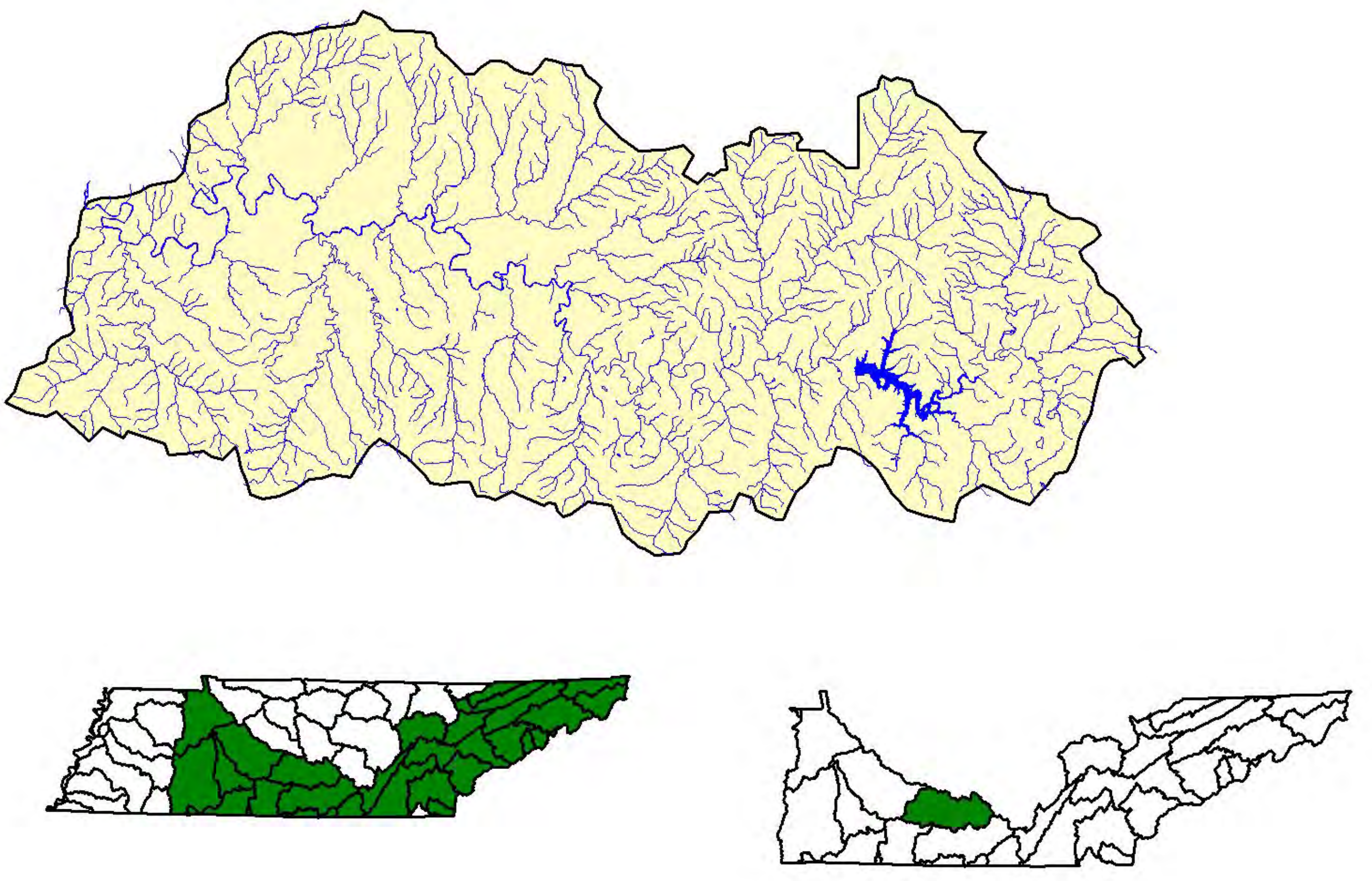
UPPER DUCK RIVER WATERSHED (06040002) OF THE TENNESSEE RIVER BASIN

WATERSHED WATER QUALITY MANAGEMENT PLAN



TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER POLLUTION CONTROL
WATERSHED MANAGEMENT SECTION

UPPER DUCK RIVER WATERSHED
WATER QUALITY MANAGEMENT PLAN

TABLE OF CONTENTS

GLOSSARY

1Q20. The lowest average 1 consecutive days flow with average recurrence frequency of once every 20 years.

30Q2. The lowest average 3 consecutive days flow with average recurrence frequency of once every 2 years.

7Q10. The lowest average 7 consecutive days flow with average recurrence frequency of once every 10 years.

303(d). The section of the federal Clean Water Act that requires a listing by states, territories, and authorized tribes of impaired waters, which do not meet the water quality standards that states, territories, and authorized tribes have set for them, even after point sources of pollution have installed the minimum required levels of pollution control technology.

305(b). The section of the federal Clean Water Act that requires EPA to assemble and submit a report to Congress on the condition of all water bodies across the Country as determined by a biennial collection of data and other information by States and Tribes.

AFO. Animal Feeding Operation.

Ambient Sites. Those sites established for long term instream monitoring of water quality.

ARAP. Aquatic Resource Alteration Permit.

Assessment. The result of an analysis of how well streams meet the water quality criteria assigned to them.

Bankfull Discharge. The momentary maximum peak flow before a stream overflows its banks onto a floodplain.

Basin. An area that drains several smaller watersheds to a common point. Most watersheds in Tennessee are part of the Cumberland, Mississippi, or Tennessee Basin (The Conasauga River and Barren River Watersheds are the exceptions).

Benthic. Bottom dwelling.

Biorecon. A qualitative multihabitat assessment of benthic macroinvertebrates that allows rapid screening of a large number of sites. A Biorecon is one tool used to recognize stream impairment as judged by species richness measures, emphasizing the presence or absence of indicator organisms without regard to relative abundance.

BMP. An engineered structure or management activity, or combination of these, that eliminates or reduces an adverse environmental effect of a pollutant.

BOD. Biochemical Oxygen Demand. A measure of the amount of oxygen consumed in the biological processes that break down organic and inorganic matter.

CAFO. Concentrated Animal Feeding Operation.

Designated Uses. The part of Water Quality Standards that describes the uses of surface waters assigned by the Water Quality Control Board. All streams in Tennessee are designated for Recreation, Fish and Aquatic Life, Irrigation, and Livestock Watering and Wildlife. Additional designated uses for some, but not all, waters are Drinking Water Supply, Industrial Water Supply, and Navigation.

DMR. Discharge Monitoring Report. A report that must be submitted periodically to the Division of Water Pollution Control by NPDES permitees.

DO. Dissolved oxygen.

EPA. Environmental Protection Agency. The EPA Region 4 web site is http://www.epa.gov/region4/

Field Parameter. Determinations of water quality measurements and values made in the field using a kit or probe. Common field parameters include pH, DO, temperature, conductivity, and flow.

Fluvial Geomorphology. The physical characteristics of moving water and adjoining landforms, and the processes by which each affects the other.

HUC-8. The 8-digit Hydrologic Unit Code corresponding to one of 54 watersheds in Tennessee.

HUC-10. The 10-digit NRCS Hydrologic Unit Code. HUC-10 corresponds to a smaller land area than HUC-8.

HUC-12. The 12-digit NRCS Hydrologic Unit Code. HUC-12 corresponds to a smaller land area than HUC-10.

MRLC. Multi-Resolution Land Classification.

MS4. Municipal Separate Storm Sewer System.

Nonpoint Source (NPS). Sources of water pollution without a single point of origin. Nonpoint sources of pollution are generally associated with surface runoff, which may carry sediment, chemicals, nutrients, pathogens, and toxic materials into receiving waterbodies. Section 319 of the Clean Water Act of 1987 requires all states to assess the impact of nonpoint source pollution on the waters of the state and to develop a program to abate this impact.

NPDES. National Pollutant Discharge Elimination System. Section 402 of the Clean Water Act of 1987 requires dischargers to waters of the U.S. to obtain NPDES permits.

NRCS. Natural Resources Conservation Service. NRCS is part of the federal Department of Agriculture. The NRCS home page is http://www.nrcs.usda.gov

Point Source. Any discernable, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture (Clean Water Act Section 502(14)).

Q Design. The average daily flow that a treatment plant or other facility is designed to accommodate.

Reference Stream (Reference Site). A stream (site) judged to be least impacted. Data from reference streams are used for comparisons with similar streams.

SBR. Sequential Batch Reactor.

Stakeholder. Any person or organization affected by the water quality or by any watershed management activity within a watershed.

STATSGO. State Soil Geographic Database. STATSGO is compiled and maintained by the Natural Resources Conservation Service.

STORET. The EPA repository for water quality data that is used by state environmental agencies, EPA and other federal agencies, universities, and private citizens. STORET (Storage and Retrieval of National Water Quality Data System) data can be accessed at http://www.epa.gov/storet/

TDA. Tennessee Department of Agriculture. The TDA web address is http://www.state.tn.us/agriculture

TDEC. Tennessee Department of Environment and Conservation. The TDEC web address is http://www.tdec.net

TMDL. Total Maximum Daily Load. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of the amount to the pollutant's sources. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation includes a margin of safety to ensure that the waterbody can be used for the purposes the State has designated. The calculation must also account for seasonal variation in water quality. A TMDL is required for each pollutant in an impaired stream as described in Section 303 of the Federal Clean Water Act of 1987. Updates and information on Tennessee's TMDLs can be found at http://www.tdec.net/wpc/tmdl/

TMSP. Tennessee Multi-Sector Permit.

USGS. United States Geological Survey. USGS is part of the federal Department of the Interior. The USGS home page is http://www.usgs.gov/.

WAS. Waste Activated Sludge.

Water Quality Standards. A triad of designated uses, water quality criteria, and antidegradation statement. Water Quality Standards are established by Tennessee and approved by EPA.

Watershed. A geographic area which drains to a common outlet, such as a point on a larger stream, lake, underlying aquifer, estuary, wetland, or ocean.

WET. Whole Effluent Toxicity.

WWTP. Waste Water Treatment Plant

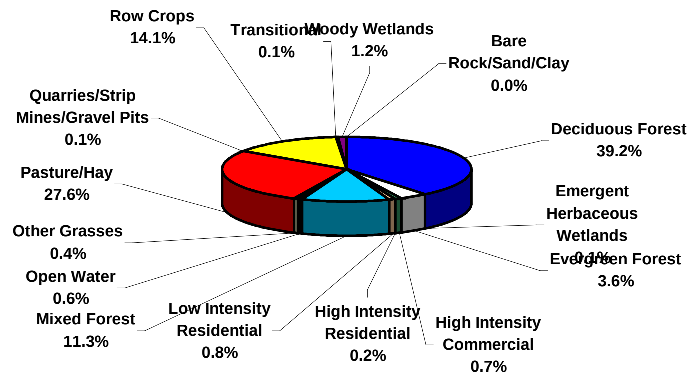
Summary – Upper Duck River

In 1996, the Tennessee Department of Environment and Conservation Division of Water Pollution Control adopted a watershed approach to water quality. This approach is based on the idea that many water quality problems, like the accumulation of point and nonpoint pollutants, are best addressed at the watershed level. Focusing on the whole watershed helps reach the best balance among efforts to control point sources of pollution and polluted runoff as well as protect drinking water sources and sensitive natural resources such as wetlands. Tennessee has chosen to use the USGS 8-digit Hydrologic Unit Code (HUC-8) as the organizing unit.

The Watershed Approach recognizes awareness that restoring and maintaining our waters requires crossing traditional barriers (point *vs.* nonpoint sources of pollution) when designing solutions. These solutions increasingly rely on participation by both public and private sectors, where citizens, elected officials, and technical personnel all have opportunities to participate. The Watershed Approach provides the framework for a watershed-based and community-based approach to address water quality problems.

Chapter 1 of the Upper Duck River Watershed Water Quality Management Plan discusses the Watershed Approach and emphasizes that the Watershed Approach is not a regulatory program or an EPA mandate; rather it is a decision-making process that reflects a common strategy for information collection and analysis as well as a common understanding of the roles, priorities, and responsibilities of all stakeholders within a watershed. Traditional activities like permitting, planning and monitoring are also coordinated in the Watershed Approach.

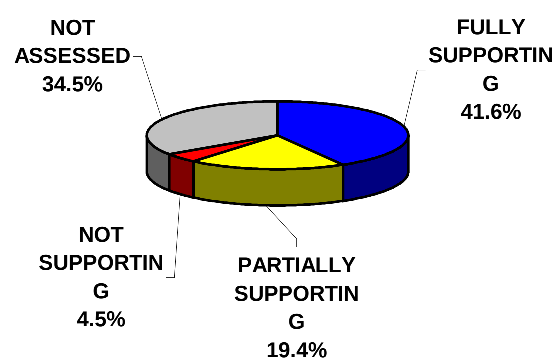
A detailed description of the watershed can be found in Chapter 2. The Upper Duck River Watershed is approximately 1,182 square miles and includes parts of 10 Middle Tennessee counties. A part of the Tennessee River drainage basin, the watershed has 1,607 stream miles and 3,260 lake acres.



Land Use Distribution in the Upper Duck River Watershed.

One greenways, four interpretive areas, and five wildlife management areas are located in the watershed. One hundred forty-seven rare plant and animal species have been documented in the watershed, to include fourteen rare fish species, fifteen rare mussel species, five rare snail species, and one rare reptile species. A portion of the Upper Duck River has been designated as a State Scenic River.

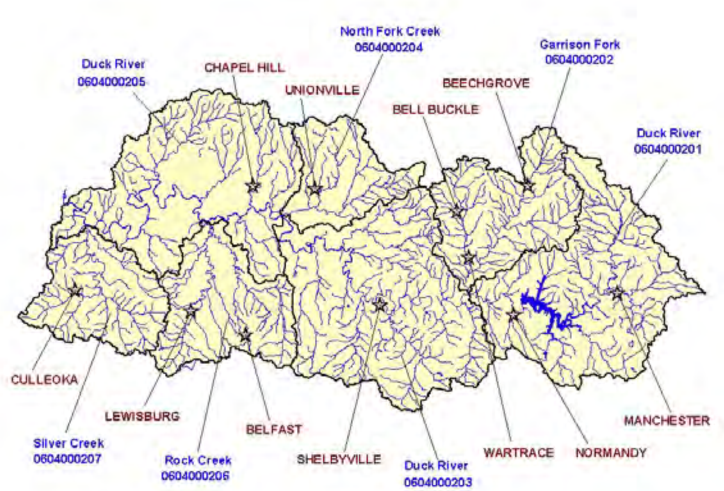
A review of water quality sampling and assessment is presented in Chapter 3. Using the Watershed Approach to Water Quality, 410 sampling events occurred in the Upper Duck River Watershed in 1999-2000. These were conducted at ambient, ecoregion or watershed monitoring sites. Monitoring results support the conclusion that 41.6% of total stream miles and 100% of lake acres fully support designated uses.



Water Quality Assessment of Streams and Rivers in the Upper Duck River Watershed. Assessment data are based on the 2002 Water Quality Assessment of 1,606.9 miles in the watershed.

Also in Chapter 3, a series of maps illustrate Overall Use Support in the watershed, as well as Use Support for the individual uses of Fish and Aquatic Life Support, Recreation, Irrigation, and Livestock Watering and Wildlife. Another series of maps illustrate streams that are listed for impairment by specific causes (pollutants) such as Pathogens, Siltation, Habitat Alteration and Nutrient Enrichment.

Point and Nonpoint Sources are addressed in Chapter 4. Chapter 4 is organized by HUC-10 subwatersheds. Maps illustrating the locations of STORET monitoring sites and USGS stream gauging stations are presented in each subwatershed.



The Upper Duck River Watershed is Composed of Seven USGS-Delineated Subwatersheds (10-Digit Subwatersheds).

Point source contributions to the Upper Duck River Watershed consist of 12 individual NPDES-permitted facilities, eight of which discharge into streams that have been listed on the 1998 303(d) list. Other point source permits in the watershed are Aquatic Resource Alteration Permits (16), Tennessee Multi-Sector Permits (62), Mining Permits (10), Ready Mix Concrete Plant Permits (3) and Water Treatment Plant Permits (3). Agricultural operations include cattle, chicken, hog, and sheep farming. Maps illustrating the locations of NPDES and ARAP permit sites are presented in each subwatershed.

Chapter 5 is entitled *Water Quality Partnerships in the Upper Duck River Watershed* and highlights partnerships between agencies and between agencies and landowners that are essential to success. Programs of federal agencies (Natural Resources Conservation Service, U.S. Fish and Wildlife Service, U.S. Geological Survey, Tennessee Valley Authority), and state agencies (TDEC Division of Community Assistance, TDEC Division of Water Supply, and Tennessee Department of Agriculture) are summarized. Local initiatives of active watershed organizations (TN Duck River Development Agency, TN Scenic River Association's Duck River Opportunities Project, The Nature Conservancy Duck River Project) are also described.

Point and Nonpoint source approaches to water quality problems in the Upper Duck River Watershed are addressed in Chapter 6. Chapter 6 also includes comments received during public meetings, along with an assessment of needs for the watershed.

The full Upper Duck River Watershed Water Quality Management Plan can be found at: http://www.state.tn.us/environment/wpc/watershed/wsmplans/.

CHAPTER 1

WATERSHED APPROACH TO WATER QUALITY

1.1 BACKGROUND. The Division of Water Pollution Control is responsible for administration of the Tennessee Water Quality Control Act of 1977 (TCA 69–3–101). Information about the Division of Water Pollution Control, updates and announcements, may be found at http://www.state.tn.us/environment/wpc/index.html, and a summary of the organization of the Division of Water Pollution Control may be found in Appendix I.

The mission of the Division of Water Pollution Control is to abate existing pollution of the waters of Tennessee, to reclaim polluted waters, to prevent the future pollution of the waters, and to plan for the future use of the waters so that the water resources of Tennessee might be used and enjoyed to the fullest extent consistent with the maintenance of unpolluted waters.

The Division monitors, analyzes, and reports on the quality of Tennessee's water. In order to perform these tasks more effectively, the Division adopted a Watershed Approach to Water Quality in 1996.

This Chapter summarizes TDEC's Watershed Approach to Water Quality.

1.2 WATERSHED APPROACH TO WATER QUALITY. The Watershed Approach to Water Quality is a coordinating framework designed to protect and restore aquatic systems and protect human health more effectively (EPA841-R-95-003). The Approach is based on the concept that many water quality problems, like the accumulation of pollutants or nonpoint source pollution, are best addressed at the watershed level. In addition, a watershed focus helps identify the most cost-effective pollution control strategies to meet clean water goals. Tennessee's Watershed Approach, updates and public participation opportunities, may be found on the web at http://www.state.tn.us/environment/wpc/wshed1.htm.

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).

Four main features are typical of the Watershed Approach: 1) Identifying and prioritizing water quality problems in the watershed, 2) Developing increased public involvement, 3) Coordinating activities with other agencies, and 4) Measuring success through increased and more efficient monitoring and other data gathering.

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

An additional characteristic of the Watershed Approach is that it complements other environmental activities. This allows for close cooperation with other state agencies and local governments as well as with federal agencies such as the Tennessee Valley Authority and the U.S. Army Corps of Engineers, U.S. Department of Agriculture (*e.g.*, Natural Resources Conservation Service, United States Forest Service), U.S. Department of the Interior (*e.g.* United States Geological Survey, U.S. Fish and Wildlife Service, National Park Service). When all permitted dischargers are considered together, agencies are better able to focus on those controls necessary to produce measurable improvements in water quality. This also results in a more efficient process: It encourages agencies to focus staff and financial resources on prioritized geographic locations and makes it easier to coordinate between agencies and individuals with an interest in solving water quality problems (EPA841-R-003).

The Watershed Approach is not a regulatory program or a new EPA mandate; rather it is a decision making process that reflects a common strategy for information collection and analysis as well as a common understanding of the roles, priorities, and responsibilities of all stakeholders within a watershed. The Watershed Approach utilizes features already in state and federal law, including:

- Water Quality Standards
- National Pollutant Discharge Elimination System (NPDES)
- Total Maximum Daily Loads (TMDLs)
- Clean Lakes Program
- Nonpoint Source Program
- Groundwater Protection

Traditional activities like permitting, planning, and monitoring are also coordinated in the Watershed Approach. A significant change from the past, however, is that the Watershed Approach encourages integration of traditional regulatory (point source pollution) and nonregulatory (nonpoint sources of pollution) programs. There are additional changes from the past as well:

THE PAST	WATERSHED APPROACH
Focus on fixed-station ambient monitoring	Focus on comprehensive watershed monitoring
Focus on pollutant discharge sites	Focus on watershed-wide effects
Focus on WPC programs	Focus on coordination and cooperation
Focus on point sources of pollution	Focus on all sources of pollution
Focus on dischargers as the problem	Focus on dischargers as an integral part of the solution
Focus on short-term problems	Focus on long-term solutions

Table 1-1. Contrast Between the Watershed Approach and the Past.

This approach places greater emphasis on all aspects of water quality, including chemical water quality (conventional pollutants, toxic pollutants), physical water quality (temperature, flow), habitat quality (channel morphology, composition and health of benthic communities), and biodiversity (species abundance, species richness).

1.2.A. <u>Components of the Watershed Approach.</u> Tennessee is composed of fifty-five watersheds corresponding to the 8-digit USGS Hydrologic Unit Codes (HUC-8). These watersheds, which serve as geographic management units, are combined in five groups according to year of implementation.

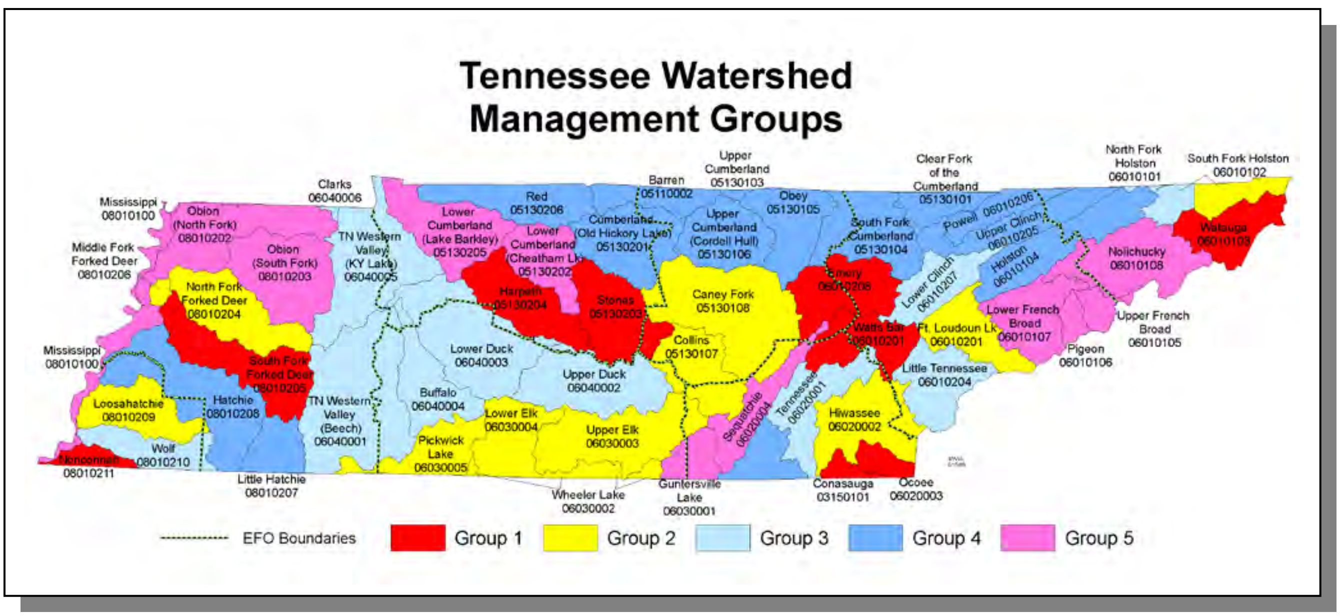


Figure 1-1. Watershed Groups in Tennessee's Watershed Approach to Water Quality.

Each year, TDEC conducts monitoring in one-fifth of Tennessee's watersheds; assessment, priority setting and follow-up monitoring are conducted in another one fifth of watersheds; modeling and TMDL studies in another one fifth; developing management plans in another one fifth; and implementing management plans in another one fifth of watersheds.

GROUP	WEST TENNESSEE	MIDDLE TENNESSEE	EAST TENNESSEE
1	Nonconnah South Fork Forked Deer	Harpeth Stones	Conasauga Emory Ocoee Watauga Watts Bar
2	Loosahatchie Middle Fork Forked Deer North Fork Forked Deer	Caney Fork Collins Lower Elk Pickwick Lake Upper Elk Wheeler Lake	Fort Loudoun Hiwassee South Fork Holston (Upper) Wheeler Lake
3	Tennessee Western Valley (Beech River) Tennessee Western Valley (KY Lake) Wolf River	Buffalo Lower Duck Upper Duck	Little Tennessee Lower Clinch North Fork Holston South Fork Holston (Lower) Tennessee (Upper)
4	Lower Hatchie Upper Hatchie	Barren Obey Red Upper Cumberland (Cordell Hull Lake) Upper Cumberland (Old Hickory Lake) Upper Cumberland (Cumberland Lake)	Holston Powell South Fork Cumberland Tennessee (Lower) Upper Clinch Upper Cumberland (Clear Fork)
5	Mississippi North Fork Obion South Fork Obion	Guntersville Lake Lower Cumberland (Cheatham Lake) Lower Cumberland (Lake Barkley)	Lower French Broad Nolichucky Pigeon Upper French Broad

Table 1-2. Watershed Groups in Tennessee's Watershed Approach.

In succeeding years of the cycle, efforts rotate among the watershed groups. The activities in the five year cycle provide a reference for all stakeholders.

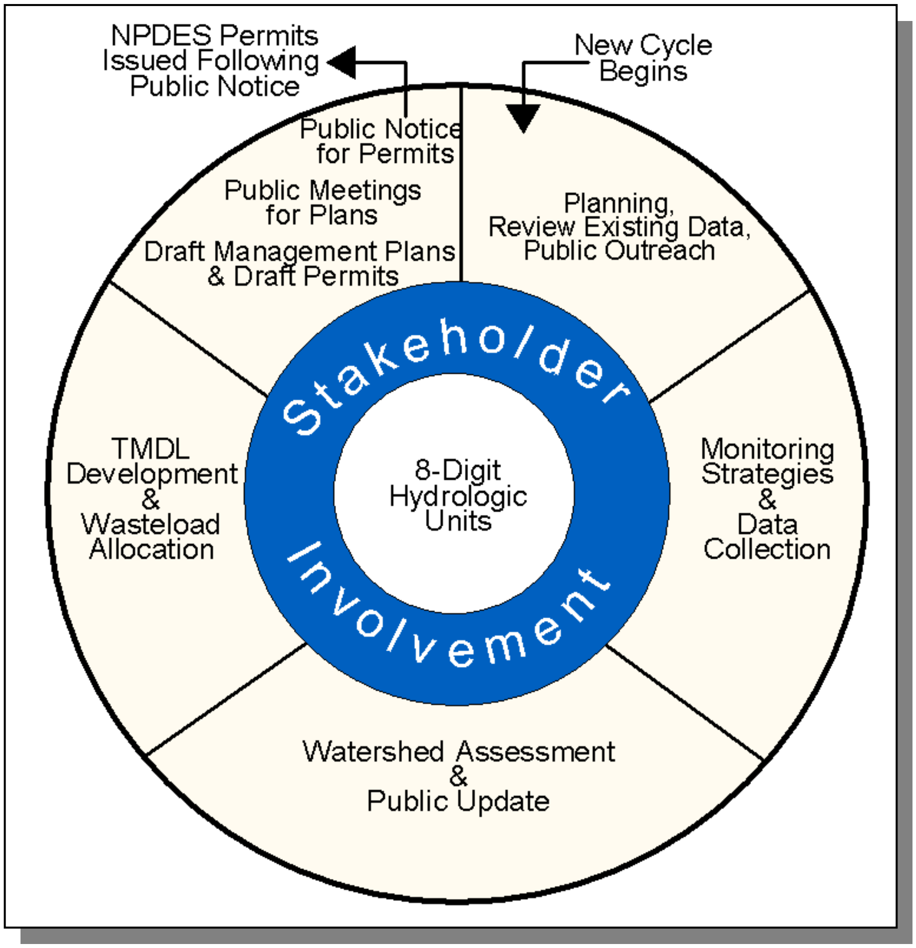


Figure 1-2. The Watershed Approach Cycle.

