATER SOURCE	PROBLEM	MEASURES	POPULATION
Advent Home	McMinn	Wells (4)	D	M	65
Cherokee Hills U.D.	Polk	Springs (4)	S	M	308
Franklin W.S.	Williamson	Harpeth River and Harpeth Valley U.D.	H	N	52,098
Tracy City W.S.	Grundy	Fiery Gizzard Lake, Big Creek, Tracy City	D	N	3,698
Big Creek U.D.	Grundy	Ranger Creek Impoundment		V	7,924
Woodbury W.S.	Cannon	East Fork Stones River and DeKalb U.D.	N	V	8,612
Mountain City W.D.	Johnson	Springs	S		9,966
Elizabethton W.D.	Carter	Springs	S	V	26,837

Table B-2. Susceptibility and Threats by Watershed: Water Systems Affected by the Drought in December 2008. Data compiled December 12, 2008. W.S., Water System; W.D., Water Department; U.D., Utility District.

Problem:

C – Treatment Plant Capacity
D – Declining Source
H – Distribution Hydraulic Capacity
L – Contract Limitation
N – None reported
P – Pump Capacity
S – Source
T – Taste and Odor

Measures Taken:

N – None (No measures have been requested by the water system)

V – Voluntary Conservation (Water system has requested that customers restrict unnecessary use and may request specific uses be deferred during specified timeframes)
M – Mandated Conservation (Specified water uses are banned or restricted and a program of surveillance, warnings, fines and cut-offs is in place to enforce the restrictions)
R – Rationing (Specified water uses are banned or restricted and overall water use is rationed based on a pre-established level of use. Surcharges for use above a ration, fines and cut-offs are in effect.)
T – Additional treatment
* - Required by the DWS to meet psi requirements
FN1 – Duck River Utilities Commission (DRUC) obtains water from Normandy Lake and sells water to Manchester (13,978) Tullahoma (25,595) and Hillsville Utility District (8,348).
FN2 – TN-American was removed from the list because they no longer require measures in the GA portion of their system.
FN3 – Reductions in demand have allowed the system to replace Mandatory Restrictions with Voluntary Conservation.
FN4 – Reportedly no source problem has resulted due to the sink hole. Monitoring the situation.
FN5 – Lake levels due to repairs to Center Hill Lake Dam and lack of rainfall to sustain water supply levels may impact Alexandria WS, DeKalb UD #1-4, Smithville WS, West Overton UD, Algood WS, Bangham UD, Baxter WD, Cookeville WD, Cookeville Boat Dock Road UD, Double Springs UD, Old Gainesboro Road, Smith UD and Smith UD #2.
FN6 – Water systems depending on Duck River include: Bedford County UD, Shelbyville WS, Lewisburg WS, Columbia WS and Spring Hill WD. Duck River flows are being maintained by releases from Normandy Lake. Currently, releases are being made to protect aquatic life and maintain water quality for assimilation of waste discharges. Mandatory restrictions will be triggered when Normandy Reservoir reaches 850 feet MSL. It is presently at 853 feet MSL.
FN7 – Water conservation, utilization of other sources and other measures are being taken to protect aquatic life and/or maintain water quality for assimilation of waste discharges.

Some of the drought-impacted communities use free flowing streams (unregulated streams) as their source of drinking water. For these communities, water supply is dependent on a steady supply of surface source water.

WATER SYSTEM	COUNTY	WATER SOURCE	G-NUMBER*	DRAINAGE AREA (MI^2)	7Q10 (CFS)
Adams-Cedar Hill	Robertson	Red River	80	593	41.80
Alcoa	Blount	Little River	120	299	43.00
Centerville	Hickman	Big Swan Creek	50	150	28.80
Dunlap	Sequatchie	Sequatchie River	100	290	17.20
Elizabethton	Carter	Valley Forge	100	99.6	13.80
Franklin W. D.	Williamson	Harpeth River	35	183	0.62
Greeneville	Greene	Nolichucky River	120	1100	265.00
Jasper	Marion	Spring & Sequatchie River	0	574	29.60
Jonesborough	Washington	Nolichucky River	120	819	213.00
Maryville	Blount	Little River	120	269	37.90
Maryville	Blount	Little River	120	269	37.90
McMinnville	Warren	Barren Fork River	140	297	51.90
Southside UD	Putnam	Cookeville via Baxter	0	27	0.14
Springfield	Robertson	Red River	80	551	38.40
St Joseph	Lawrence	Spring	140	4.62	1.16
Waynesboro	Wayne	Green River	140	20.4	5.15
Whitwell	Marion	Sequatchie River	100	406	24.20
Woodbury	Cannon	East Fork Stones River	50	38.8	4.76

Table B-3. Communities Whose Water Supply is From a Nonregulated Stream That are Addressing Drought by Implementing Emergency Management Plans in 2008. **Also called Stream Flow Recession Index; 7Q10, 7-day consecutive low flow with a 10-year return frequency; CFS, cubic feet per second.*

The same data can be rearranged from low to high flow (7Q10).

WATER SYSTEM	COUNTY	WATER SOURCE	G-NUMBER*	DRAINAGE AREA	7Q10
Southside UD	Putnam	Cookeville via Baxter	0	27	0.14
Franklin W. D.	Williamson	Harpeth River	35	183	0.62
St Joseph	Lawrence	Spring	140	4.62	1.16
Woodbury	Cannon	E. Fork Stones River	50	38.8	4.76
Waynesboro	Wayne	Green River	140	20.4	5.15
Elizabethton	Carter	Valley Forge	100	99.6	13.80
Dunlap	Sequatchie	Sequatchie River	100	290	17.20
Whitwell	Marion	Sequatchie River	100	406	24.20
Centerville	Hickman	Big Swan Creek	50	150	28.80
Jasper	Marion	Spring & Sequatchie River	0	574	29.60
Maryville	Blount	Little River	120	269	37.90
Maryville	Blount	Little River	120	269	37.90
Springfield	Robertson	Red River	80	551	38.40
Adams-Cedar Hill	Robertson	Red River	80	593	41.80
Alcoa	Blount	Little River	120	299	43.00
McMinnville	Warren	Barren Fork River	140	297	51.90
Jonesborough	Washington	Nolichucky River	120	819	213.00
Greeneville	Greene	Nolichucky River	120	1100	265.00

Table B-4. Communities Whose Water Supply is From a Nonregulated Stream That are Addressing Drought by Implementing Emergency Management Plans in 2008. **Also called Stream Flow Recession Index; 7Q10, 7-day consecutive low flow with a 10-year return frequency; CFS, cubic feet per second.*