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 is 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, 1700 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, water quality goals, major water quality concerns and issues, and management strategies.

Public participation opportunities occur throughout the entire five year cycle. Participation in Years 1, 3 and 5 is emphasized, although additional meetings are held at stakeholder's request. People tend to participate more readily and actively in protecting the quality of waters in areas where they live and work, and have some roles and responsibilities:

- Data sharing
- Identification of water quality stressors
- Participation in public meetings
- Commenting on management plans
- Shared commitment for plan implementation

1.2.B. Benefits of the Watershed Approach. The Watershed Approach fosters a better understanding of the physical, chemical and biological effects on a watershed, thereby allowing agencies and citizens to focus on those solutions most likely to be effective. The Approach recognizes the need for a comprehensive, ecosystem-based approach that depends on local governments and local citizens for success (EPA841-R-95-004). On a larger scale, many lessons integrating public participation with aquatic ecosystem-based programs have been learned in the successful Chesapeake Bay, Great Lakes, Clean Lakes, and National Estuary Programs.

Benefits of the Watershed Approach include (EPA841-R-95-004):

- Focus on water quality goals and ecological integrity rather than on program activities such as number of permits issued.

- Improve basis for management decisions through consideration of both point and nonpoint source stressors. A watershed strategy improves the scientific basis for decision making and focuses management efforts on basins and watersheds where they are most needed. Both point and nonpoint control strategies are more effective under a watershed approach because the Approach promotes timely and focused development of TMDLs.

- Enhance program efficiency, as the focus becomes watershed. A watershed focus can improve the efficiency of water management programs by facilitating consolidation of programs within each watershed. For example, handling all point source dischargers in a watershed at the same time reduces administrative costs due to the potential to combine hearings and notices as well as allowing staff to focus on more limited areas in a sequential fashion.

- Improve coordination between federal, state and local agencies including data sharing and pooling of resources. As the focus shifts to watersheds, agencies are better able to participate in data sharing and coordinated assessment and control strategies.

- Increase public involvement. The Watershed Approach provides opportunities for stakeholders to increase their awareness of water-related issues and inform staff about their knowledge of the watershed. Participation is via three public meetings over the five-year watershed management cycle as well as meetings at stakeholder's request. Additional opportunities are provided through the Department of Environment and Conservation homepage and direct contact with local Environmental Assistance Centers.

- Greater consistency and responsiveness. Developing goals and management plans for a basin or watershed with stakeholder involvement results in increased responsiveness to the public and consistency in determining management actions. In return, stakeholders can expect improved consistency and continuity in decisions when management actions follow a watershed plan.

Additional benefits of working at the watershed level are described in the Clean Water Action Plan (EPA-840-R-98-001), and can be viewed at http://www.cleanwater.gov/action/toc.html.

The Watershed Approach represents awareness that restoring and maintaining our waters requires crossing traditional barriers (point *vs.* nonpoint sources of pollution) when designing solutions. These solutions increasingly rely on participation by both public and private sectors, where citizens, elected officials and technical personnel all have opportunity to participate. This integrated approach mirrors the complicated relationships in which people live, work and recreate in the watershed, and suggests a comprehensive, watershed-based and community-based approach is needed to address these (EPA841-R-97-005).

CHAPTER 2

DESCRIPTION OF THE UPPER DUCK RIVER WATERSHED

2.1. BACKGROUND. The Duck River was first settled about 8,000 years ago, but its modern name originated from early surveyors who recognized the abundant waterfowl in the Duck River valley. Much of the watershed, especially in the Yanahli area, was considered prime hunting ground by Cherokee and Chickasaw tribes, as well as by the first settlers. The Duck River flows through some of the most scenic landscapes and least populated counties in Tennessee.

This Chapter describes the location and characteristics of the Upper Duck River Watershed.

2.2. DESCRIPTION OF THE WATERSHED.

2.2.A. General Location. The Upper Duck River Watershed is located in Middle Tennessee and includes parts of Bedford, Coffee, Franklin, Giles, Lincoln, Marshall, Maury, Moore, Rutherford, and Williamson Counties.

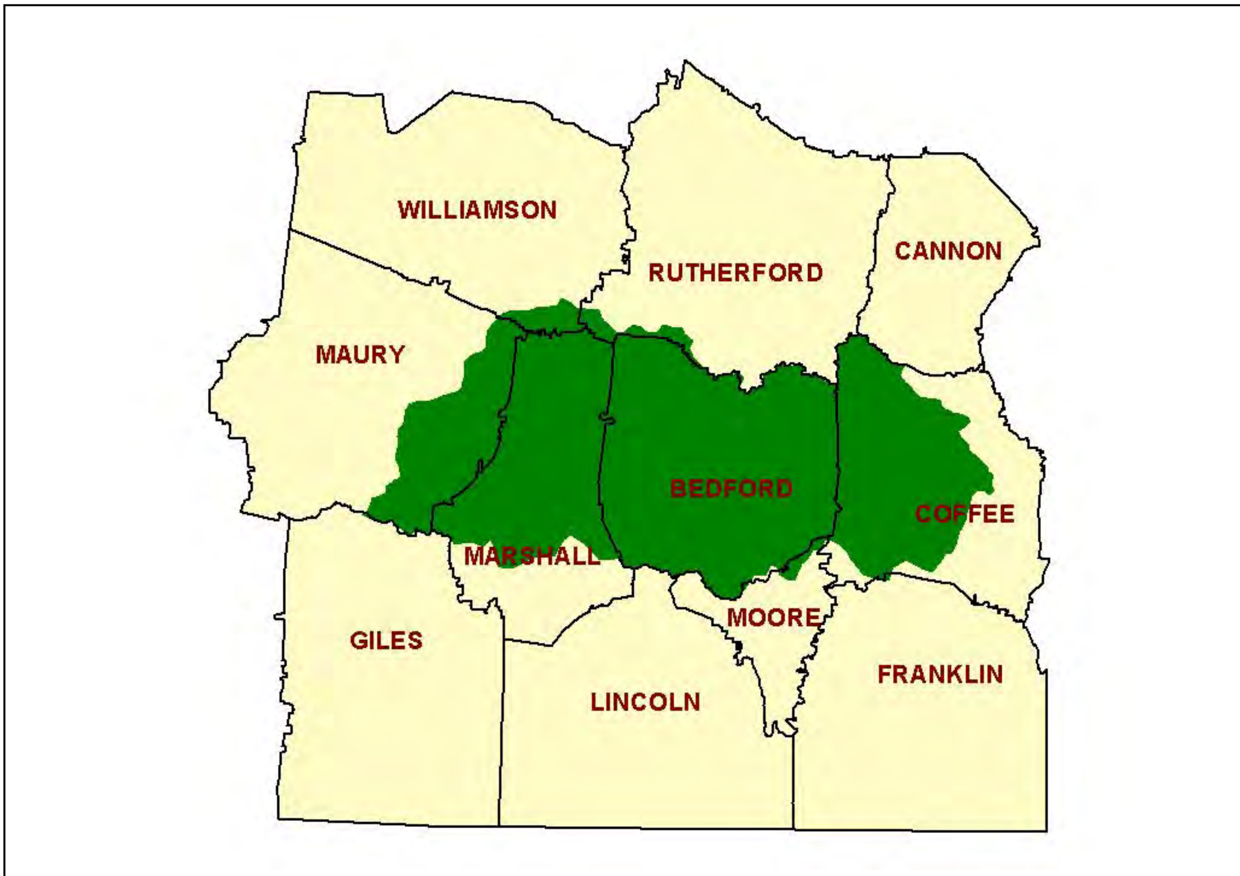


Figure 2-1. General Location of the Upper Duck River Watershed.

COUNTY	% OF WATERSHED IN EACH COUNTY
Bedford	39.4
Marshall	22.9
Coffee	20.8
Maury	12.6
Williamson	1.2
Rutherford	0.8
Giles	0.7
Franklin	0.2
Lincoln	0.2
Moore	0.1

Table 2-1. The Upper Duck River Watershed Includes Parts of Ten Middle Tennessee Counties.

2.2.B. Population Density Centers. Seven state highways and two interstates serve the major communities in the Upper Duck River Watershed.

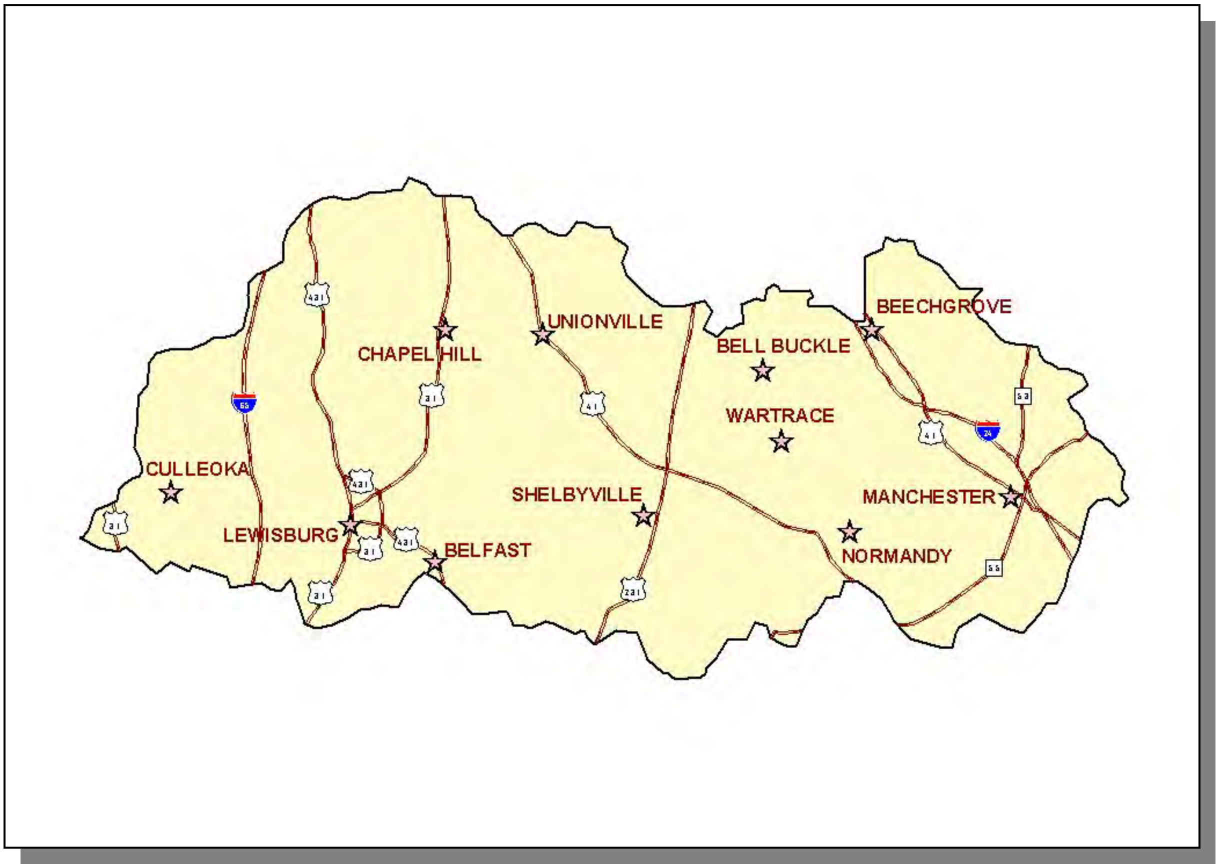


Figure 2-2. Municipalities and Roads in the Upper Duck River Watershed.

MUNICIPALITY	POPULATION	COUNTY
Shelbyville*	17,003	Bedford
Lewisburg*	11,337	Marshall
Manchester*	9,888	Coffee
Chapel Hill	1,049	Marshall
Wartrace	537	Bedford
Bell Buckle	364	Bedford
Normandy	126	Bedford

Table 2-2. Communities and Populations in the Lower Duck River Watershed. *Population based on 1999 census (Tennessee 2001/2002 Blue Book). Asterisk (*) indicates county seat.*

2.3. GENERAL HYDROLOGIC DESCRIPTION.

2.3.A. Hydrology. The Upper Duck River Watershed, designated 06040002 by the USGS, drains approximately 1,182 square miles and empties to the Lower Duck River Watershed (06040003).

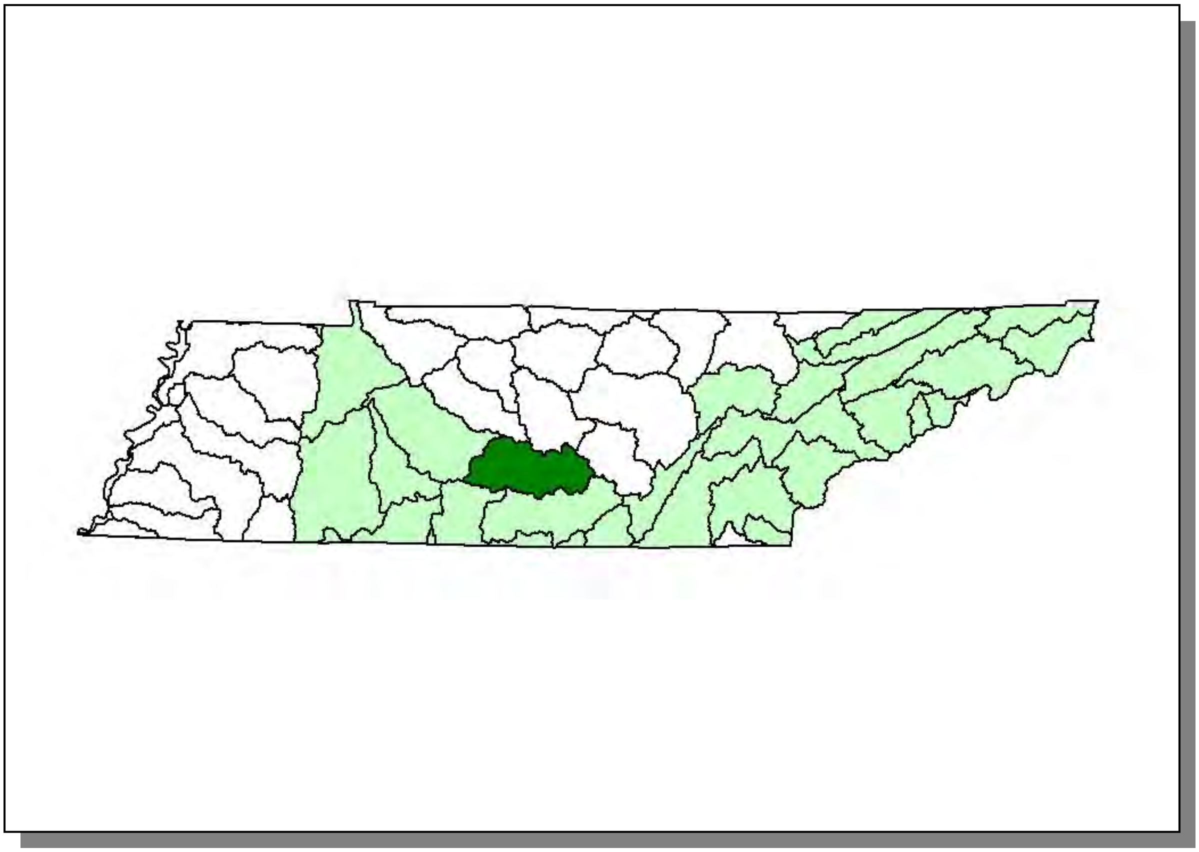


Figure 2-3. The Upper Duck River Watershed is Part of the Tennessee River Basin.

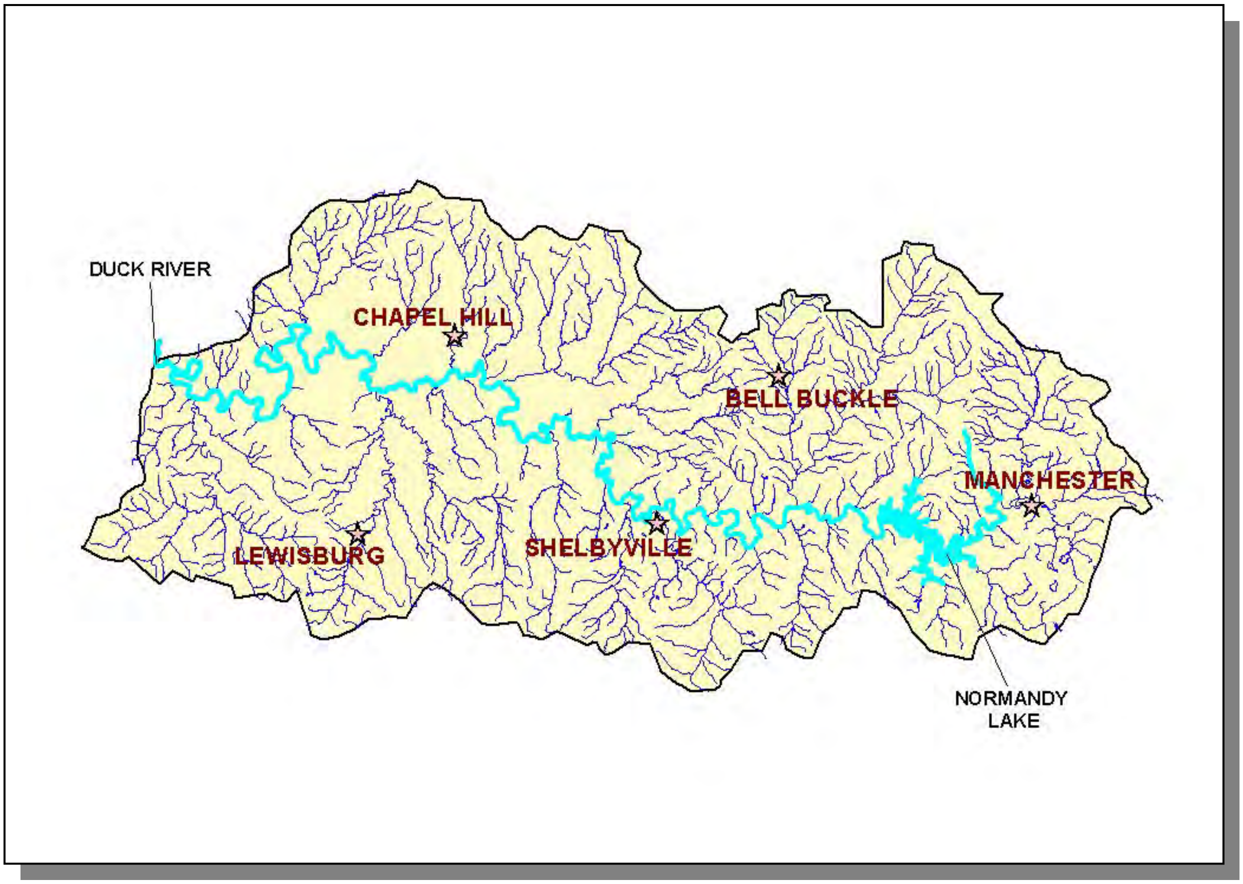


Figure 2-4. Hydrology in the Upper Duck River Watershed. *There are 1,607 stream miles and 3,260 lake acres in the Upper Duck River Watershed as catalogued in the assessment database. Location of the Duck River and Normandy Lake, and the cities of Bell Buckle, Chapel Hill, Lewisburg, Manchester, and Shelbyville are shown for reference.*

2.3.B. Dams. There are 18 dams inventoried by TDEC Division of Water Supply in the Upper Duck River Watershed. These dams either retain 30 acre-feet of water or have structures at least 20 feet high.

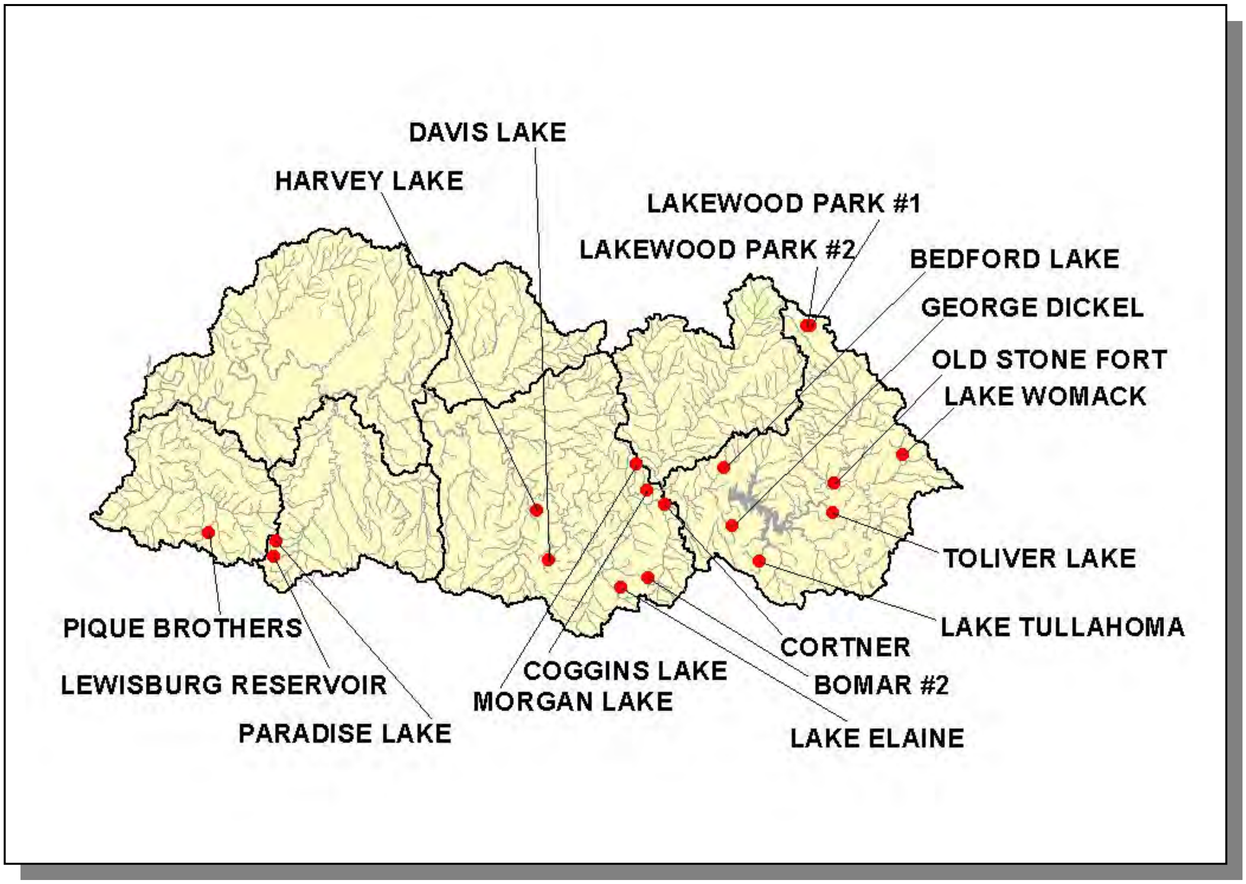


Figure 2-5. Location of Inventoried Dams in the Upper Duck River Watershed. *More information is provided in Appendix II and on the TDEC homepage at http://gwidc.memphis.edu/website/dws/.*

2.4. LAND USE. Land Use/Land Cover information was provided by EPA Region 4 and was interpreted from 1992 Multi-Resolution Land Cover (MRLC) satellite imagery.

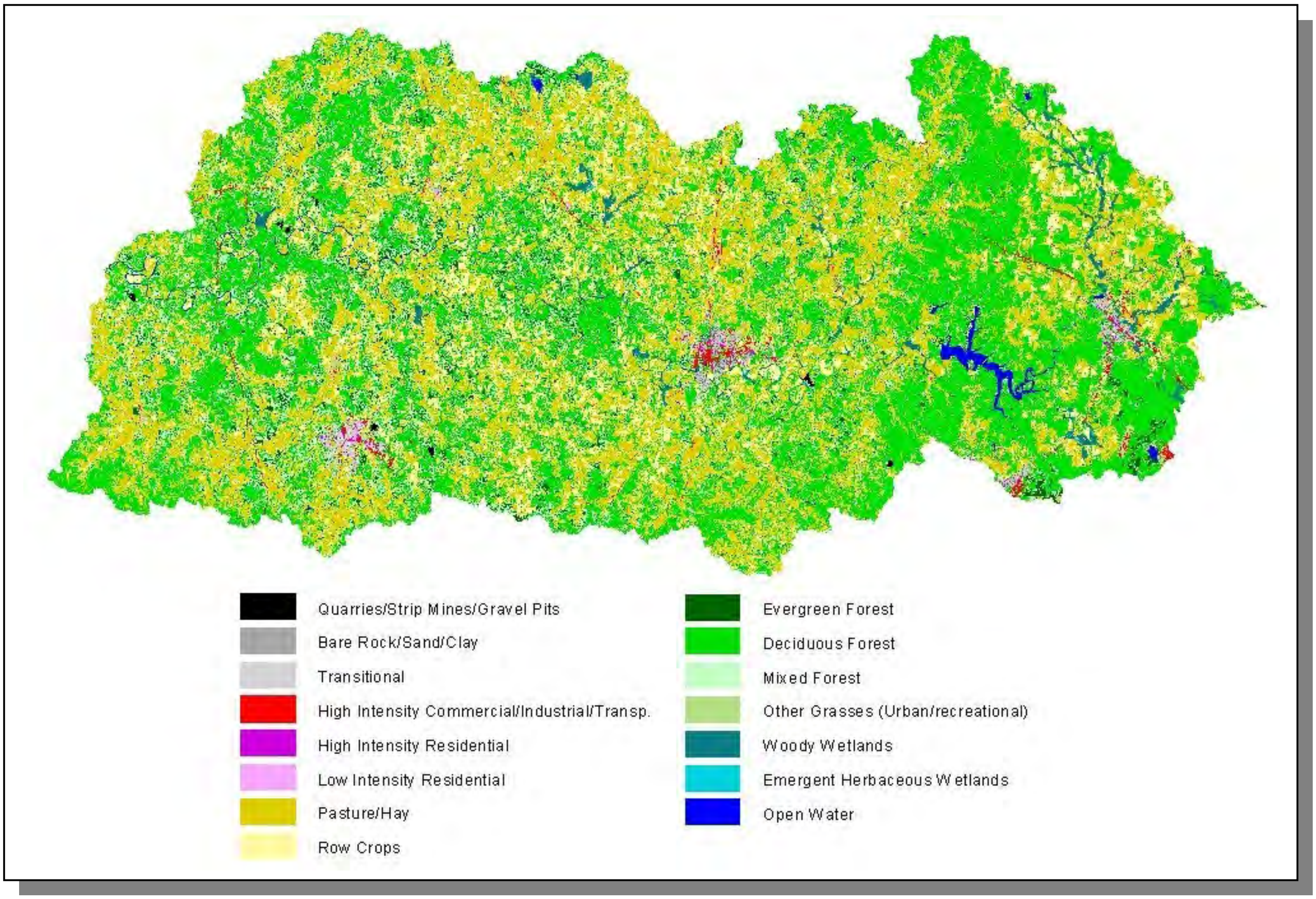


Figure 2-6. Illustration of Select Land Cover/Land Use Data from MRLC Satellite Imagery in the Upper Duck River Watershed.

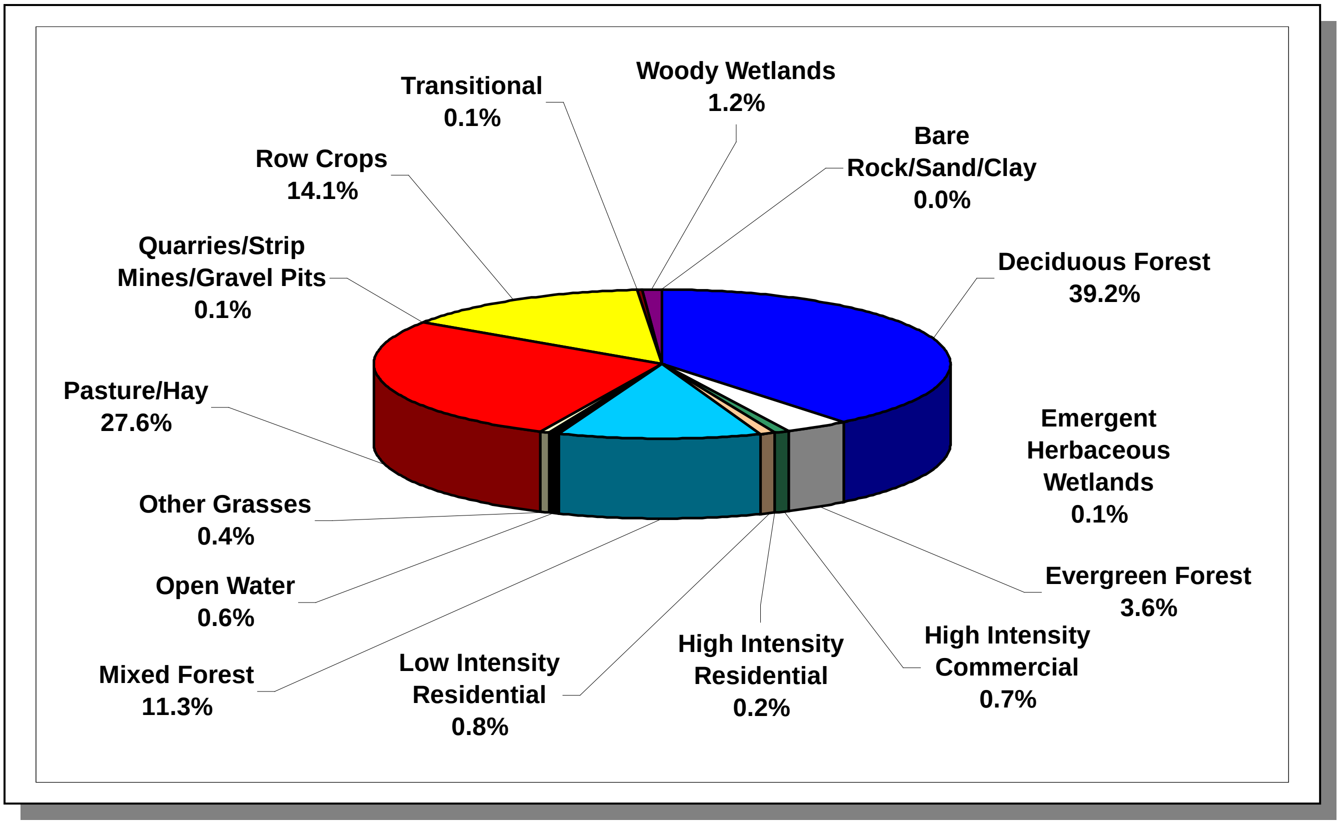


Figure 2-7. Land Use Distribution in the Upper Duck River Watershed. *More information is provided in Appendix II.*

Sinkholes, springs, disappearing streams and caves characterize karst topography. The term "karst" describes a distinctive landform that indicates dissolution of underlying soluble rocks by surface water or ground water. Although commonly associated with limestone and dolomite (carbonate rocks), other highly soluble rocks such as gypsum and rock salt can be sculpted into karst terrain. In karst areas, the ground water flows through solution-enlarged channels, bedding planes and microfractures within the rock. The characteristic landforms of karst regions are: closed depressions of various size and arrangement; disrupted surface drainage; and caves and underground drainage systems. The term "karst" is named after a famous region in the former country of Yugoslavia.

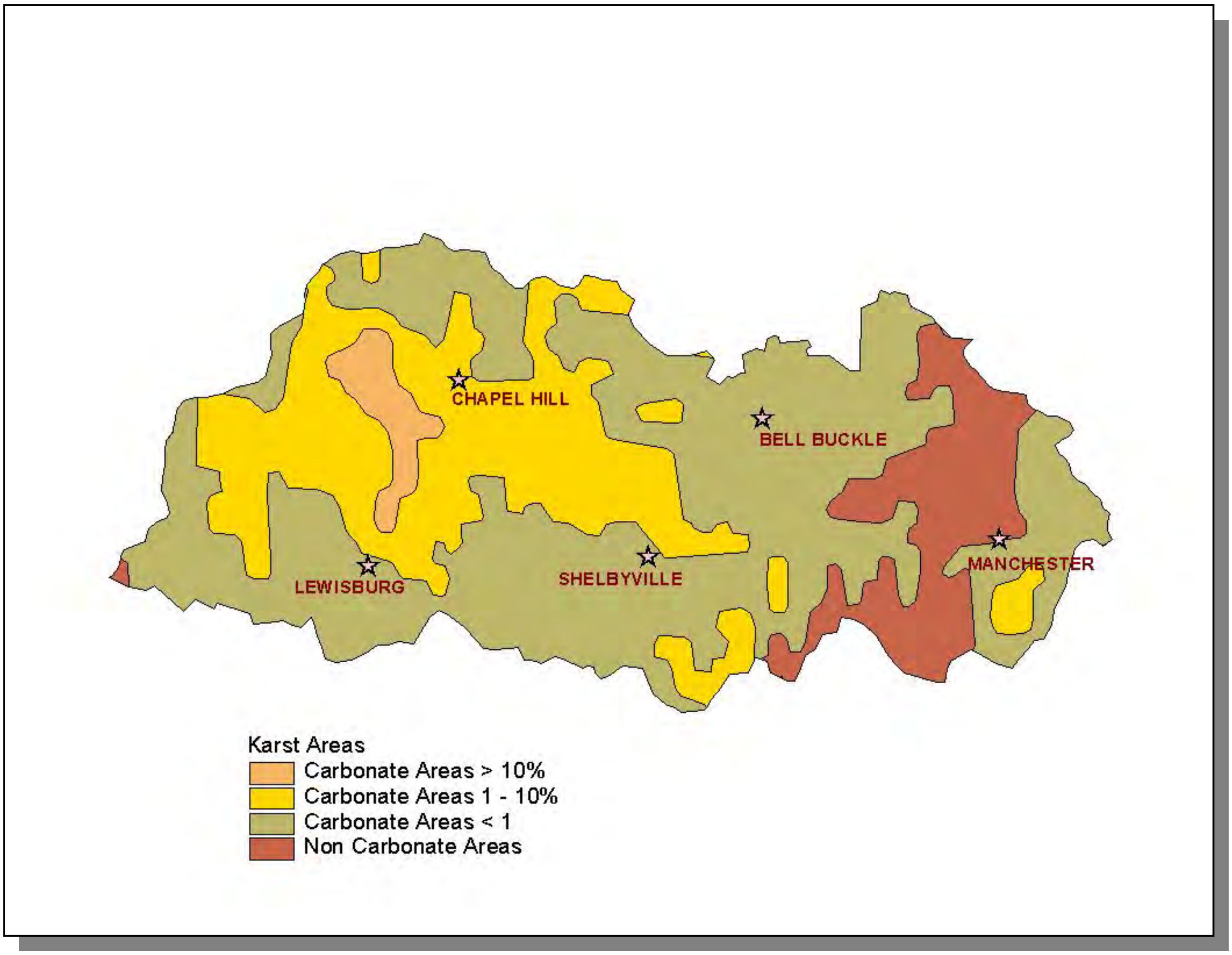


Figure 2-8. Illustration of Karst Areas in Upper Duck River Watershed. *Locations of Bell Buckle, Chapel Hill, Lewisburg, Manchester, and Shelbyville are shown for reference.*

2.5. ECOREGIONS AND REFERENCE STREAMS. Ecoregions are relatively homogeneous areas of similar geography, topography, climate and soils that support similar plant and animal life. Ecoregions serve as a spatial framework for the assessment, management, and monitoring of ecosystems and ecosystem components. Ecoregion studies can aid the selection of regional stream reference sites, identifying high quality waters, and developing ecoregion-specific chemical and biological water quality criteria.

There are eight Level III Ecoregions and twenty-five Level IV subecoregions in Tennessee. The Upper Duck River Watershed lies within a single Level III ecoregion (Interior Plateau) and contains 4 Level IV subecoregions:

- **Western Highland Rim (71f)** is characterized by dissected, rolling terrain of open hills, with elevations of 400-1000 feet. The geologic base of Mississippian-age limestone, chert, and shale is covered by soils that tend to be cherty and acidic with low to moderate fertility. Streams are relatively clear with a moderate gradient. Substrates are coarse chert, gravel and sand with areas of bedrock. The native oak-hickory forests were removed over broad areas in the mid-to late 1800's in conjunction with the iron-ore related mining and smelting of the mineral limonite, however today the region is again heavily forested. Some agriculture occurs on the flatter interfluves and in the stream and river valleys. The predominant land uses are hay, pasture, and cattle with some cultivation of corn and tobacco.

- **Eastern Highland Rim (71g)** has more level terrain than the Western Highland Rim (71f), with landforms characterized as tablelands of moderate relief and irregular plains. Mississippian-age limestone, chert, shale and dolomite predominate. Karst terrain sinkholes and depressions are especially noticeable between Sparta and McMinnville. Numerous springs and spring-associated fish fauna typify the region. Natural vegetation is transitional between the oak-hickory forests to the west and the mixed mesophytic forests of the Appalachian ecoregions (68, 69) to the east. Bottomland hardwoods forests were once abundant in some areas, although much of the original bottomland forest has been inundated by several large impoundments. Barrens and former prairie areas are now primarily oak thickets, pasture or cropland.

- **Outer Nashville Basin (71h)** is a more heterogeneous region than the Inner Nashville Basin (71I), with rolling and hilly topography with slightly higher elevations. The region encompasses most of the outer areas of the generally non-cherty Ordovician limestone bedrock. The higher hills and knobs are capped by the more cherty Mississippian-age formation, and some Devonian-age Chattanooga shale, remnants of the Highland Rim. The region's limestone rocks and soils are high in phosphorus, and commercial phosphate is mined. Deciduous forest with pasture and cropland are the dominant land covers. The region has areas of intense urban development with the city of Nashville occupying the northwest region. Streams are low to moderate gradient, with productive, nutrient-rich waters, resulting in algae, rooted vegetation, and occasionally high densities of fish. The Nashville Basin has a distinctive fish population, notable for species that avoid the region, as well as those that are present.

- **Inner Nashville Basin (71i)** is less hilly and lower than the Outer Nashville Basin (71h). Outcrops of the Ordovician-age limestone are common. The generally shallow soils are redder and lower in phosphorous than those of the outer basin. Streams are lower gradient than surrounding regions, often flowing over large expanses of limestone bedrock. The most characteristic hardwoods within the inner basin are a maple-oak-hickory-ash-association. The limestone cedar glades of Tennessee, a unique mixed grassland/forest cedar glades vegetation type with many endemic species, are located primarily on the limestones of the Inner Nashville Basin. The more xeric, open characteristics and shallow soils of the cedar glades also result in a distinct distribution of amphibian and reptile species. Urban, suburban, and industrial land use in the region is increasing.

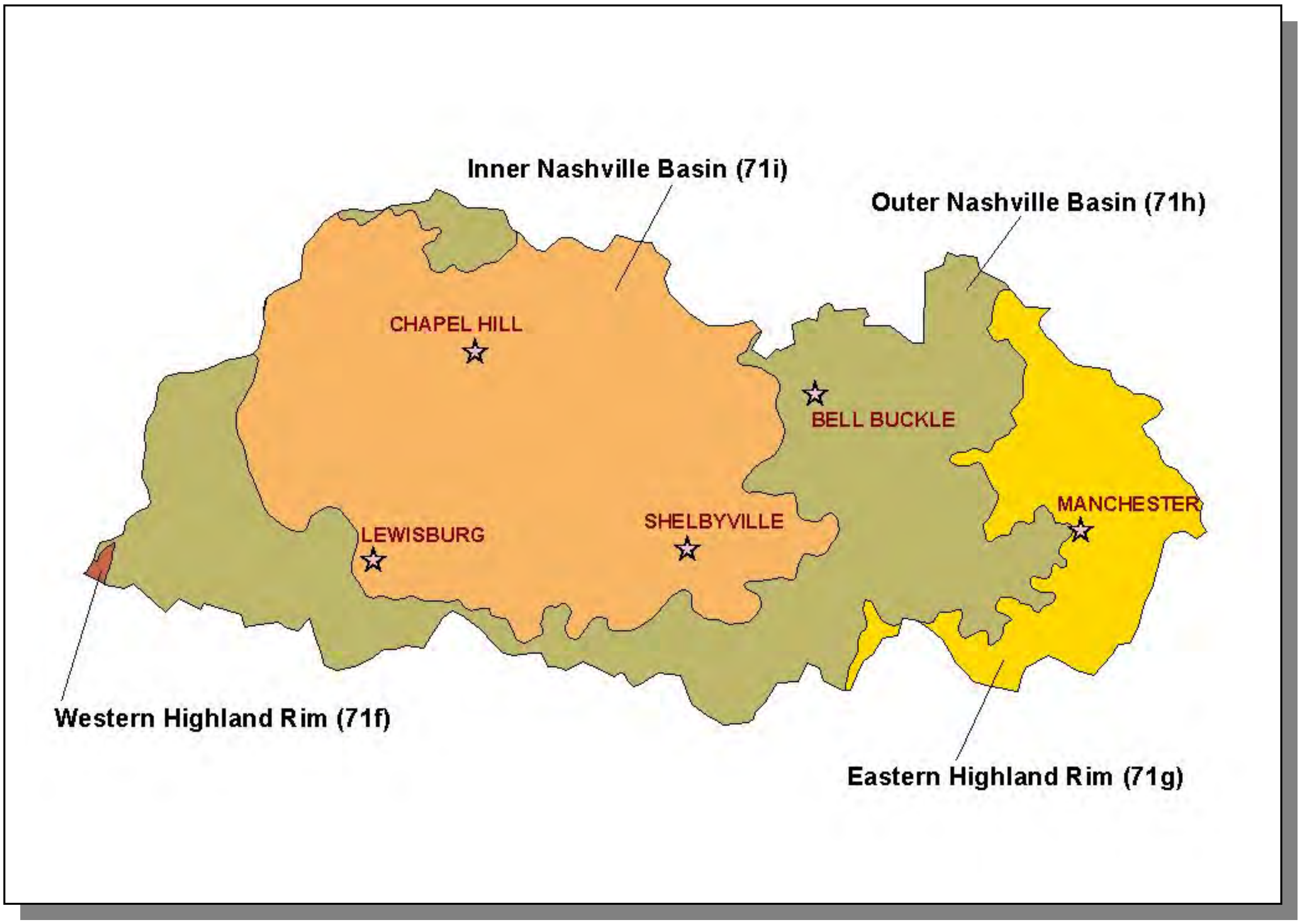


Figure 2-9. Level IV Ecoregions in the Upper Duck River Watershed. *Locations of Bell Buckle, Chapel Hill, Lewisburg, Manchester, and Shelbyville are shown for reference.*

Each Level IV Ecoregion has at least one reference stream associated with it. A reference stream represents a least impacted condition and may not be representative of a pristine condition.

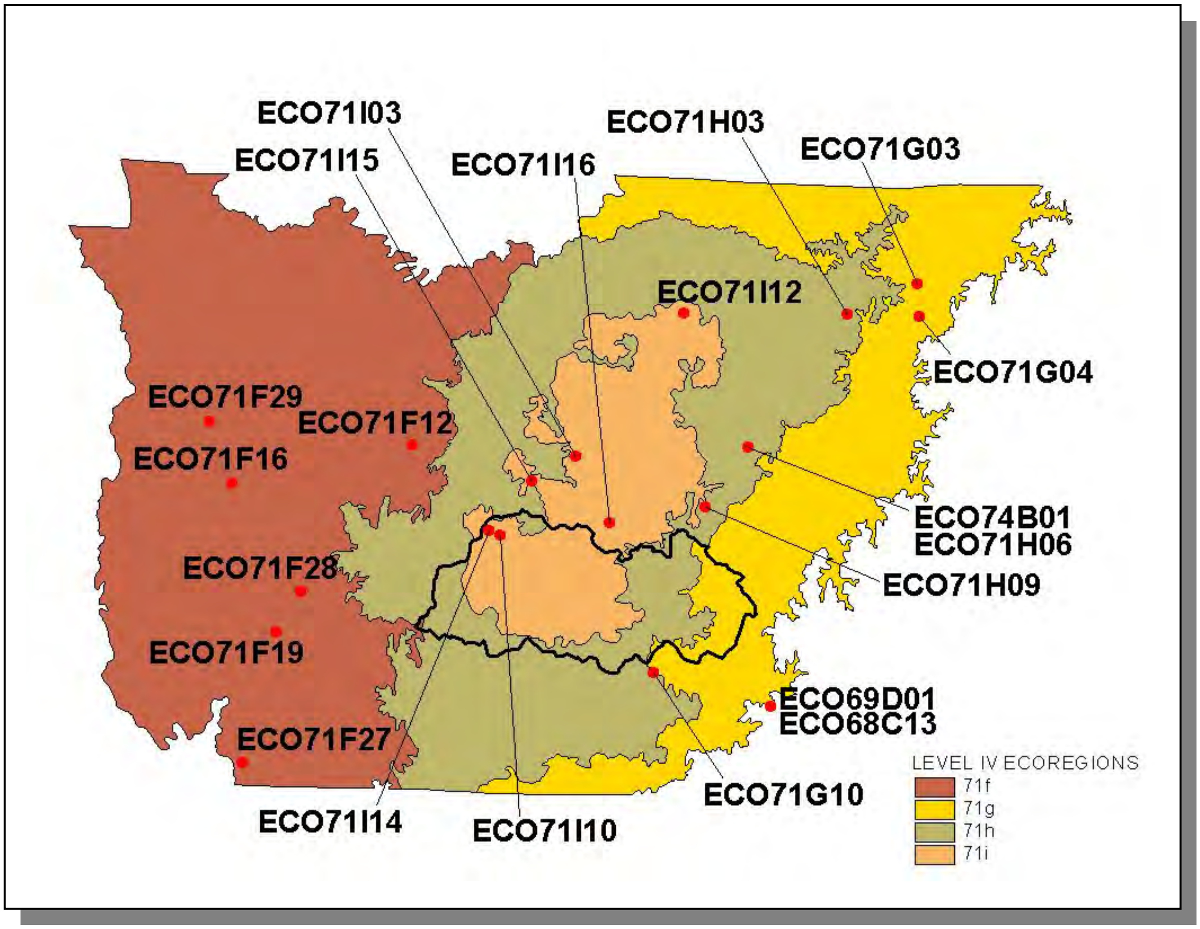


Figure 2-10. Ecoregion Monitoring Sites in Level IV Ecoregions 71f, 71g, 71h, and 71i. The Upper Duck River Watershed boundary is shown for reference. More information is provided in Appendix II.

2.6. NATURAL RESOURCES.

2.6.A. Rare Plants and Animals. The Heritage Program in the TDEC Division of Natural Heritage maintains a database of rare species that is shared by partners at The Nature Conservancy, Tennessee Wildlife Resources Agency, the US Fish and Wildlife Service, and the Tennessee Valley Authority. The information is used to: 1) track the occurrence of rare species in order to accomplish the goals of site conservation planning and protection of biological diversity, 2) identify the need for, and status of, recovery plans, and 3) conduct environmental reviews in compliance with the federal Endangered Species Act.

GROUPING	NUMBER OF RARE SPECIES
Insects and Spiders	2
Mussels	15
Snails	5
Amphibians	4
Birds	3
Fish	14
Mammals	6
Reptiles	1
Plants	97
Total	**147**

Table 2-3. There are 147 Known Rare Plant and Animal Species in the Upper Duck River Watershed.

In the Upper Duck River Watershed, there are 14 rare fish species, 19 rare mussel species, and 9 rare snail species.

SCIENTIFIC NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS
Etheostoma aquali	Coppercheek Darter	MC	T
Etheostoma cinereum	Ashy Darter	MC	T
Etheostoma denoncourti	Golden Darter		
Etheostoma forbesi	Barrens Darter	MC	E
Etheostoma luteovinctum	Redband Darter		D
Etheostoma striatulum	Striated Darter	MC	T
Fundulus julisia	Barrens Topminnow	MC	E
Hemitremia flammea	Flame Chub	MC	D
Notropus rupestris	Bedrock Shiner		D
Noturus sp 3	Saddled Madtom		T
Percina burtoni	Blotchside Darter	MC	D
Percina macrocephala	Longhead Darter		T
Percina phoxocephala	Slenderhead Darter		D
Typhlichthys subterraneus	Southern Cavefish	MC	D
Conradilla caelata	Birdwing Pearly Mussel	LE	E
Epioblasma brevidens	Cumberland Combshell	LE	E
Epioblasma capsaeformis	Oyster Mussel	LE	E
Epioblasma florentina walkeri	Tan Riffleshell	LE	E
Epioblasma triquetra	Snuffbox		
Lexingtonia dolabelloides	Slabside Pearly Nussel	C	
Obovaria subrotunda	Round Hickorynut		
Plethobasus cooperianus	Orange-Foot Pimpleback	LE	E
Pleurobema oviforme	Tennessee Clubshell		
Pleurobema rubrum	Pyramid Pigtoe		
Quadrula cylindria cylindrica	Rabbitsfoot		
Quadrula intermedia	Cumberland Monkeyface	LE	E
Toxolasma cylindrellus	Pale Lilliput	LE	E
Toxolasma lividum	Purple Lilliput		
Villosa fabalis	Rayed Bean		
Lithasia duttoniana	Helmet Rocksnail		
Lithasia geniculata fulginosa	Geniculate Riversnail		
Lithasia geniculata pinguis	Small Geniculate Riversnail		
Lithasia salebrosa	Rustic Rocksnail		
Polygyra auriformis	Rockpile Liptooth		

Table 2-4. Rare Aquatic Species in the Upper Duck River Watershed. *Federal Status: LE, Listed Endangered by the U.S. Fish and Wildlife Service; MC, Management Concern for U.S. Fish and Wildlife Service; C, Candidate species proposed for listing by the U.S. Fish and Wildlife Service. State Status: E, Listed Endangered by the Tennessee Wildlife Resources Agency; T, Listed Threatened by the Tennessee Wildlife Resources Agency; D, Deemed in Need of Management by the Tennessee Wildlife Resources Agency. More information may be found at http://www.state.tn.us/environment/nh/data.php.*

2.6.B. Wetlands. The Division of Natural Heritage maintains a database of wetland records in Tennessee. These records are a compilation of field data from wetland sites inventoried by various state and federal agencies. Maintaining this database is part of Tennessee's Wetland Strategy, which is described at:

http://www.state.tn.us/environment/nh/wetlands/

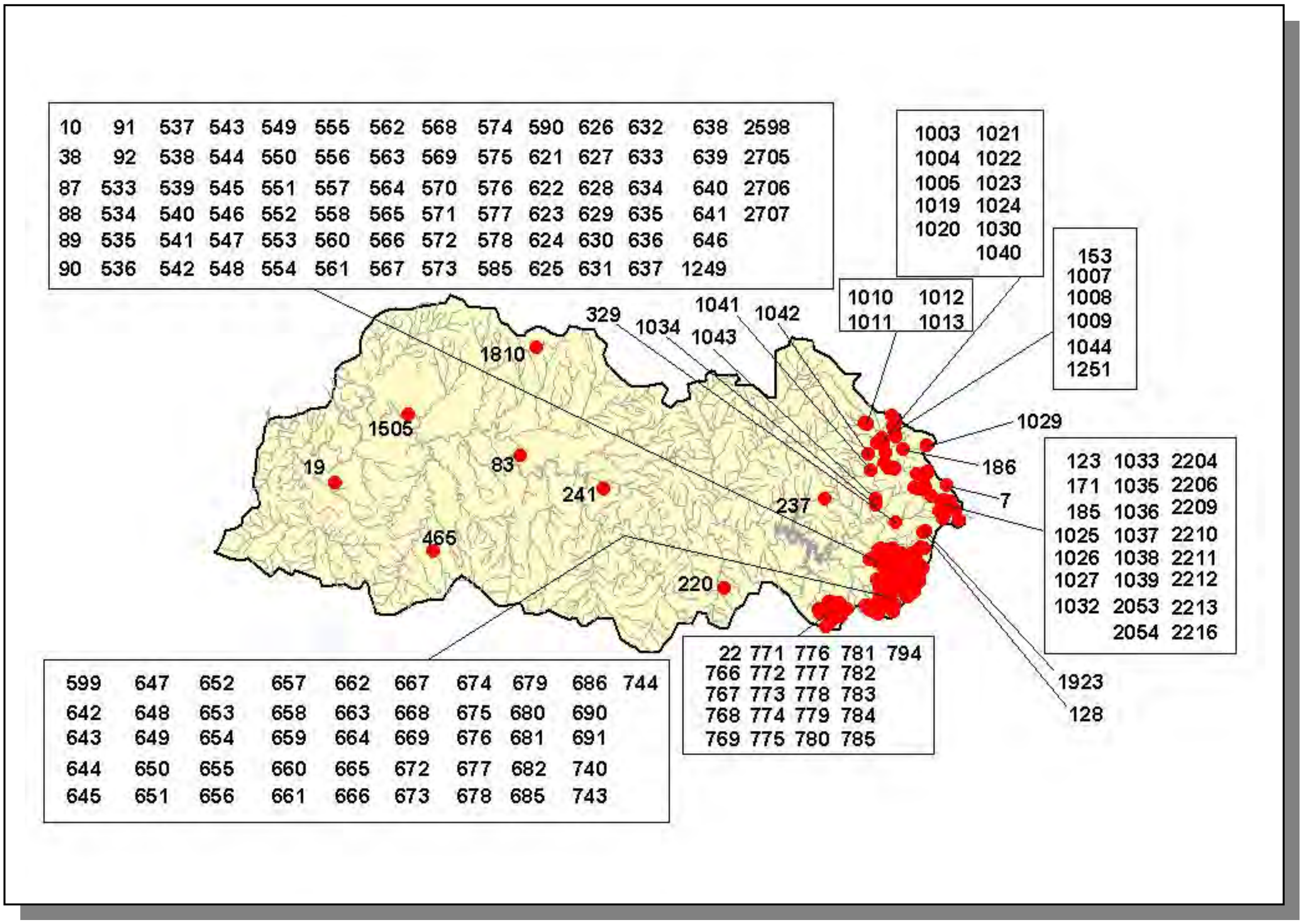


Figure 2-11. Location of Wetland Sites in TDEC Division of Natural Heritage Database in the Upper Duck River Watershed. This map represents an incomplete inventory and should not be considered a dependable indicator of the presence of wetlands. *More information is provided in Appendix II.*

2.7. CULTURAL RESOURCES.

2.7.A. State Scenic River. A portion of the Upper Duck River has been designated as a State Scenic River. The segment from Iron Bridge Road (in the Lower Duck River Watershed) upstream to the Marshall County line has been designated as a Class II Pastoral River Area. The Tennessee Scenic Rivers Act of 1968, as amended, defines Class II State Scenic Rivers as streams that flow through agricultural areas or lands used for dispersed human activities. More information about Tennessee's State Scenic River Program may be found at:

http://www.state.tn.us/environment/nh/scenicrivers/

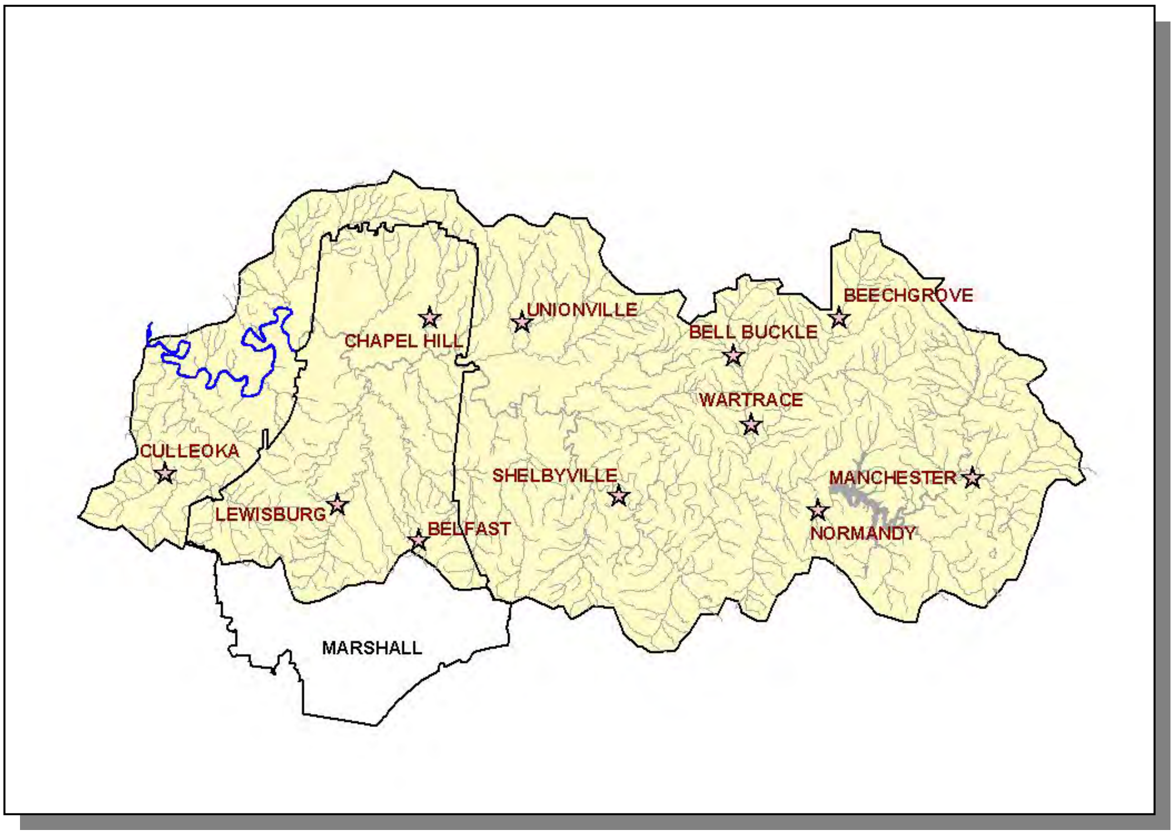


Figure 2-12. A Portion of the Upper Duck River is Designated as a State Scenic River. *Location of Beechgrove, Belfast, Bell Buckle, Chapel Hill, Culleoka, Lewisburg, Manchester, Normandy, Shelbyville, Unionville, and Wartrace are shown for reference.*

2.7.B. Greenways. The Upper Duck River Watershed has at least one greenways/trail:

- Little Duck River Greenway in Manchester

More information about greenways and trails in the watershed may be found at:

http://www2.state.tn.us/tdec/GREENWAYS/tnmap.htm

2.7.C. Interpretive Areas. Some sites representative of the natural or cultural heritage are under state or federal protection:

- Arnold Engineering Development Center is part of the Arnold Air Force Base. Commissioned in AEDC is the largest and most complex collection of flight simulation test facilities. The site is managed by the U.S. Air Force.
- Henry Horton State Park is an 1,140-acre park situated on the estate of the late Henry Horton, 36th governor of Tennessee. The park is located on the shores of the Duck River and is managed by the state of Tennessee.
- Normandy Hatchery was established as a partnership between TVA and TWRA. This 200-acre warm water hatchery is located south of Normandy Dam and is managed by the Tennessee Wildlife Resources Agency.
- Old Stone Fort Archaeological Area is a 200-year old Native American ceremonial site. A combination of mounds, walls, cliffs and rivers form a 50-acre enclosure. The site is managed by the state of Tennessee.

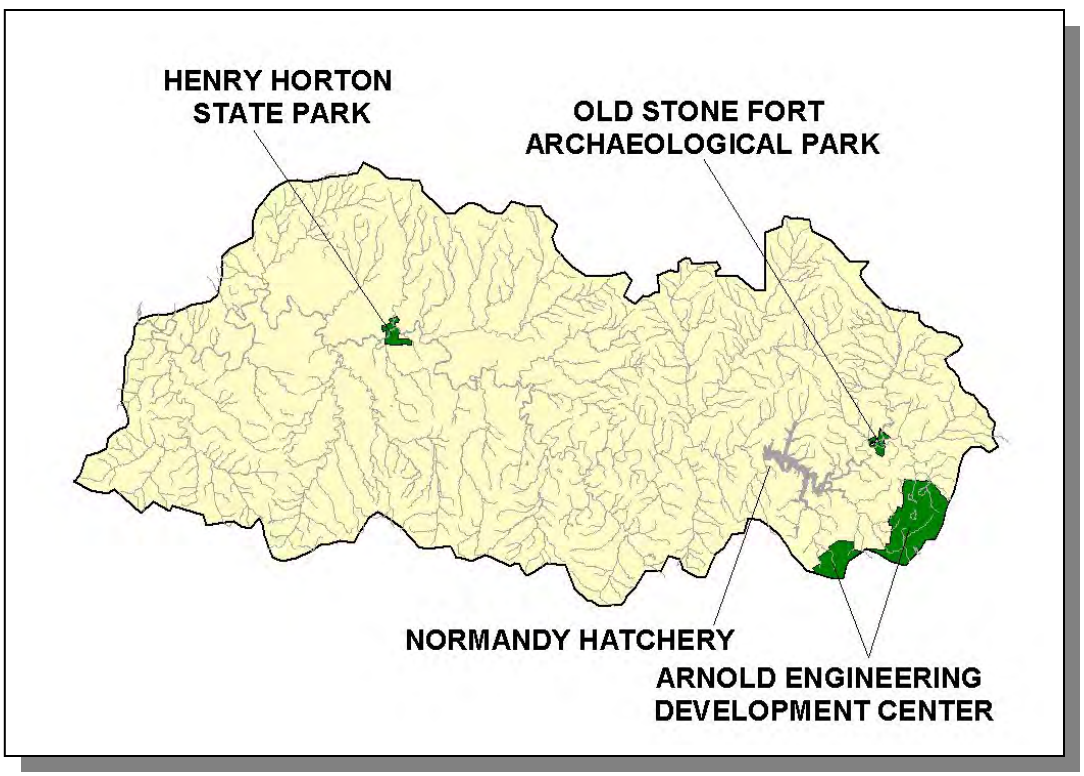


Figure 2-13. Locations of State- and Federally-Managed Lands in the Upper Duck River Watershed.

2.7.D. Wildlife Management Area. The Tennessee Wildlife Resources Agency manages five wildlife management areas in the Upper Duck River Watershed.

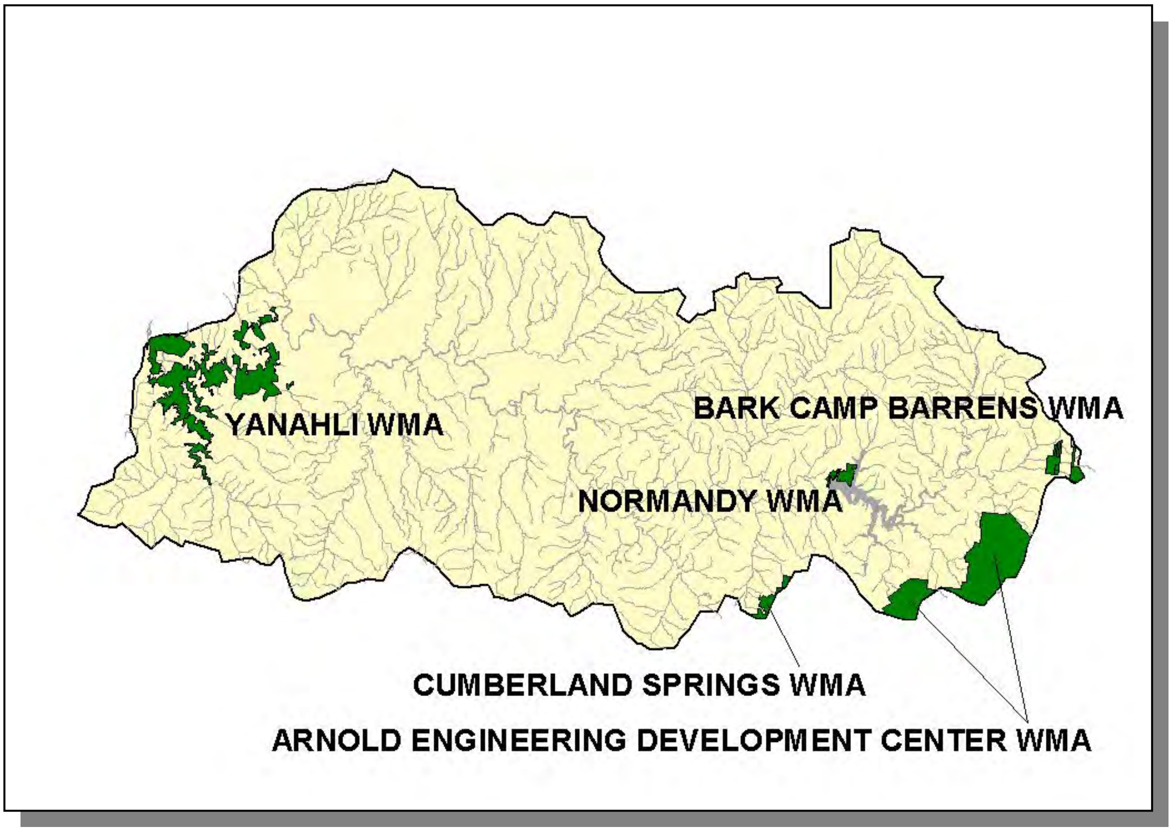


Figure 2-14. TWRA Manages Wildlife Management Areas in the Upper Duck River Watershed.

2.8. Tennessee Rivers Assessment Project. The Tennessee Rivers Assessment is part of a national program operating under the guidance of the National Park Service's Rivers and Trails Conservation Assistance Program. The Assessment is an inventory of river resources, and should not be confused with "Assessment" as defined by the Environmental Protection Agency. A more complete description can be found in the Tennessee Rivers Assessment Summary Report, which is available from the Department of Environment and Conservation and on the web at:

http://www.state.tn.us/environment/wpc/publications/riv/

STREAM	NSQ	RB	RF		STREAM	NSQ	RB	RF
Alexander Creek	3				Little Hurricane Creek	3		
Beaverdam Creek	2				Mill Creek	3		1
Benford Creek	3				New Lake Branch Big Rock Creek	4		
Big Rock Creek	3,4				Noah Fork Creek	3		
Bobo Creek	2				North Fork Creek	3	3	2
Brewer Creek	1				Oppossum Creek	2		
Caney Creek	3				Ovoca Creek	3		
Crumpton Creek	1	2	3		Rich Creek	2		
Daddy Creek	2				Riley Creek	2		
Dry Branch Big Rock Creek	3				Rock Creek	3	2	
Duck River	2,3,4	2	1,2		Shipman Creek	3		
East Fork Spring Creek	4				Silver Creek	2		
East Rock Creek	2	2			Sinking Creek	4		2
Fall Creek	3	3			Snake Creek			
Flat Creek	3		2		South Fork Flat Creek			
Fountain Creek	3		2		Spring Creek	3		
Garrison Fork Creek	3	3	1,2		Sugar Creek	3		
Globe Creek	3				Taylor Branch North Fork Creek	3		
Huckleberry Creek	2				Thick Creek	3		
Hunt Creek	4				Thompson Creek	3		
Hurricane Branch Fall Creek	3				Wartrace Ceeek	3		
Hutton Creek	3				Weakly Creek	3		
Lick Creek	3				Wilson Creek	3		
Little Duck River	2	3			Wolf Creek	2		
Little Flat Creek	4				Wright Branch Big Rock Creek	3		

Table 2-5. Stream Scoring from the Tennessee Rivers Assessment Project in the Upper Duck River Watershed.

Categories: NSQ, Natural and Scenic Qualities
RB, Recreational Boating
RF, Recreational Fishing

Scores: 1. Statewide or greater Significance; Excellent Fishery
2. Regional Significance; Good Fishery
3. Local Significance; Fair Fishery
4. Not a significant Resource; Not Assessed

CHAPTER 3

WATER QUALITY ASSESSMENT OF THE UPPER DUCK RIVER WATERSHED

3.1. BACKGROUND. Section 305(b) of The Clean Water Act requires states to report the status of water quality every two years. Historically, Tennessee's methodologies, protocols, frequencies and locations of monitoring varied depending upon whether sites were ambient, ecoregion, or intensive survey. Alternatively, in areas where no direct sampling data existed, water quality may have been assessed by evaluation or by the knowledge and experience of the area by professional staff.

In 1996, Tennessee began the watershed approach to water quality protection. In the Watershed Approach, resources—both human and fiscal—are better used by assessing water quality more intensively on a watershed-by-watershed basis. In this approach, water quality is assessed in year three of the watershed cycle, following one to two years of data collection. More information about the Watershed Approach may be found in Chapter 1 and at http://www.state.tn.us/environment/wpc/watershed/

The assessment information is used in the 305(b) Report (The Status of Water Quality in Tennessee) and the 303(d) list as required by the Clean Water Act.

The 305(b) Report documents the condition of the State's waters. Its function is to provide information used for water quality based decisions, evaluate progress, and measure success.

Tennessee uses the 305(b) Report to meet four goals (from 2002 305(b) Report):

1. Assess the general water quality conditions of rivers, streams, lakes and wetlands

2. Identify causes of water pollution and the sources of pollutants

3. Specify waters which have been found to pose human health risks due to elevated bacteria levels or contamination of fish

4. Highlight areas of improved water quality

EPA aggregates the state use support information into a national assessment of the nation's water quality. This aggregated use support information can be viewed at EPA's "Surf Your Watershed" site at http://www.epa.gov/surf/.

The 303(d) list is a compilation of the waters of Tennessee that fail to support some or all of their classified uses. The 303(d) list does not include streams determined to be fully supporting designated uses as well as streams the Division of Water Pollution Control cannot assess due to lack of water quality information. Also absent are streams where a control strategy is already in the process of being implemented.

Once a stream is placed on the 303(d) list, it is considered a priority for water quality improvement efforts. These efforts not only 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. If a stream is on the 303(d) list, the Division of Water Pollution Control cannot use its regulatory authority to allow additional sources of the same pollutant(s) for which it is listed.

States are required to develop Total Maximum Daily Loads (TMDLs) for 303(d)-listed waterbodies. The TMDL process establishes the maximum amount of a pollutant that a waterbody can assimilate without exceeding water quality standards and allocates this load among all contributing pollutant sources. The purpose of the TMDL is to establish water quality objectives required to reduce pollution from both point and nonpoint sources and to restore and maintain the quality of water resources.

The current 303(d) List is available on the TDEC homepage at:
http://www.state.tn.us/environment/wpc/publications/2004_303dlist.pdf

and information about Tennessee's TMDL program may be found at:
http://www.state.tn.us/environment/wpc/tmdl/.

This chapter provides a summary of water quality in the Upper Duck River Watershed, summarizes data collection and assessment results, and describes impaired waters.

3.2. DATA COLLECTION. Comprehensive water quality monitoring in the Upper Duck River Watershed was conducted in 1999-2000. Data are from one of four site types: (1) Ambient sites, (2) Ecoregion sites, (3) Watershed sites, or (4) Tier Evaluation sites.

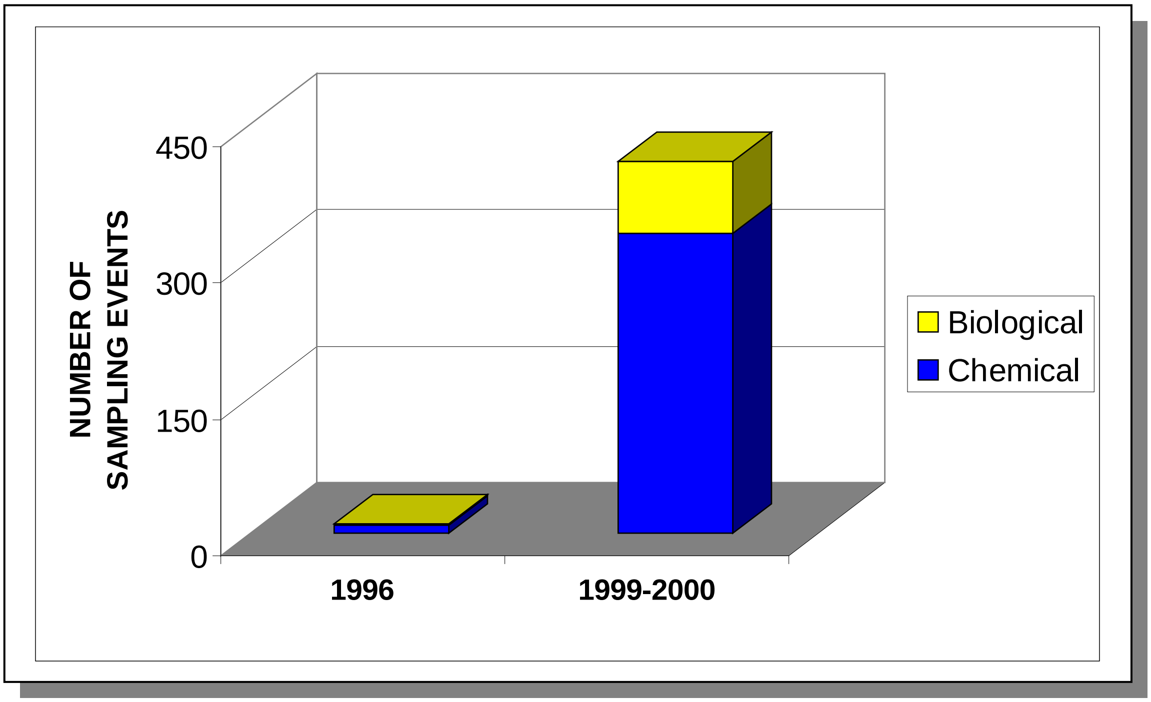


Figure 3-1. Number of Sampling Events Using the Traditional Approach (1996) and Watershed Approach (1999-2000) in the Upper Duck River Watershed.

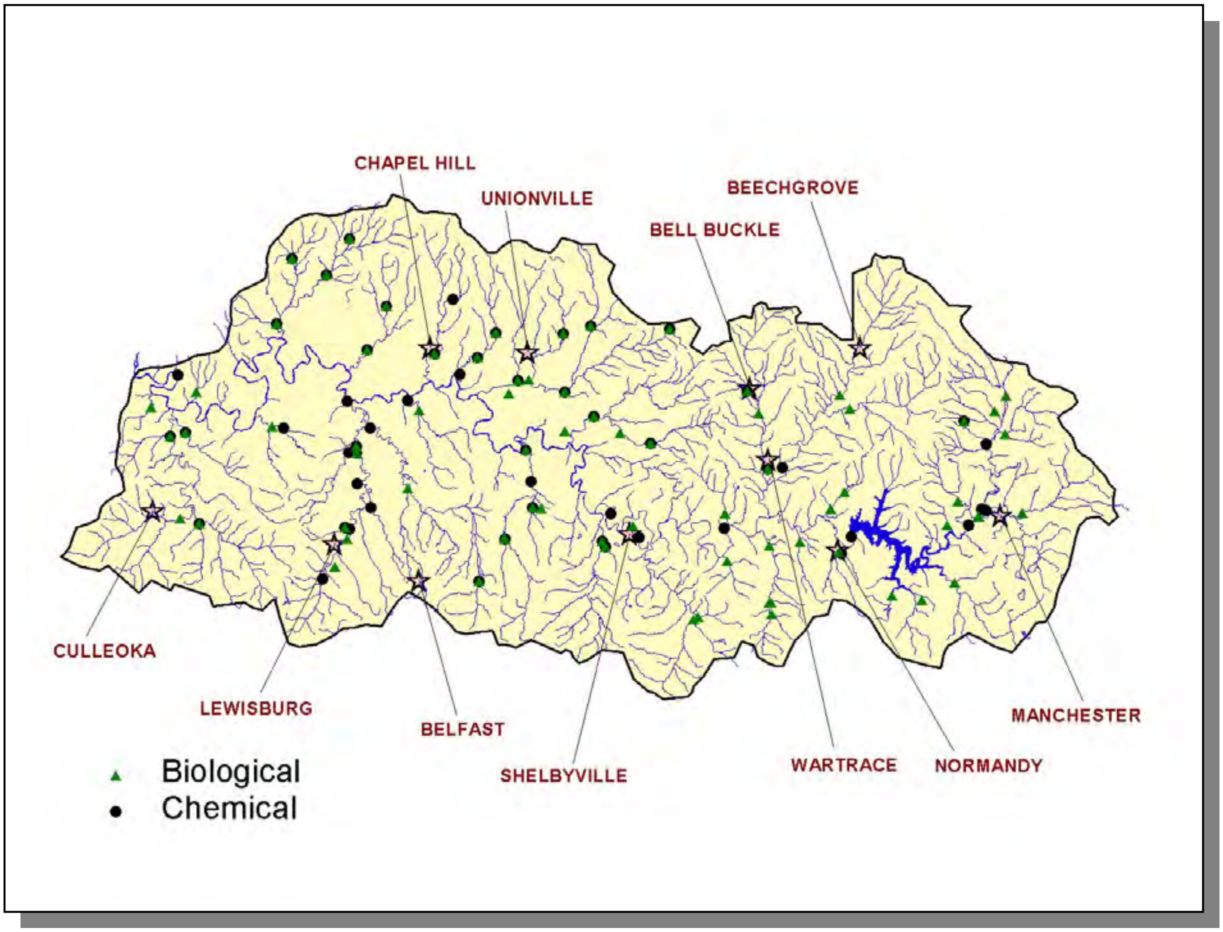


Figure 3-2. Location of Monitoring Sites in the Upper Duck River Watershed. *Locations of Beech Grove, Belfast, Bell Buckle, Chapel Hill, Culleoka, Lewisburg, Manchester, Normandy, Shelbyville, Unionville, and Wartrace are shown for reference.*

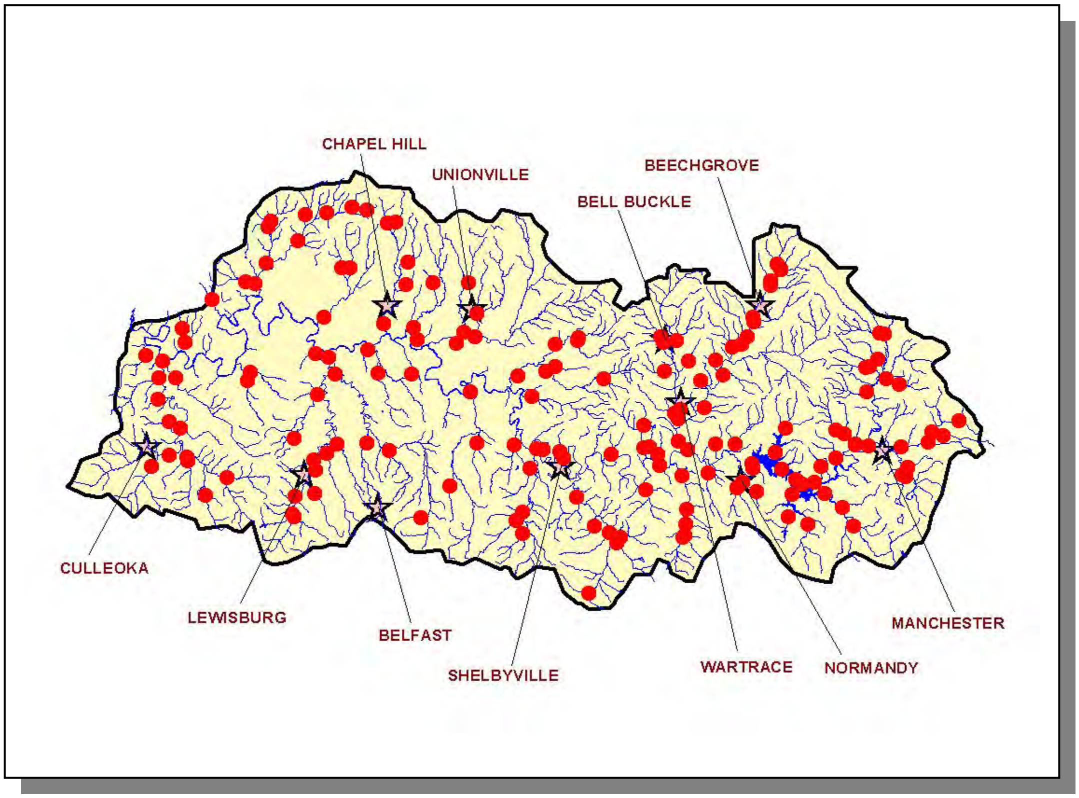


Figure 3-3. Location of Monitoring Sites Used by Tennessee Department of Health Lab Services Aquatic Biology Section in the Upper Duck River Watershed. *Chemical and biological sampling was funded under an agreement with the Tennessee Department of Agriculture, Nonpoint Source Program and the U.S. Environmental Protection Agency, Assistance Agreement #C9994674-99-0. Locations of Beech Grove, Belfast, Bell Buckle, Chapel Hill, Culleoka, Lewisburg, Manchester, Normandy, Shelbyville, Unionville, and Wartrace are shown for reference.*

	1996	1999-2000
Biological	1	79
Chemical	10	331
Total	**11**	**410**

Table 3-1. Number of Sampling Events in the Upper Duck River Watershed During the Data Collection Phase of the Watershed Approach.

3.2.A. Ambient Monitoring Sites. These fixed-station chemical monitoring sites are sampled quarterly or monthly by the Environmental Field Office-Columbia (this is in addition to samples collected by water and wastewater treatment plant operators). Samples are analyzed by the Tennessee Department of Health, Division of Environmental Laboratory Services. Ambient monitoring data are used to assess water quality in major bodies of water where there are NPDES facilities and to identify trends in water quality. Water quality parameters traditionally measured at ambient sites in the Upper Duck River Watershed are provided in Appendix IV.

Data from ambient monitoring stations are entered into the STORET (Storage and Retrieval) system administered by EPA.

3.2.B. Ecoregion Sites. Ecoregions are relatively homogeneous areas of similar geography, topography, climate and soils that support similar plants and animals. The delineation phase of the Tennessee Ecoregion Project was completed in 1997 when the ecoregions and subecoregions were mapped and summarized (EPA/600/R-97/022). There are eight Level III Ecoregions and twenty-five Level IV subecoregions in Tennessee (see Chapter 2 for more details). The Upper Duck River Watershed lies within 1 Level III ecoregion (Interior Plateau) and contains 4 subecoregions (Level IV):

- Western Highland Rim (71f)
- Eastern Highland Rim (71g)
- Outer Nashville Basin (71h)
- Inner Nashville Basin (71i)

Ecoregion reference sites are chemically monitored using methodology outlined in the Division's Chemical Standard Operating Procedure (Standard Operating Procedure for Modified Clean Technique Sampling Protocol). Macroinvertebrate samples are collected in spring and fall. These biological sample collections follow methodology outlined in the Tennessee Biological Standard Operating Procedures Manual. Volume 1: Macroinvertebrates and EPA's Revision to Rapid Bioassessment Protocols for use in Streams and Rivers.

Ecoregion stations are scheduled to be monitored during the watershed sampling time period.

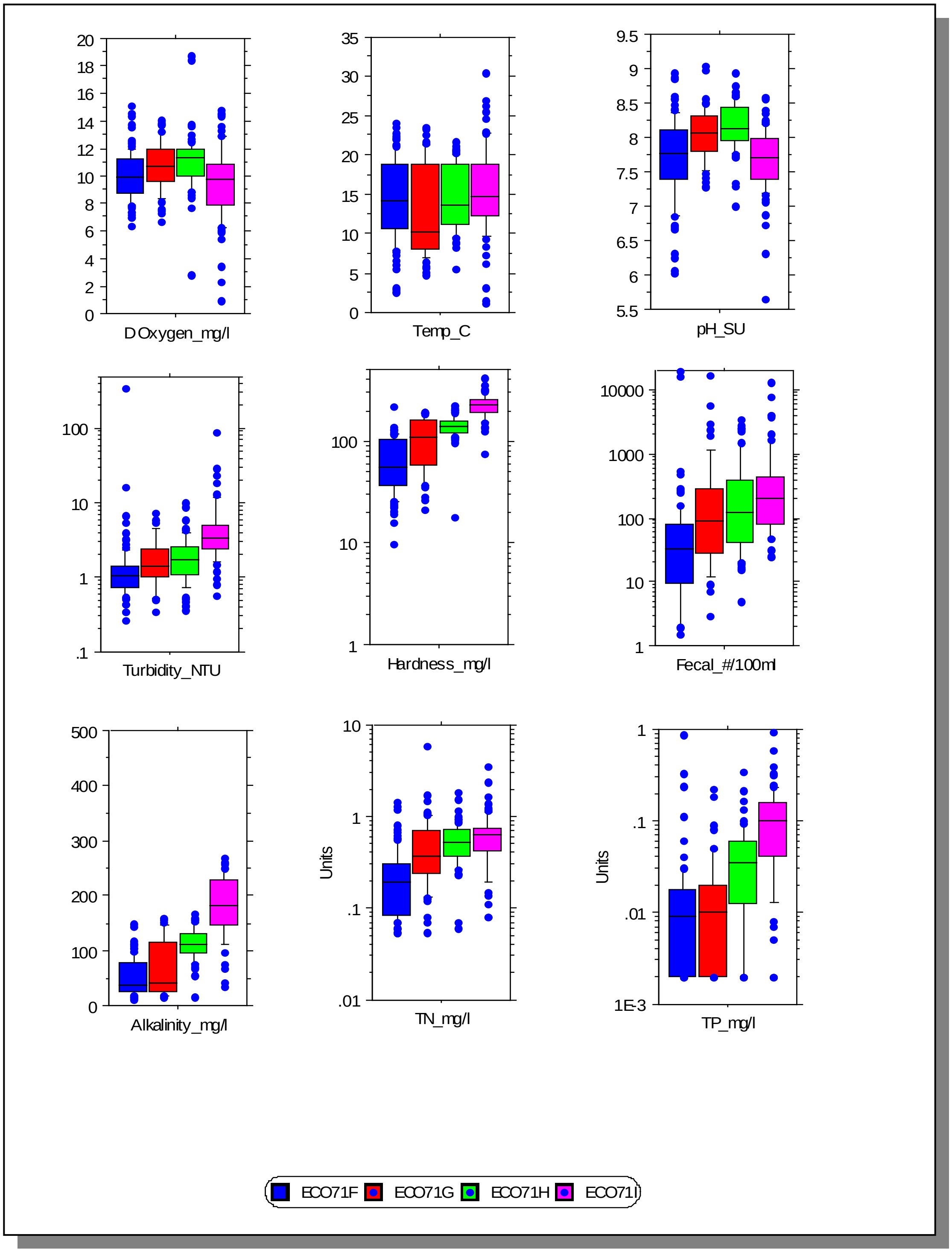

D Oxygen_mg/l
Temp_C
pH_SU
Turbidity_NTU
Hardness_mg/l
Fecal_#/100ml
Alkalinity_mg/l
TN_mg/l
TP_mg/l
Units
ECO71F
ECO71G
ECO71H
ECO71I

Figure 3-4. Select Chemical Data Collected in Upper Duck River Watershed Ecoregion Sites. *Boxes and bars illustrate 10th, 25th, median, 75th, and 90th percentiles. Extreme values are also shown as dots. Fecal, fecal coliform bacteria; TN, Total Nitrogen; TP, Total Phosphorus.*

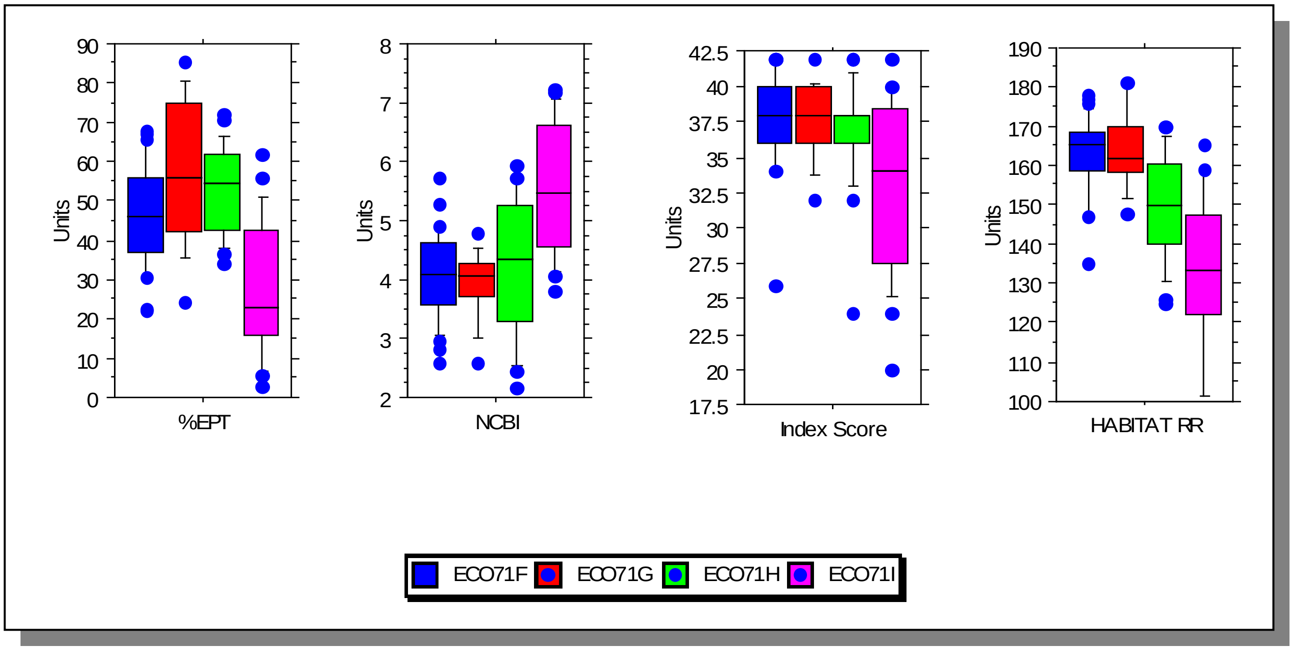


Figure 3-5. Benthic Macroinvertebrate and Habitat Scores for Upper Duck River Watershed Ecoregion Sites. *Boxes and bars illustrate 10th, 25th, median, 75th, and 90th percentiles. Extreme values are also shown as dots. NCBI, North Carolina Biotic Index. Index Score and Habitat Riffle/Run scoring system are described in TDEC's Quality System Standard Operating Procedure for Macroinvertebrate Surveys (2002).*

3.2.C. Watershed Screening Sites. Activities that take place at watershed sites are benthic macroinvertebrate stream surveys, physical habitat determinations and/or chemical monitoring. Following review of existing data, watershed sites are selected in Year 1 of the watershed approach when preliminary monitoring strategies are developed. Additional sites may be added in Year 2 when additional monitoring strategies are implemented.

A Biological Reconnaissance (BioRecon) is used as a screening tool to describe the condition of water quality, in general, by determining the absence or presence of clean water indicator organisms, such as EPT (Ephemeroptera [mayfly], Plecoptera [stonefly], Trichoptera [caddisfly]). Factors and resources used for selecting BioRecon sites are:

- The current 303(d) list,
- HUC-10 maps (every HUC-10 is scheduled for a BioRecon)
- Land Use/Land Cover maps
- Topographic maps
- Locations of NPDES facilities
- Sites of recent ARAP activities.

An intensive multiple or single habitat assessment involves the regular monitoring of a station over a fixed period of time. Intensive surveys (Rapid Bioassessment Protocols) are performed when BioRecon results warrant it.

3.2.D. Special Surveys. These investigations are performed when needed and include:

- ARAP in-stream investigation
- Time-of-travel dye study
- Sediment oxygen demand study
- Lake eutrophication study

3.3. STATUS OF WATER QUALITY. Overall use support is a general description of water quality conditions in a water body based on determination of individual use supports. Use support determinations, which can be classified as monitored or evaluated, are based on:

- Data less than 5 years old (monitored)
- Data more than 5 years old (evaluated)
- Knowledge and experience of the area by technical staff (evaluated)
- Complaint investigation (monitored, if samples are collected)
- Other readily available Agencies' data (monitored)
- Readily available Volunteer Monitoring data (monitored, if certain quality assurance standards are met)

All readily available data are considered, including data from TDEC Environmental Field Offices, Tennessee Department of Health (Aquatic Biology Section of Laboratory Services), Tennessee Wildlife Resources Agency, National Park Service, Tennessee Valley Authority, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Geological Survey, U.S. Forest Service, universities and colleges, the regulated community, and the private sector.

The assessment is based on the degree of support of designated uses as measured by compliance with Tennessee's water quality standards.

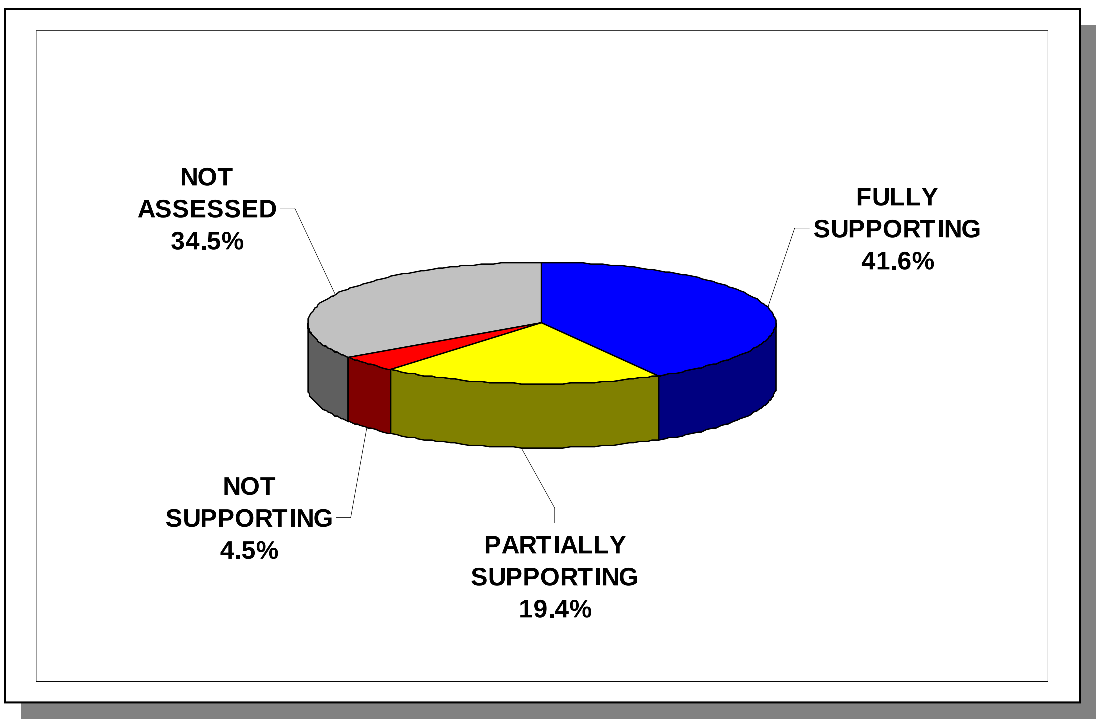


Figure 3-6a. Water Quality Assessment of Streams and Rivers in the Upper Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment of 1,606.9 miles in the watershed. More information is provided in Appendix III.*

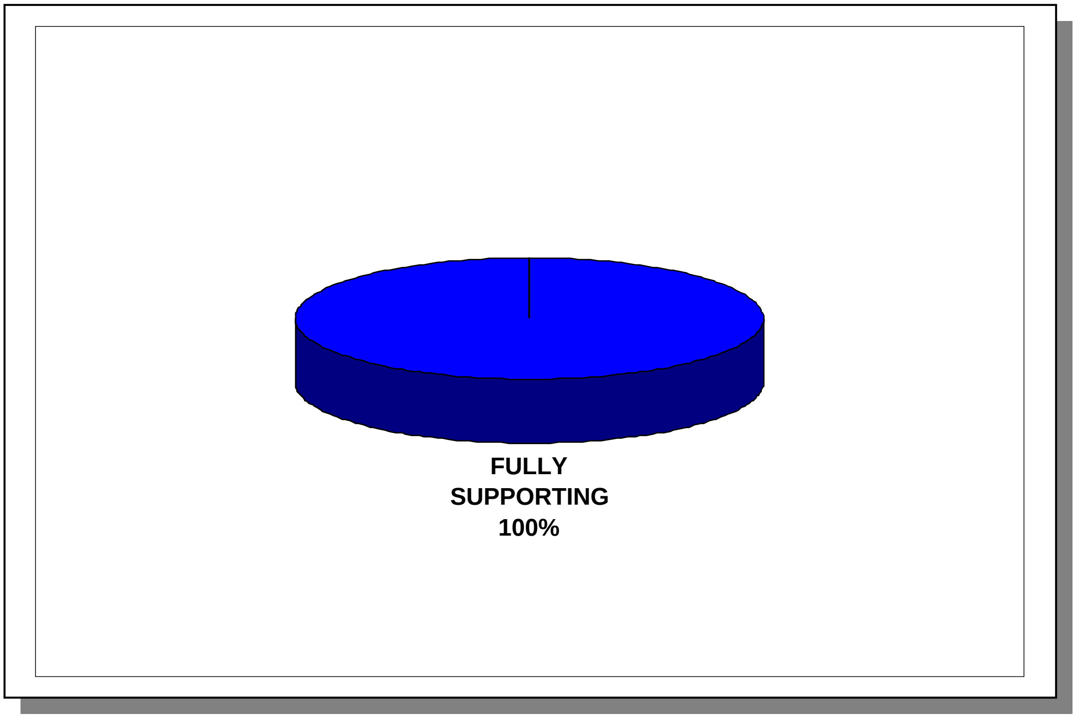


Figure 3-6b. Water Quality Assessment of Lakes in the Upper Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment of 3,260 lake acres in the watershed. More information is provided in Appendix III.*

3.3.A. Assessment Summary.

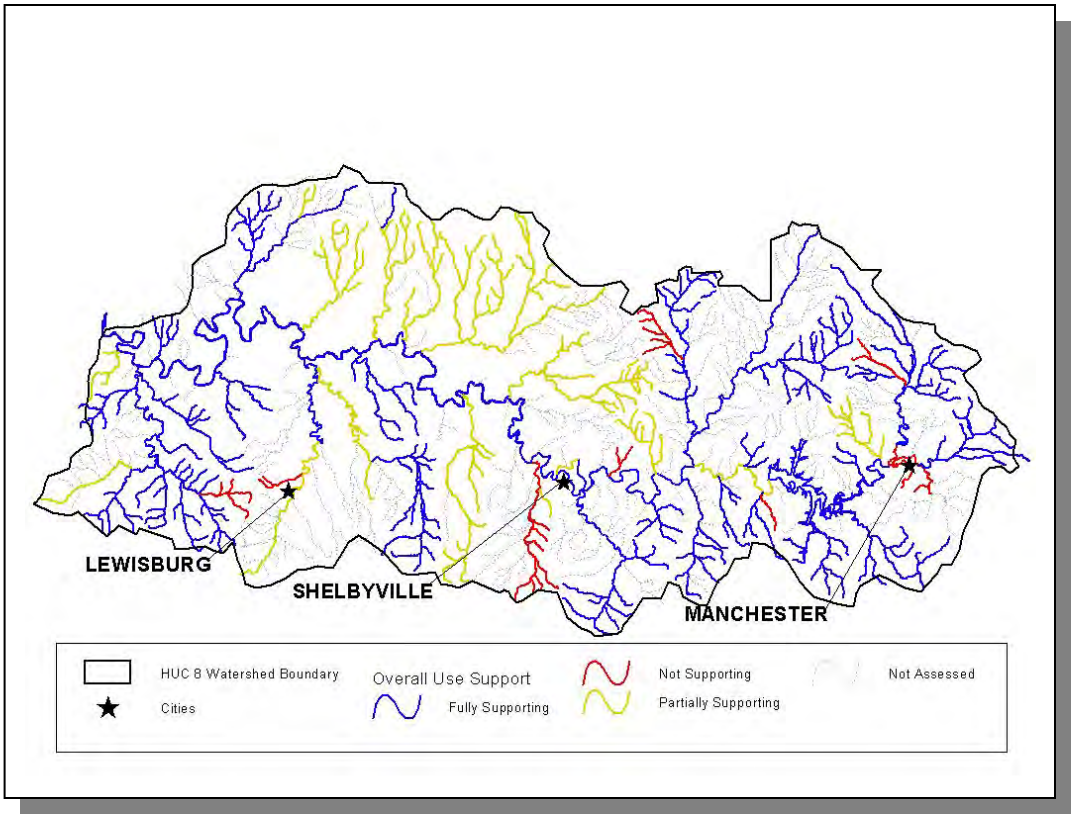


Figure 3-7a. Overall Use Support Attainment in the Upper Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Locations of Lewisburg, Manchester, and Shelbyville are shown for reference. More information is provided in Appendix III.*

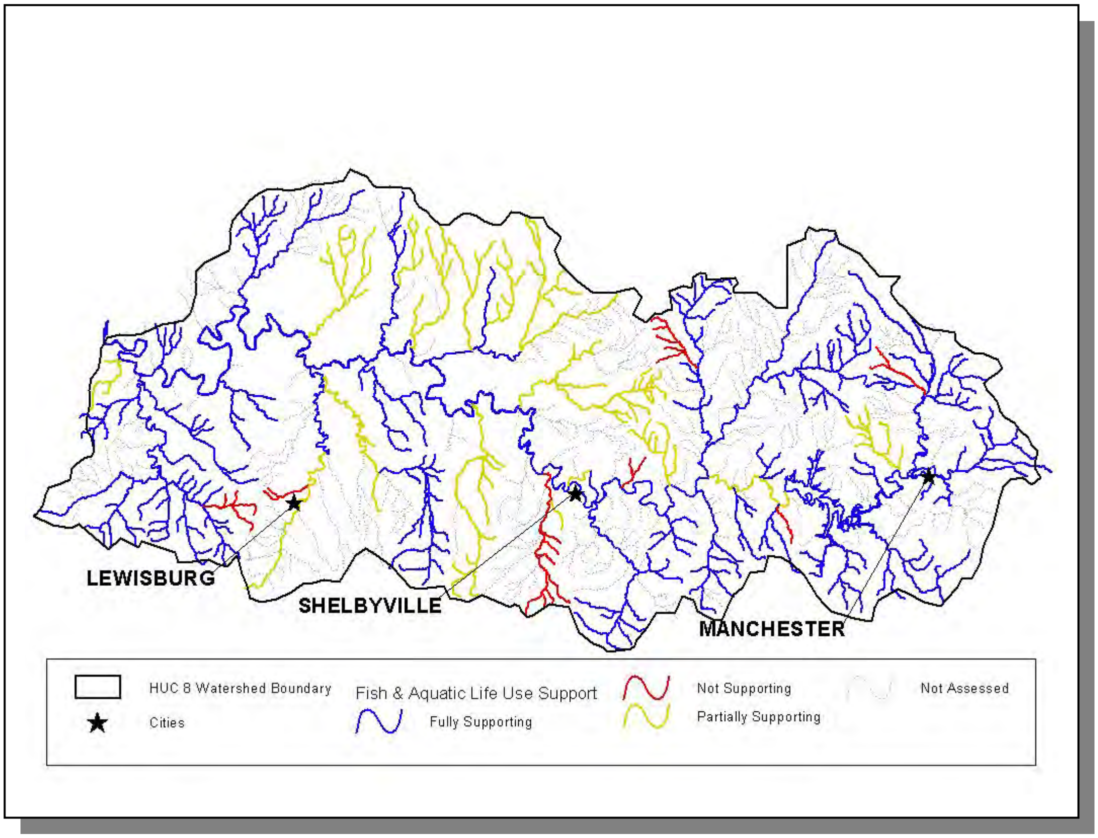


Figure 3-7b. Fish and Aquatic Life Use Support Attainment in the Upper Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Locations of Lewisburg, Manchester, and Shelbyville are shown for reference. More information is provided in Appendix III.*

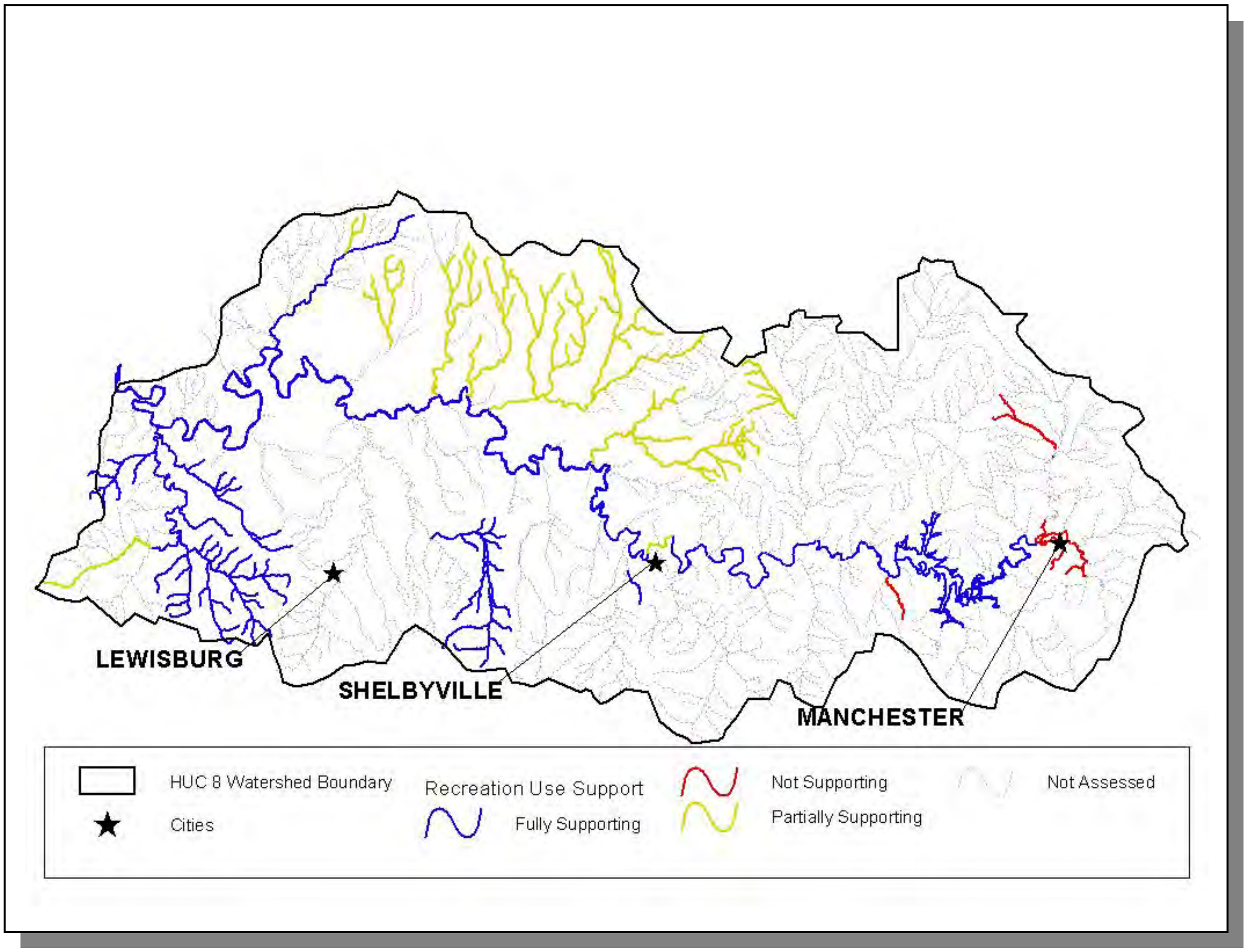


Figure 3-7c. Recreation Use Support Attainment in the Upper Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Locations of Lewisburg, Manchester, and Shelbyville are shown for reference. More information is provided in Appendix III.*

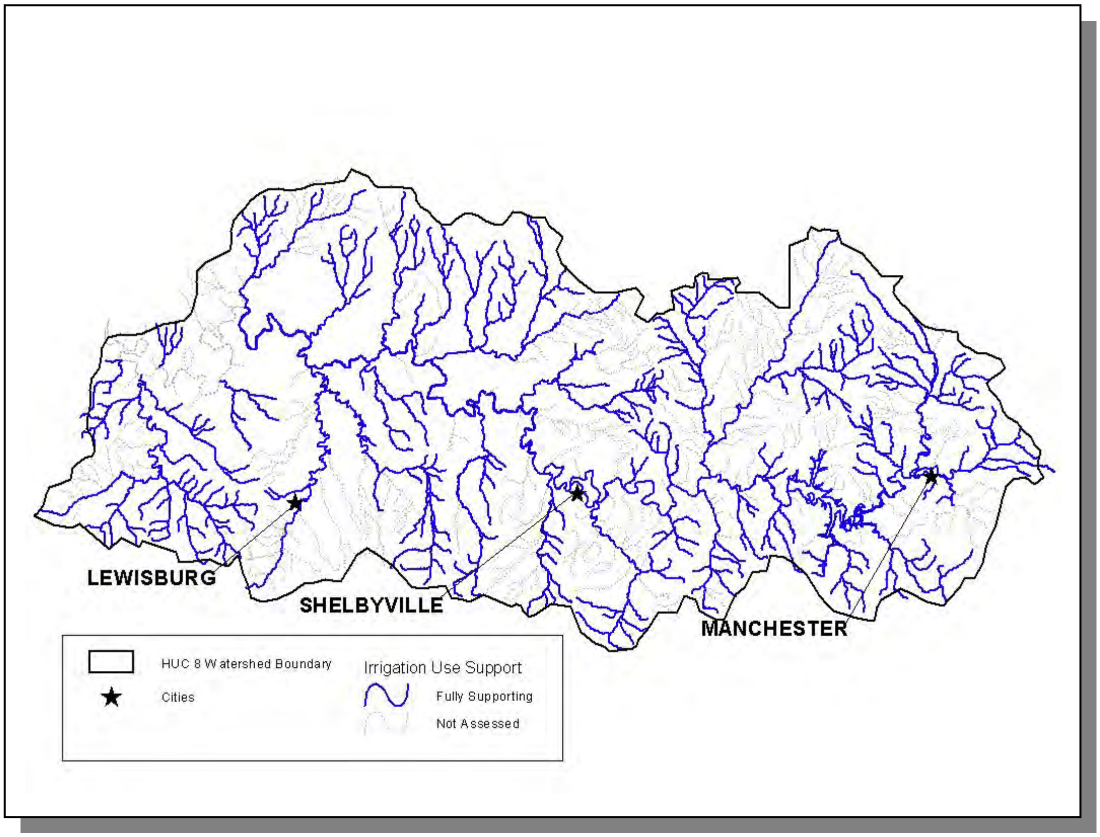


Figure 3-7d. Irrigation Use Support Attainment in the Upper Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Locations of Lewisburg, Manchester, and Shelbyville are shown for reference. More information is provided in Appendix III.*

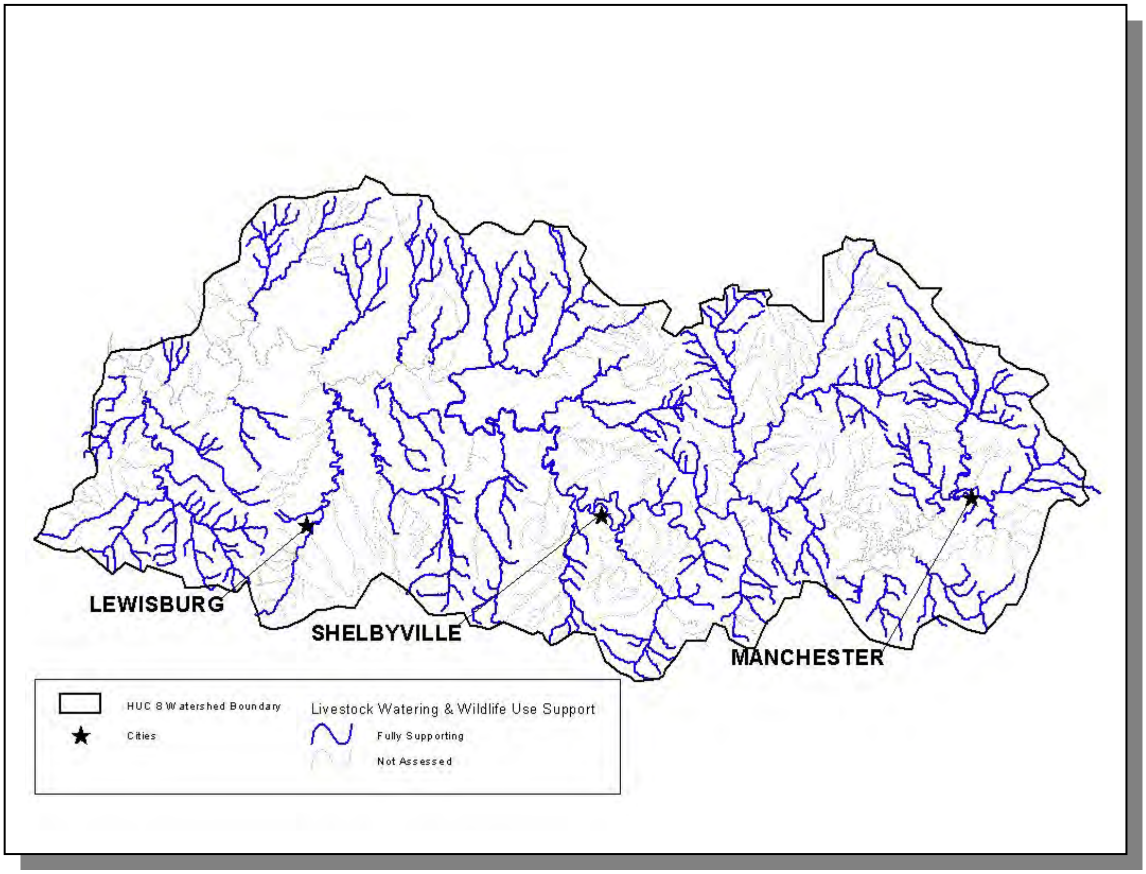


Figure 3-7e. Livestock Watering and Wildlife Use Support Attainment in the Upper Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Locations of Lewisburg, Manchester, and Shelbyville are shown for reference. More information is provided in Appendix III.*

3.3.B. Use Impairment Summary.

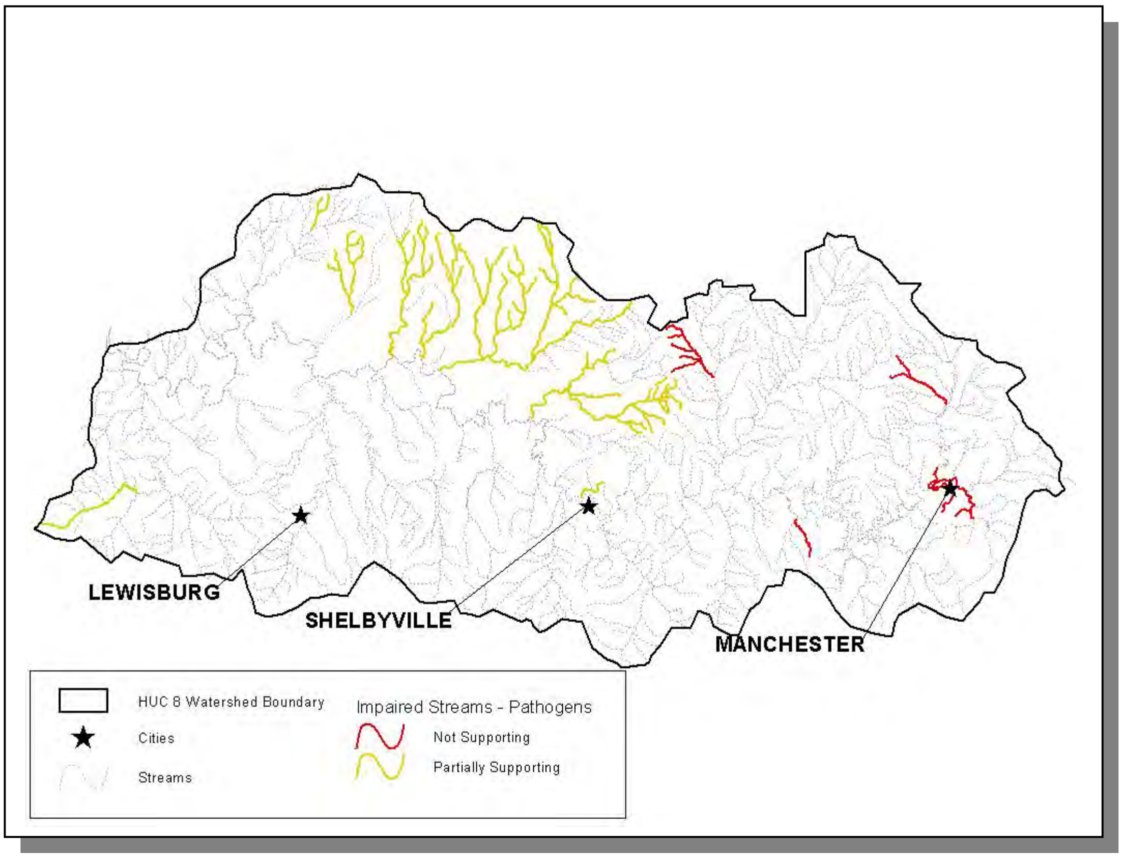


Figure 3-8a. Impaired Streams Due to Pathogens in the Upper Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Locations of Lewisburg, Manchester, and Shelbyville are shown for reference. More information is provided in Appendix III.*

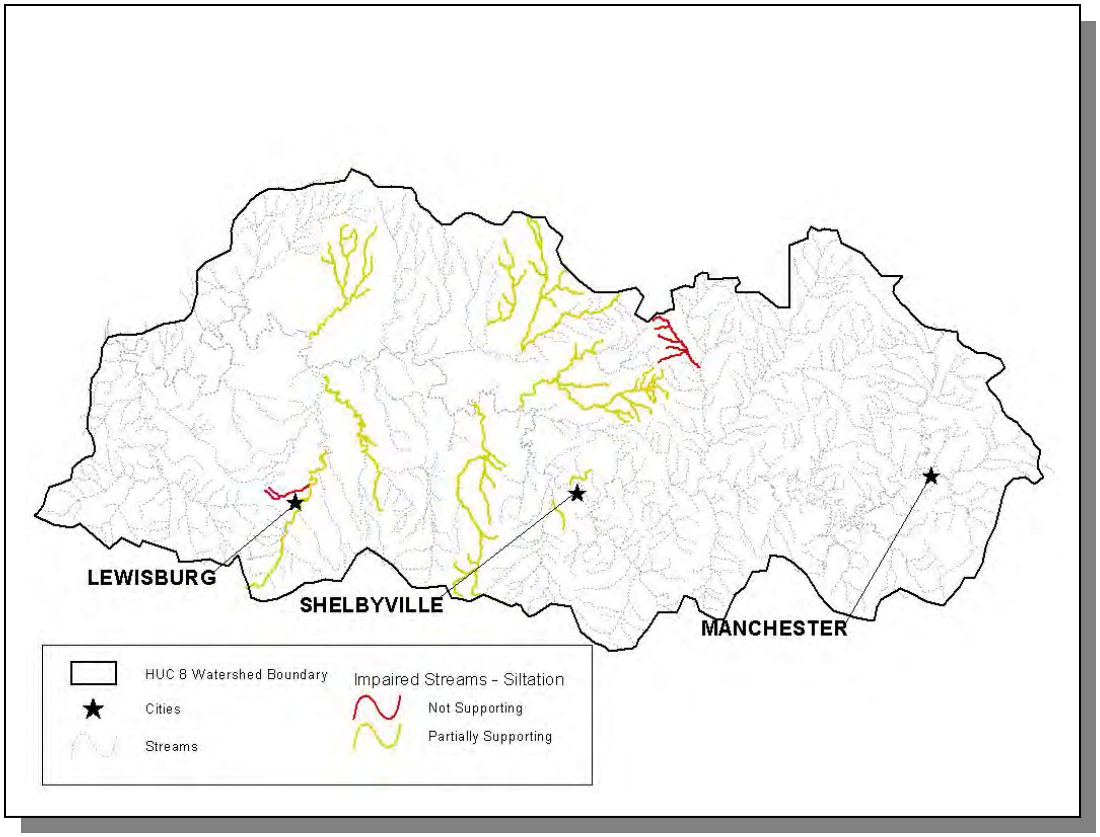


Figure 3-8b. Impaired Streams Due to Siltation in the Upper Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Locations of Lewisburg, Manchester, and Shelbyville are shown for reference. More information is provided in Appendix III.*

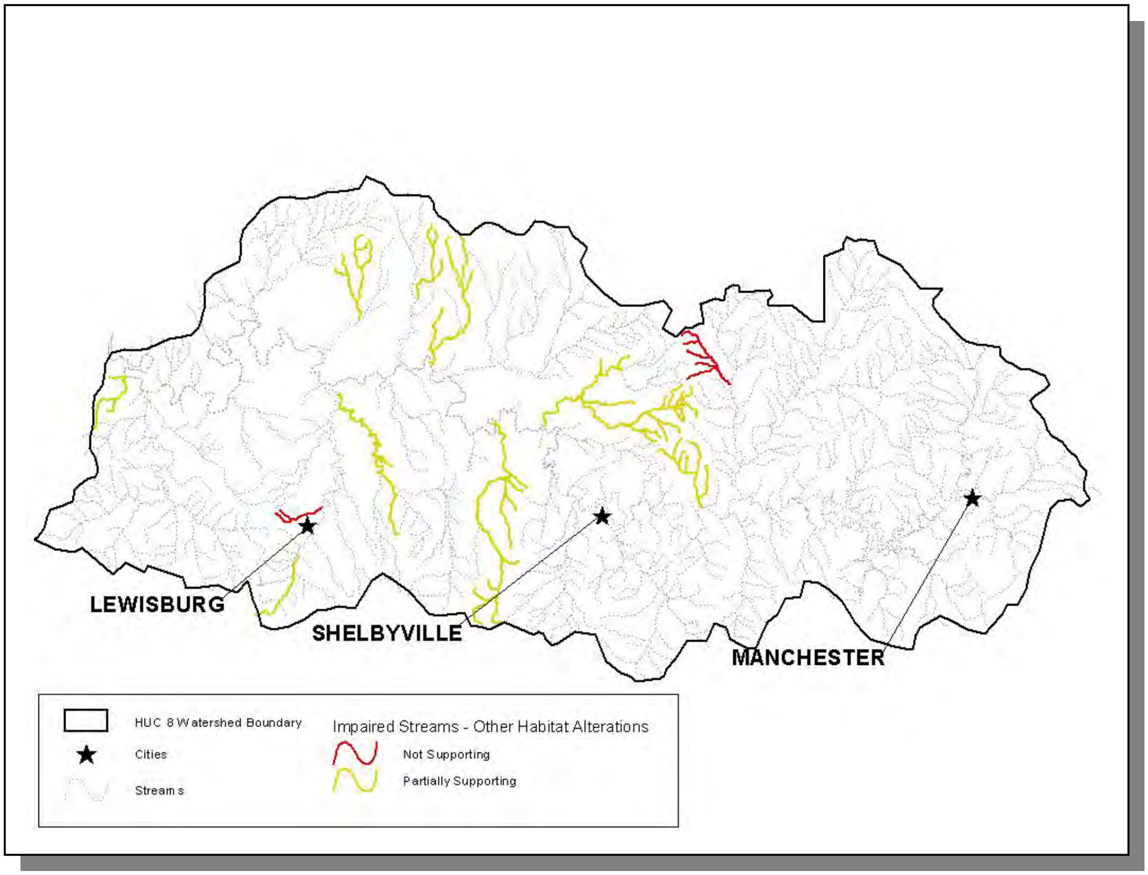


Figure 3-8c. Impaired Streams Due to Habitat Alterations in the Upper Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Locations of Lewisburg, Manchester, and Shelbyville are shown for reference. More information is provided in Appendix III.*

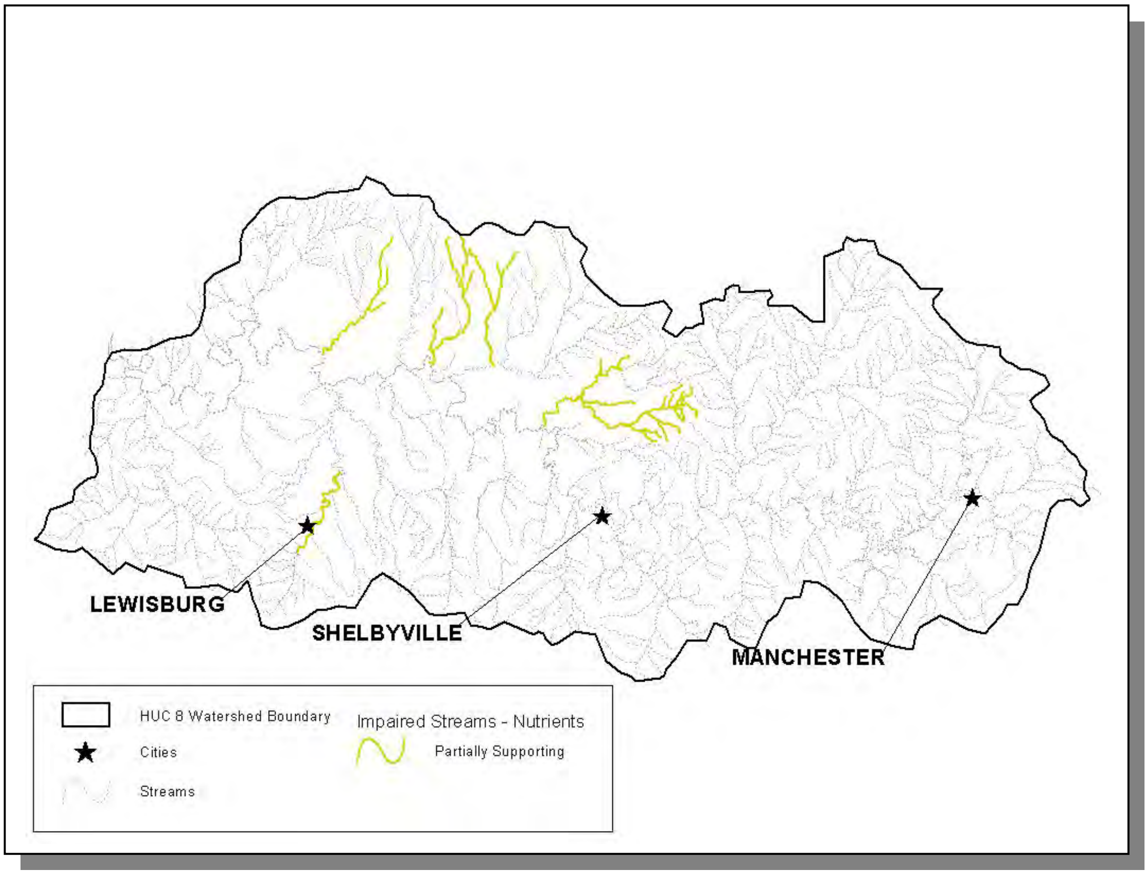


Figure 3-8d. Impaired Streams Due to Nutrient Enrichment in the Upper Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Locations of Lewisburg, Manchester, and Shelbyville are shown for reference. More information is provided in Appendix III.*

The listing of impaired waters that do not support designated uses (the 303(d) list) is traditionally submitted to EPA every two years. A copy of the most recent 303(d) list may be downloaded from: http://www.state.tn.us/environment/water.htm.

Since the year 2002, the 303(d) list is compiled by using EPA's ADB (Assessment Database) software developed by RTI (Research Triangle Institute). The ADB allows for a more detailed segmentation of waterbodies. While this results in a more accurate description of the status of water quality, it makes it difficult when comparing water quality assessments with and without using this tool. A more meaningful comparison will be between assessments conducted in Year 3 of each succeeding five-year cycle.

The ADB was used to create maps that illustrate water quality. These maps may be viewed on TDEC's homepage at http://www.state.tn.us/environment/water.htm,

CHAPTER 4

POINT AND NONPOINT SOURCE CHARACTERIZATION OF THE UPPER DUCK RIVER WATERSHED

4.1. BACKGROUND. This chapter is organized by HUC-10 subwatershed, and the description of each subwatershed is divided into four parts:

i. General description of the subwatershed
ii. Description of point source contributions
ii.a. Description of facilities discharging to water bodies listed on the 2002 303(d) list
iii. Description of nonpoint source contributions

The Upper Duck River Watershed (HUC 06040002) has been delineated into seven HUC 10-digit subwatersheds.

Information for this chapter was obtained from databases maintained by the Division of Water Pollution Control or provided in the WCS (Watershed Characterization System) data set. The WCS used was version 2.0 (developed by Tetra Tech, Inc for EPA Region 4) released in 2003.

WCS integrates with ArcView® v3.x and Spatial Analyst® v1.1 to analyze user-delineated (sub)watersheds based on hydrologically connected water bodies. Reports are generated by integrating WCS with Microsoft® Word. Land Use/Land Cover information from 1992 MRLC (Multi-Resolution Land Cover) data are calculated based on the proportion of county-based land use/land cover in user-delineated (sub)watersheds. Nonpoint source data in WCS are based on agricultural census data collected 1992–1998; nonpoint source data were reviewed by Tennessee NRCS staff.

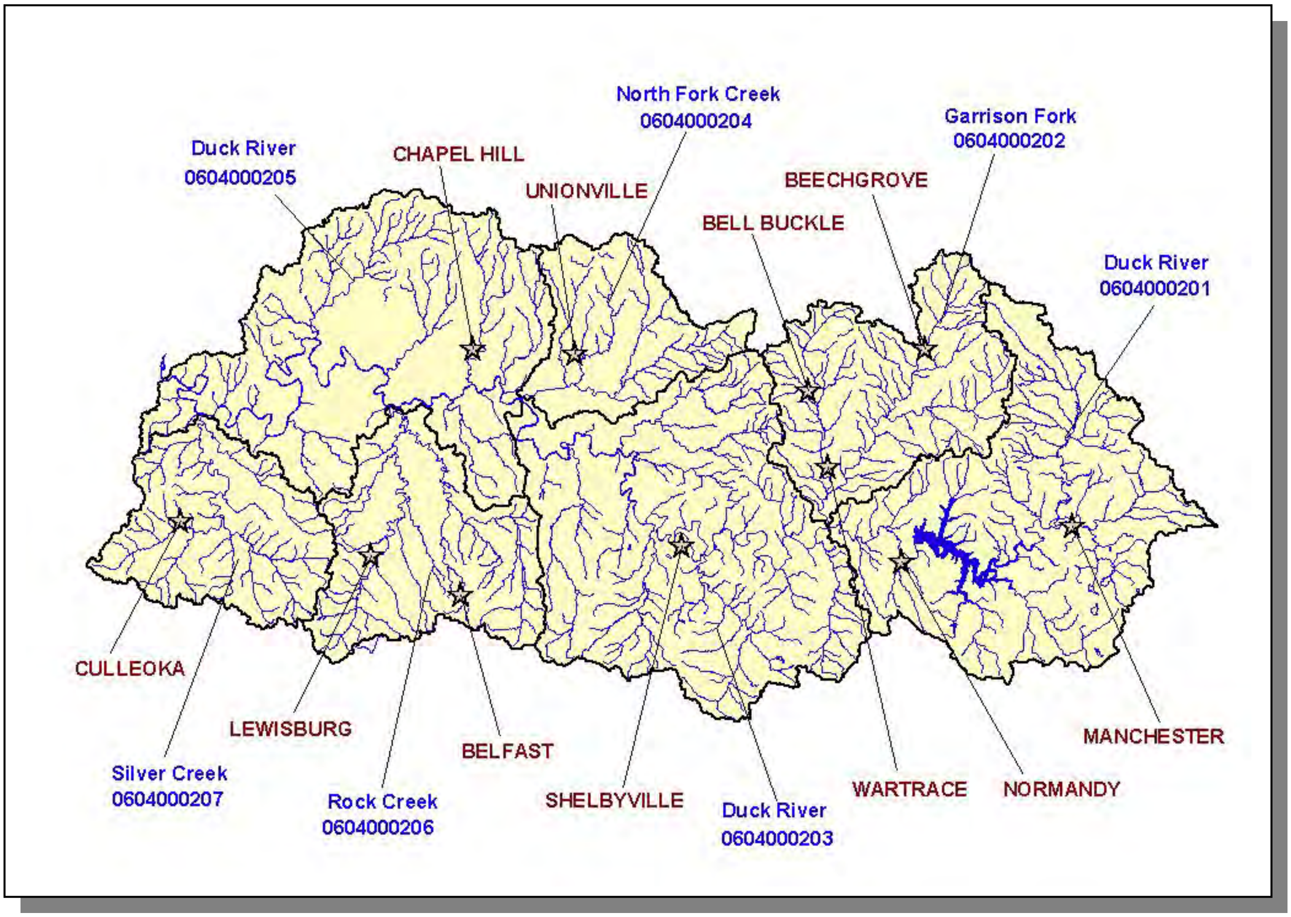


Figure 4-1. The Upper Duck River Watershed is Composed of Seven USGS-Delineated Subwatersheds (10-Digit Subwatersheds). *Locations of Beech Grove, Belfast, Bell Buckle, Chapel, Hill, Culleoka, Lewisburg, Manchester, Normandy, Shelbyville, Unionville, and Wartrace are shown for reference.*

4.2. CHARACTERIZATION OF HUC-10 SUBWATERSHEDS. The Watershed Characterization System (WCS) software and data sets provided by EPA Region IV were used to characterize each subwatershed in the Upper Duck River Watershed.

HUC-10	HUC-12	
0604000201	060400020101 (Duck River)	060400020105 (Duck River)
	060400020102 (Wolf Creek)	060400020106 (Norman Creek)
	060400020103 (Normandy Lake)	060400020107 (Shipman Creek)
	060400020104 (Crumpton Creek)	
0604000202	060400020201 (Garrison Fork)	060400020203 (Wartrace Creek)
	060400020202 (Noah Creek)	
0604000203	060400020301 (Duck River)	060400020306 (Duck River)
	060400020302 (Thompson Creek)	060400020307 (Little Sinking Creek)
	060400020303 (Little Flat Creek)	060400020308 (Fall Creek)
	060400020304 (Flat Creek)	060400020309 (Sinking Creek)
	060400020305 (Sugar Creek)	
0604000204	060400020401 (Upper North Fork Creek)	060400020404 (Weakley Creek)
	060400020402 (Alexander Creek)	060400020405 (Clem Creek)
	060400020403 (Lower North Fork Creek)	
0604000205	060400020501 (Duck River)	060400020505 (Duck River)
	060400020502 (Wilson Creek)	060400020506 (Flat Creek)
	060400020503 (Spring Creek)	060400020507 (Duck River)
	060400020504 (Caney Creek)	
0604000206	060400020601 (Big Rock Creek)	060400020602 (Rock Creek)
0604000207	060400020701 (Globe Creek)	060400020703 (Silver Creek)
	060400020702 (Fountain Creek)	

Table 4-1. HUC-12 Drainage Areas are Nested Within HUC-10 Drainages. *NRCS worked with USGS to delineate the HUC-10 and HUC-12 drainage boundaries.*

4.2.A. 0604000201 (Duck River).

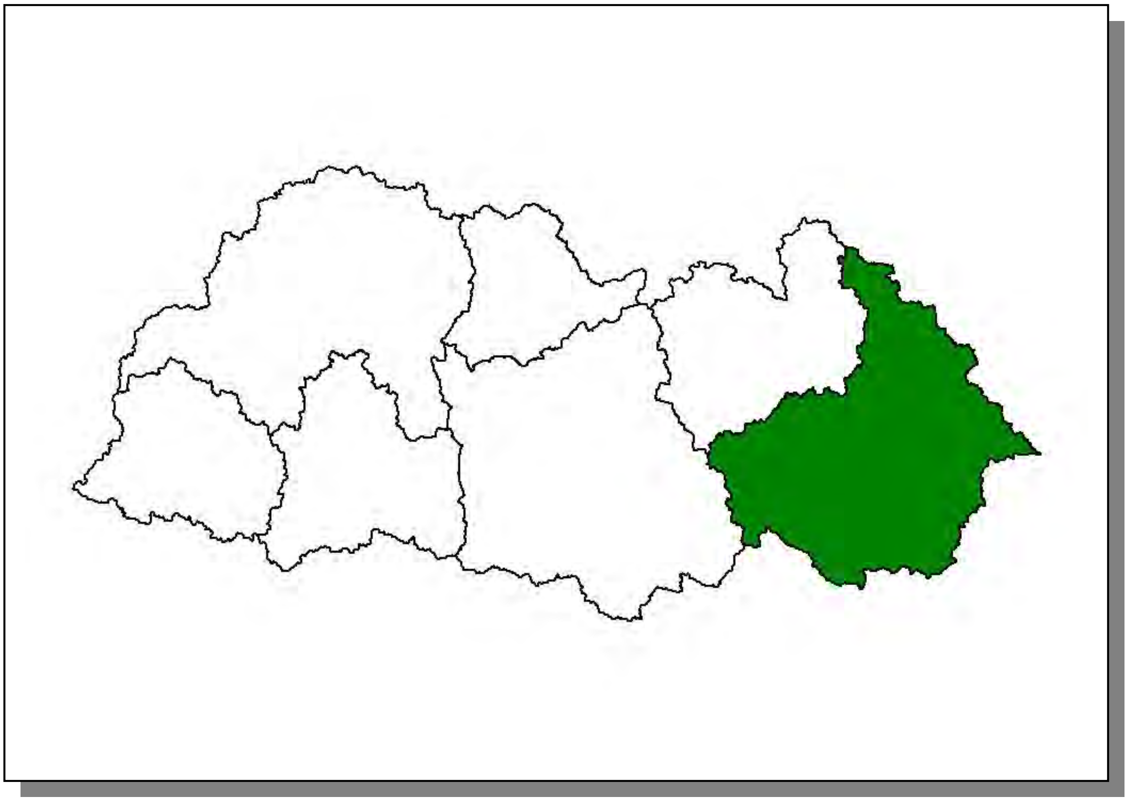


Figure 4-2. Location of Subwatershed 0604000201. *All Upper Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.A.i. General Description.

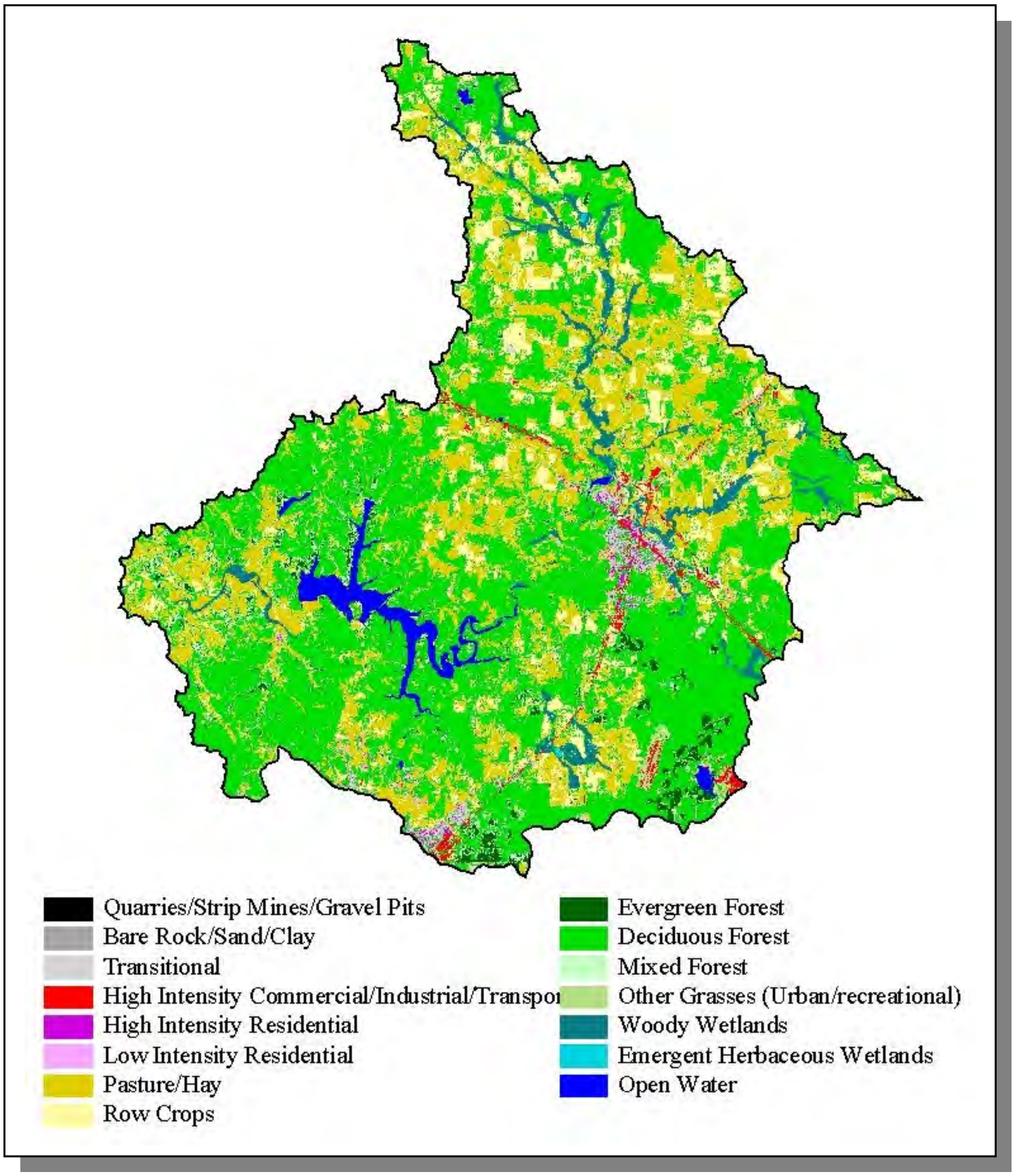


Figure 4-3. Illustration of Land Use Distribution in Subwatershed 0604000201.

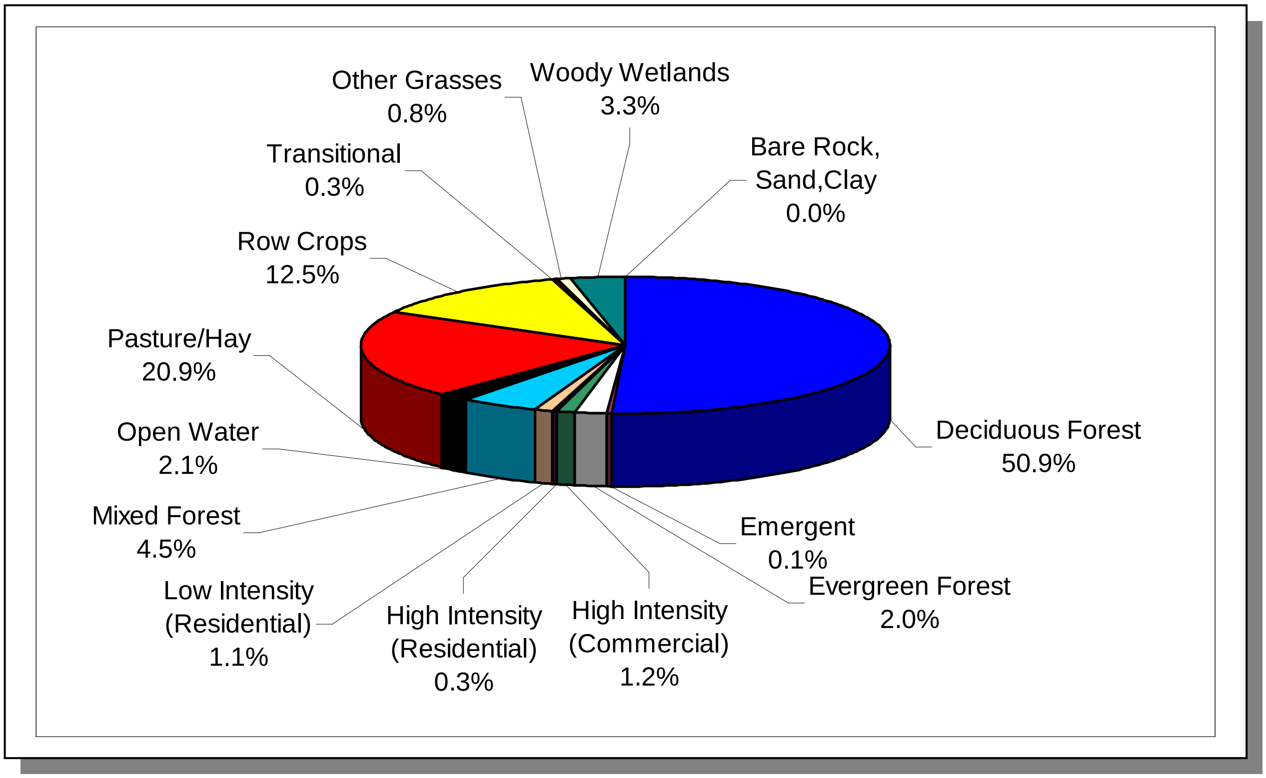


Figure 4-4. Land Use Distribution in Subwatershed 0604000201. *More information is provided in Appendix IV.*

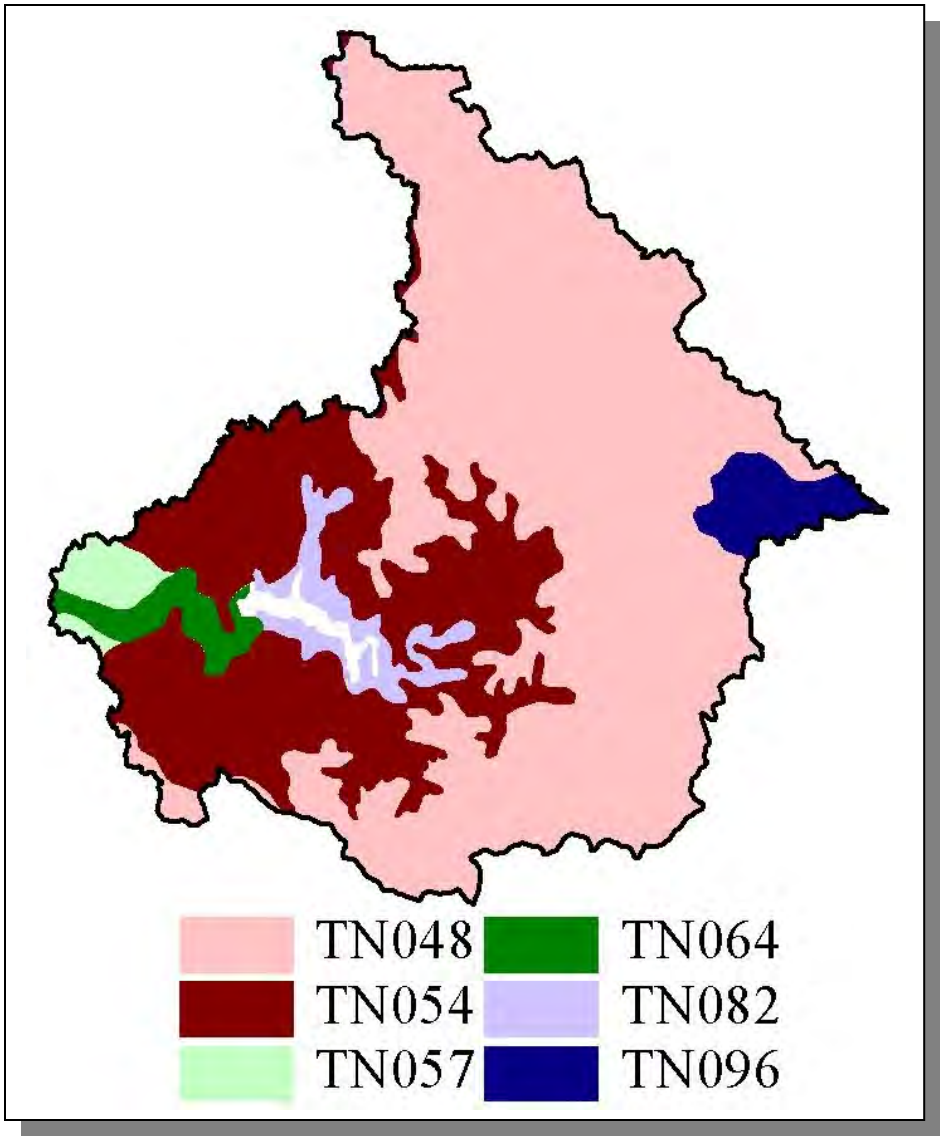


Figure 4-5. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000201.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN048	8.00	C	1.38	5.06	Silty Loam	0.42
TN054	0.00	C	3.04	4.84	Loam	0.32
TN057	0.00	C	1.14	5.01	Clayey Loam	0.33
TN064	7.00	C	1.19	5.82	Silty Loam	0.37
TN082	0.00	B	1.63	5.47	Loam	0.34
TN096	10.00	C	1.22	5.16	Silty Loam	0.38

Table 4-2. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000201. *More details are provided in Appendix IV.*

	COUNTY POPULATION				ESTIMATED POPULATION IN WATERSHED			
County	1990	1997	2000	Portion of Watershed (%)	1990	1997	2000	% Change (1990-1997)
Bedford	30,411	34,203	37,586	5.99	1,821	2,048	2,250	23.6
Coffee	40,339	45,347	48,014	47.17	19,028	21,391	22,649	19.0
Franklin	34,275	37,152	39,270	0.22	76	81	86	13.2
Moore	4,721	5,205	5,740	2.14	101	111	123	21.8
Totals	**110,196**	**121,907**	**130,610**		**21,026**	**23,631**	**25,108**	**19.4**

Table 4-3. Population Estimates in Subwatershed 0604000201.

			NUMBER OF HOUSING UNITS			
Populated Place	County	Population	Total	Public Sewer	Septic Tank	Other
Manchester	Coffee	7,709	3,330	2,925	384	21
Normandy	Bedford	135	54	0	54	0
Tullahoma	Coffee	16,757	7,109	6,184	920	5
Totals		**24,601**	**1,0493**	**9,109**	**1,358**	**26**

Table 4-4. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 0604000201.

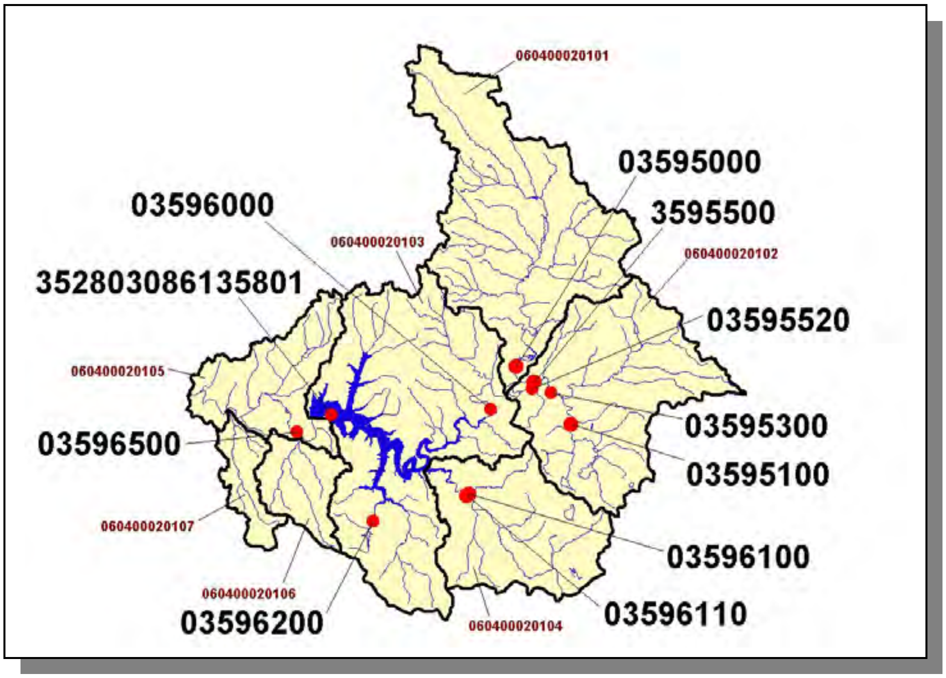


Figure 4-6. Location of Historical Streamflow Data Collection Sites in Subwatershed 0604000201. *Subwatershed 060400020101, 060400020102, 060400020103, 060400020104, 060400020105, 060400020106, and 060400020107 boundaries are shown for reference. More information is provided in Appendix IV.*

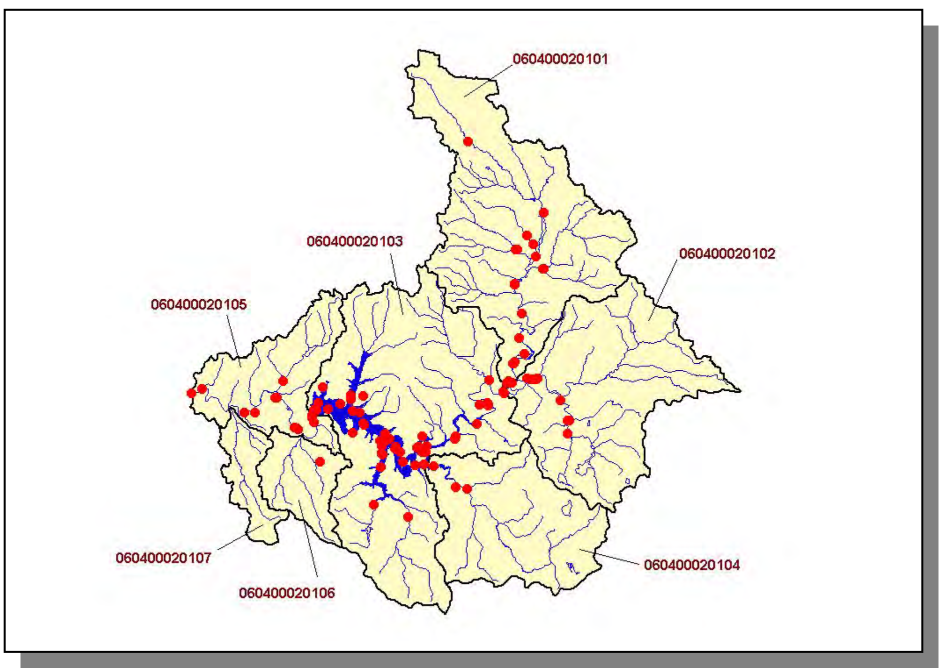


Figure 4-7. Location of STORET Monitoring Sites in Subwatershed 0604000201. *Subwatershed 060400020101, 060400020102, 060400020103, 060400020104, 060400020105, 060400020106, and 060400020107 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.A.ii Point Source Contributions.

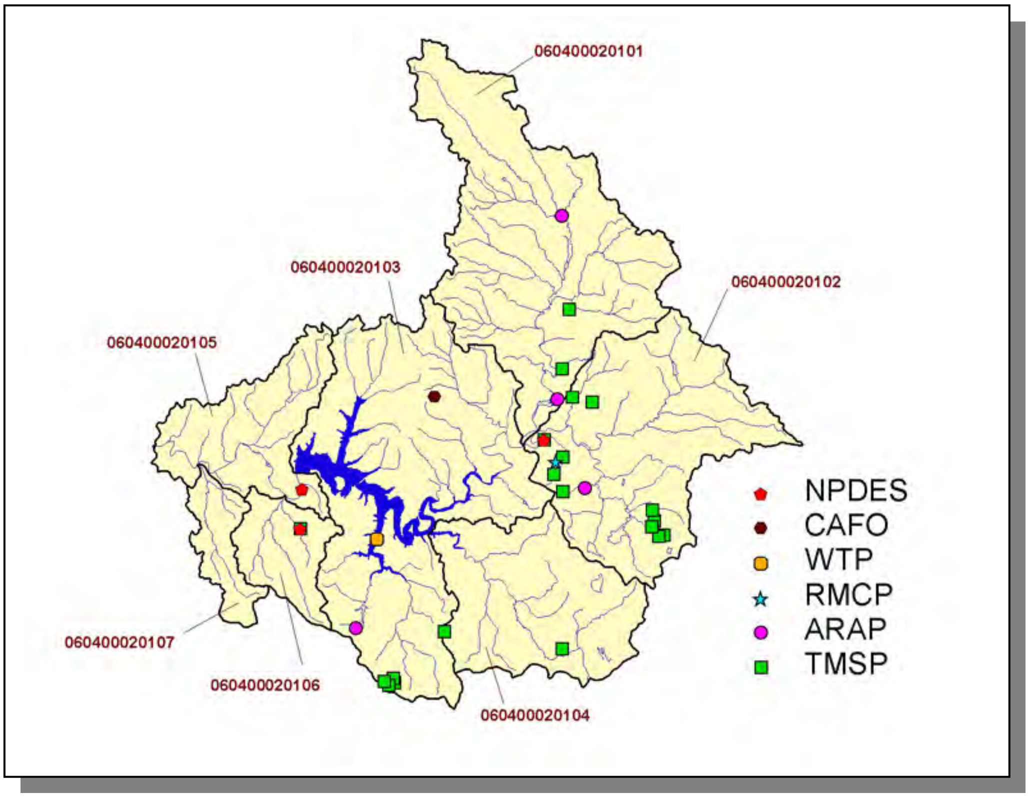


Figure 4-8. Location of Active Point Source Facilities in Subwatershed 0604000201. *Subwatershed 060400020101, 060400020102, 060400020103, 060400020104, 060400020105, 060400020106, and 060400020107 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-9. Location of NPDES Facilities in Subwatershed 0604000201. *Subwatershed 060400020101, 060400020102, 060400020103, 060400020104, 060400020105, 060400020106, and 060400020107 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-10. Location of Concentrated Animal Feeding Operations (CAFO) in Subwatershed 0604000201. *Subwatershed 060400020101, 060400020102, 060400020103, 060400020104, 060400020105, 060400020106, and 060400020107 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

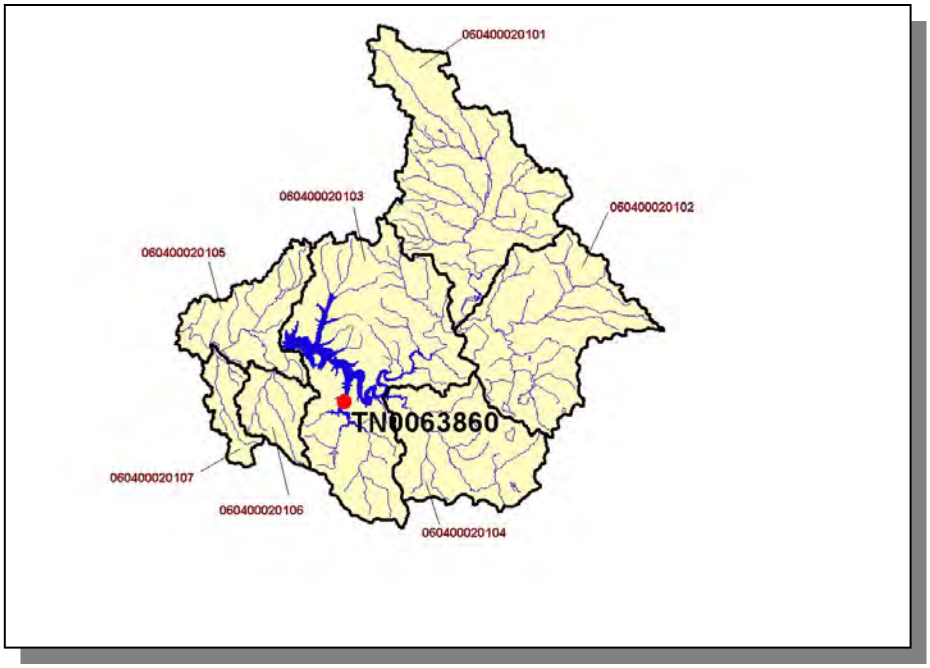


Figure 4-11. Location of Water Treatment Plants in Subwatershed 0604000201. *Subwatershed 060400020101, 060400020102, 060400020103, 060400020104, 060400020105, 060400020106, and 060400020107 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

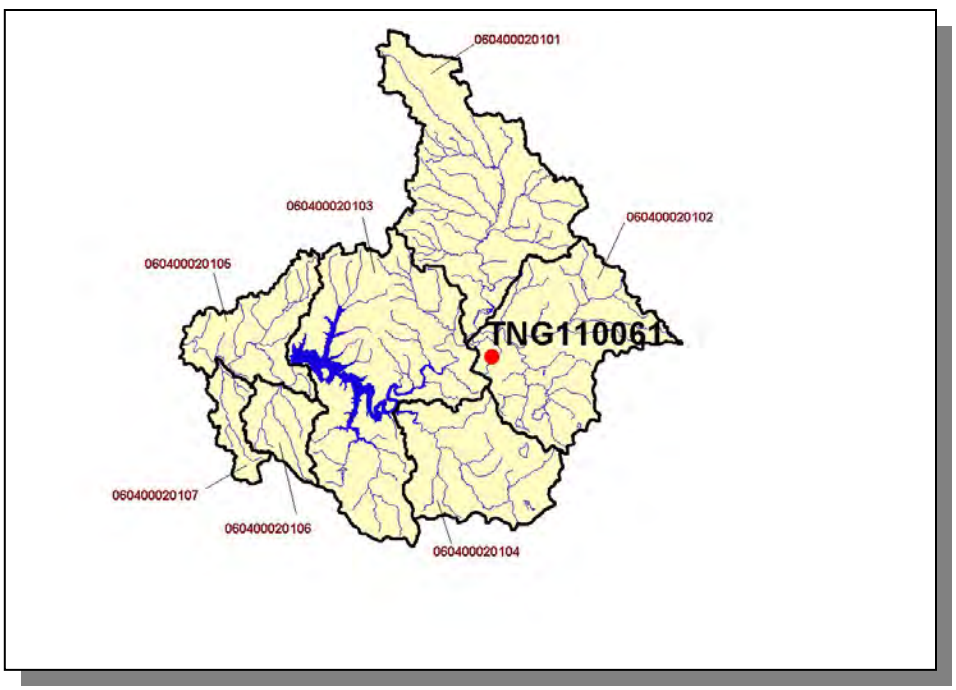


Figure 4-12. Location of Ready Mix Concrete Plants in Subwatershed 0604000201. *Subwatershed 060400020101, 060400020102, 060400020103, 060400020104, 060400020105, 060400020106, and 060400020107 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

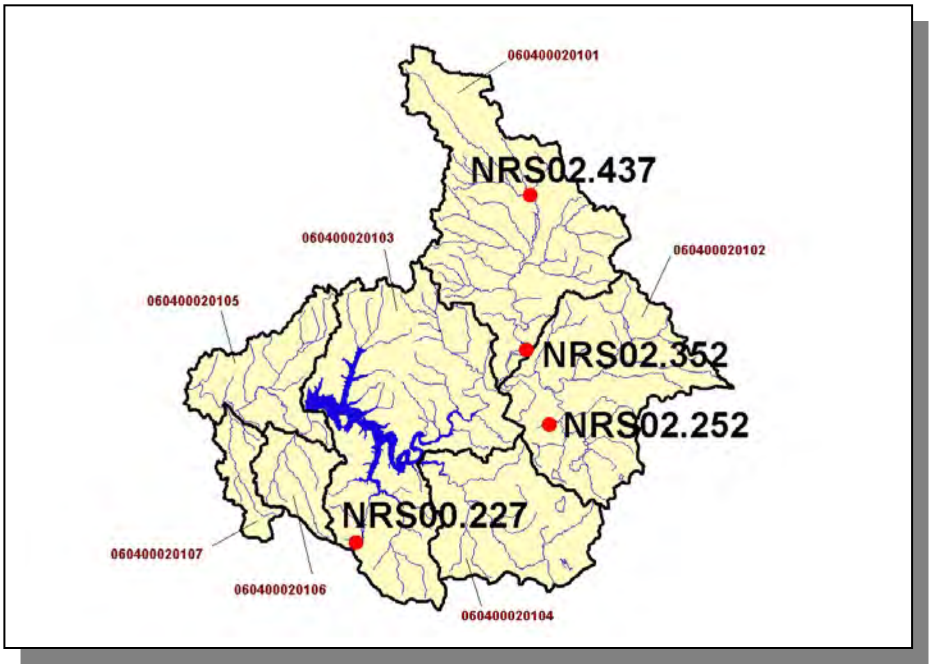


Figure 4-13. Location of ARAP Sites (Individual Permits) in Subwatershed 0604000201. *Subwatershed 060400020101, 060400020102, 060400020103, 060400020104, 060400020105, 060400020106, and 060400020107 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

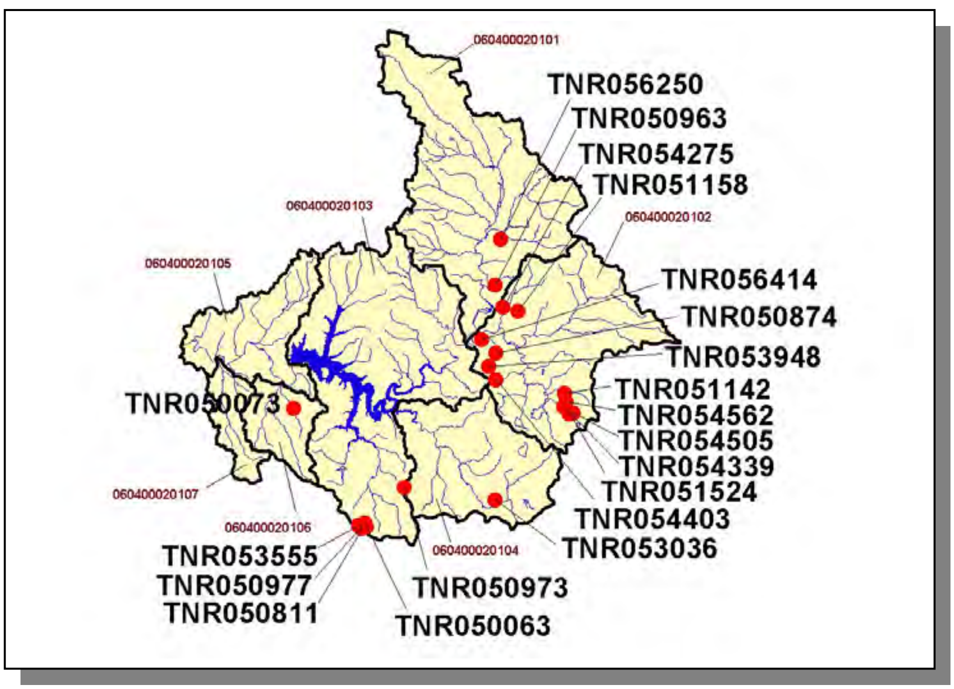


Figure 4-14. Location of TMSP Facilities in Subwatershed 0604000201. *Subwatershed 060400020101, 060400020102, 060400020103, 060400020104, 060400020105, 060400020106, and 060400020107 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

4.2.A.ii.a. Dischargers to Water Bodies Listed on the 2002 303(d) List

There are three NPDES facilities discharging to water bodies listed on the 2002 303(d) list in Subwatershed 0604000201:

- TN0067938 (TWRA-Normandy Fish Hatchery) discharges to Duck River @ RM 248.0
- TN0025038 (Manchester STP) discharges to Duck River @ RM 268.5
- TN0002470 (Tennessee Dickel Distilling Company) discharges to Cascade Creek @ RM 0.1 to cascade Branch @ RM 1.4

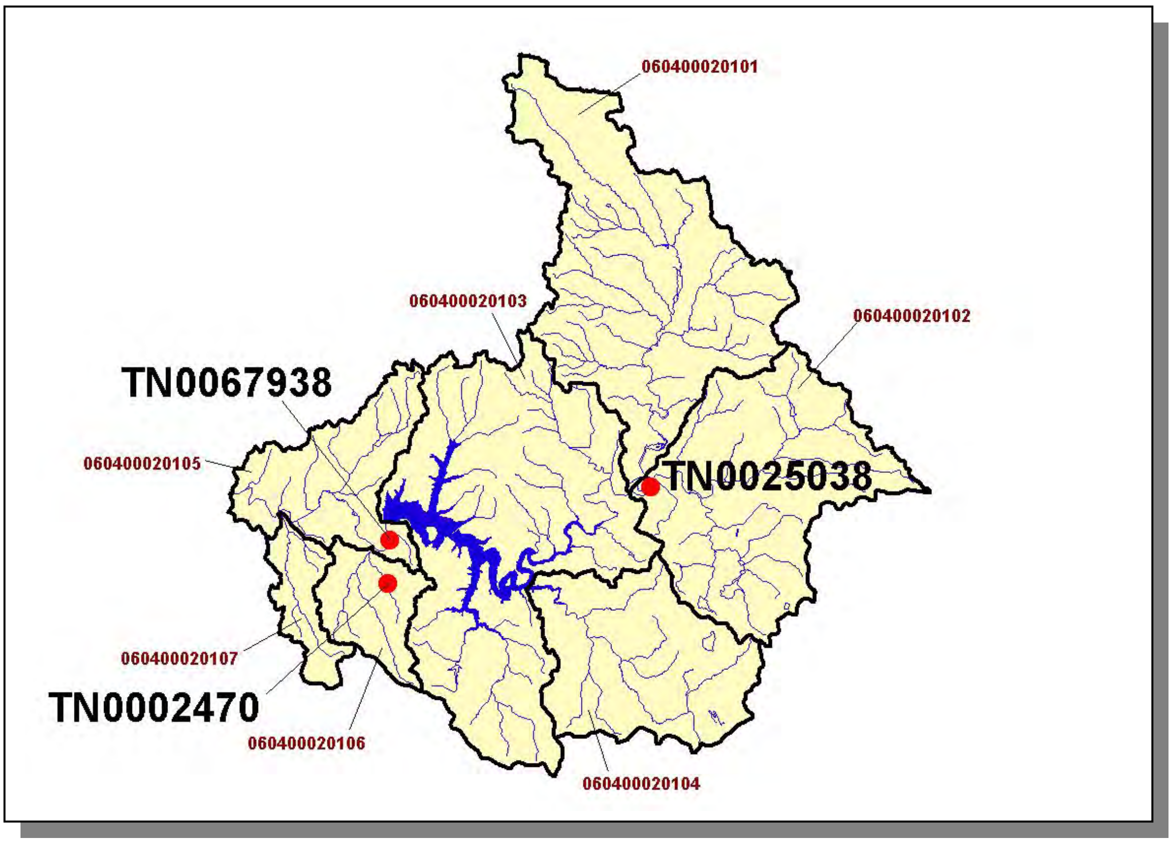


Figure 4-15. Location of NPDES Dischargers to Water Bodies Listed on the 2002 303(d) List in Subwatershed 0604000201. *Subwatershed 060400020101, 060400020102, 060400020103, 060400020104, 060400020105, 060400020106, and 060400020107 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

PERMIT #	1Q10	3Q10	7Q10	3Q20	QDESIGN
TN0067938	48	48	48	45	
TN0025038	11.7	12.2	13.0	10.9	3.4
TN0002470					

Table 4-5. Receiving Stream Flow Information for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000201. *Data are in million gallons per day (MGD). Data were obtained from the USGS publication Flow Duration and Low Flows of Tennessee Streams Through 1992 or from permit files.*

PERMIT #	WET	$CBOD_5$	FECAL COLIFORM	*E. COLI*	NH_3	Cl^-	TRC	TSS	SETTLEABLE SOLIDS	DO	pH
TN0067938	X							X	X		X
TN0025038	X	X	X	X	X		X	X	X	X	X
TN0002470						X		X	X		X

Table 4-6. Parameters Monitored for Daily Maximum Limits for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000201. *WET, Whole Effluent Toxicity; $CBOD_5$, Carbonaceous Biochemical Oxygen Demand (5-Day); TRC, Total Residual Chlorine; TSS, Total Suspended Solids, Cl^-, Dissolved Chloride.*

4.2.A.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens (Layers)	Chickens (Broilers Sold)	Hogs	Sheep
6,418	15,967	1,396	15	2,617,260	1,416	119

Table 4-7. Summary of Livestock Count Estimates in Subwatershed 0604000201. *According to the 1997 Census of Agriculture (http://www.nass.usda.gov/census/),* **"***Cattle" includes heifers, heifer calves, steers, bulls and bull calves; "Chickens" are layers 20 weeks and older; "Chickens Sold" are all chickens used to produce meat.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Bedford	74.6	74.6	0.5	1.3
Coffee	114.4	114.2	2.8	12.7
Franklin	183.4	183.0	6.0	28.7
Moore	36.6	36.6	0.0	0.0
Total	**409.0**	**408.4**	**9.3**	**42.7**

Table 4-8. Forest Acreage and Annual Removal Rates (1987-1994) in Subwatershed 0604000201.

CROPS	TONS/ACRE/YEAR
Grass (Pastureland)	1.37
Grass (Hayland)	0.82
Legumes (Hayland)	0.72
Legumes, Grass (Hayland)	0.21
Grass, Forbs, Legumes (Mixed Pasture)	0.31
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	9.92
Cotton (Row Crops)	4.03
Soybeans (Row Crops)	14.90
Wheat (Close-Grown Cropland)	12.41
All Other Close-Grown Cropland	5.82
Other Vegetable and Truck Crop	4.37
Summer Fallow (Other Cropland)	4.60
Other Cropland not Planted	6.65
Other Horticulture	1.92
Conservation Reserve Program Lands	0.15
Non-Agricultural Land Use	0.00
Farmsteads and Ranch Headquarters	0.16

Table 4-9. Annual Estimated Total Soil Loss in Subwatershed 0604000201.

4.2.B. 0604000202 (Garrison Fork).

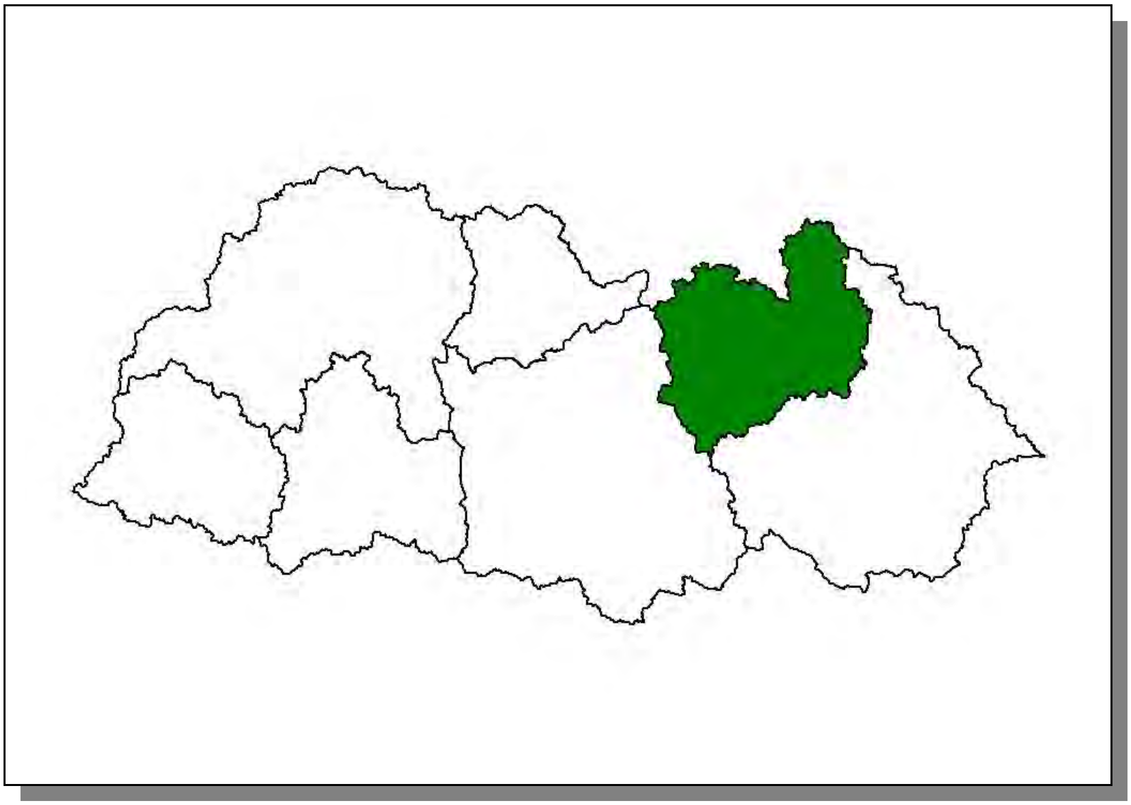


Figure 4-16. Location of Subwatershed 0604000202. *All Upper Duck River HUC-10 subwatershed boundaries are shown for reference.*

4.2.B.i. General Description.

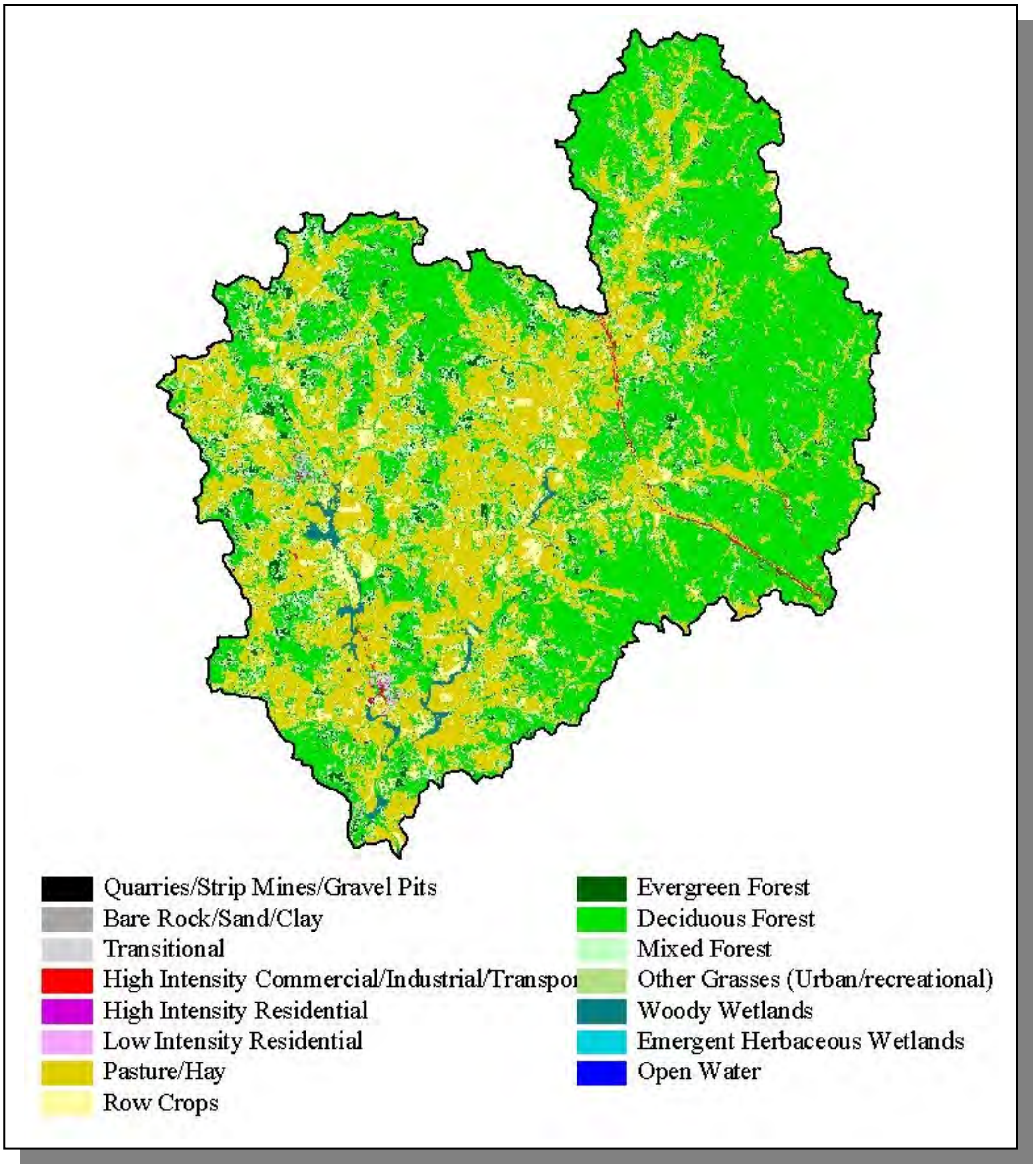


Figure 4-17. Illustration of Land Use Distribution in Subwatershed 0604000202.

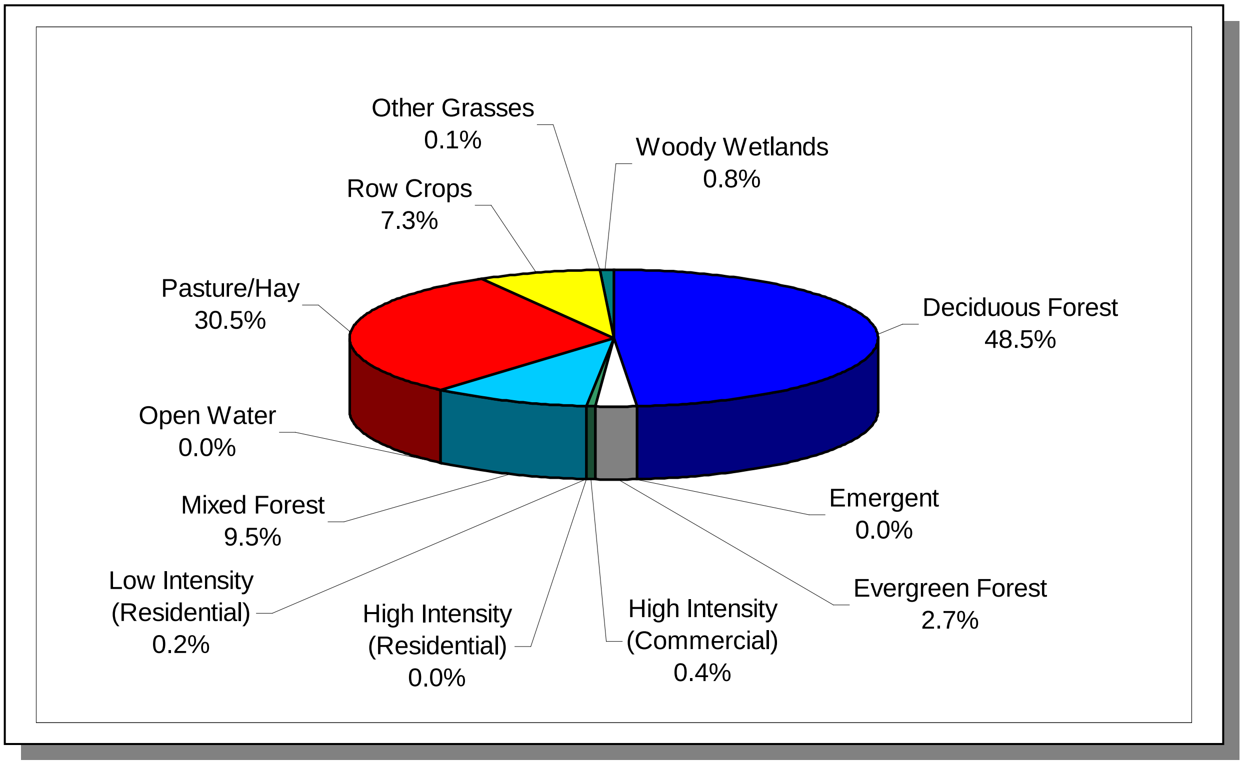


Figure 4-18. Land Use Distribution in Subwatershed 0604000202. *More information is provided in Appendix IV.*

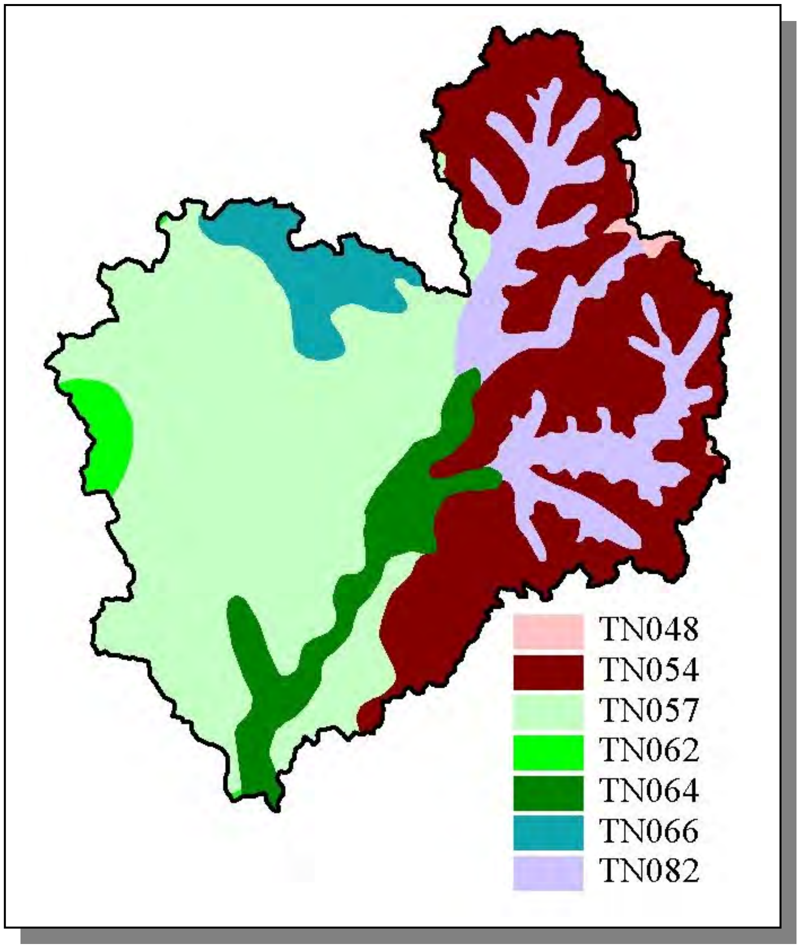


Figure 4-19. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000202.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN048	8.00	C	1.38	5.06	Silty Loam	0.42
TN054	0.00	C	3.04	4.84	Loam	0.32
TN057	0.00	C	1.14	5.01	Clayey Loam	0.33
TN062	0.00	C	0.98	4.40	Clayey Loam	0.26
TN064	7.00	C	1.19	5.82	Silty Loam	0.37
TN066	0.00	B	2.62	4.75	Loam	0.28
TN082	0.00	B	1.63	5.47	Loam	0.34

Table 4-10. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000202. *More information is provided in Appendix IV.*

	COUNTY POPULATION				ESTIMATED POPULATION IN WATERSHED			
County	1990	1997	2000	Portion of Watershed (%)	1990	1997	2000	% Change (1990-1997)
Bedford	30,411	34,203	37,586	17.35	5,277	5,934	6,521	23.6
Coffee	40,339	45,347	48,014	10.39	4,190	4,710	4,987	19.0
Rutherford	118,570	159,987	182,023	0.4	479	646	735	53.4
Totals	**189,320**	**239,537**	**267,623**		**9,946**	**11,290**	**12,243**	**23.1**

Table 4-11. Population Estimates in Subwatershed 0604000202.

			NUMBER OF HOUSING UNITS			
Populated Place	County	Population	Total	Public Sewer	Septic Tank	Other
Bell Buckle	Bedford	324	136	129	7	0
Wartrace	Bedford	496	233	200	33	0
Totals		**820**	**369**	**329**	**40**	**0**

Table 4-12. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 0604000202.

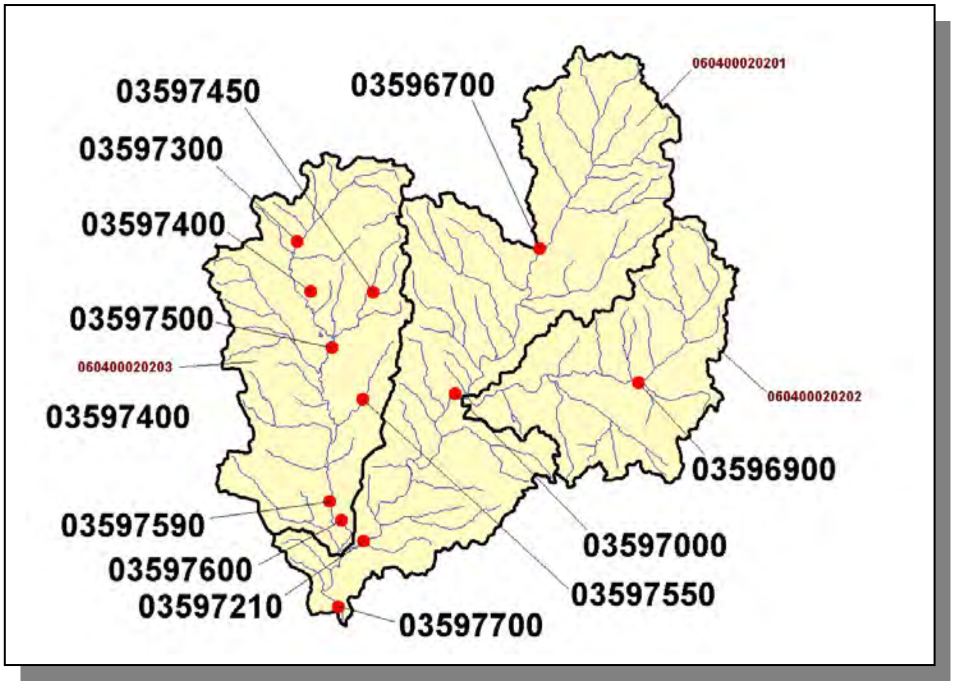


Figure 4-20. Location of Historical Streamflow Data Collection Sites in Subwatershed 0604000202. *Subwatershed 060400020201, 060400020202, and 060400020203 boundaries are shown for reference. More information is provided in Appendix IV.*

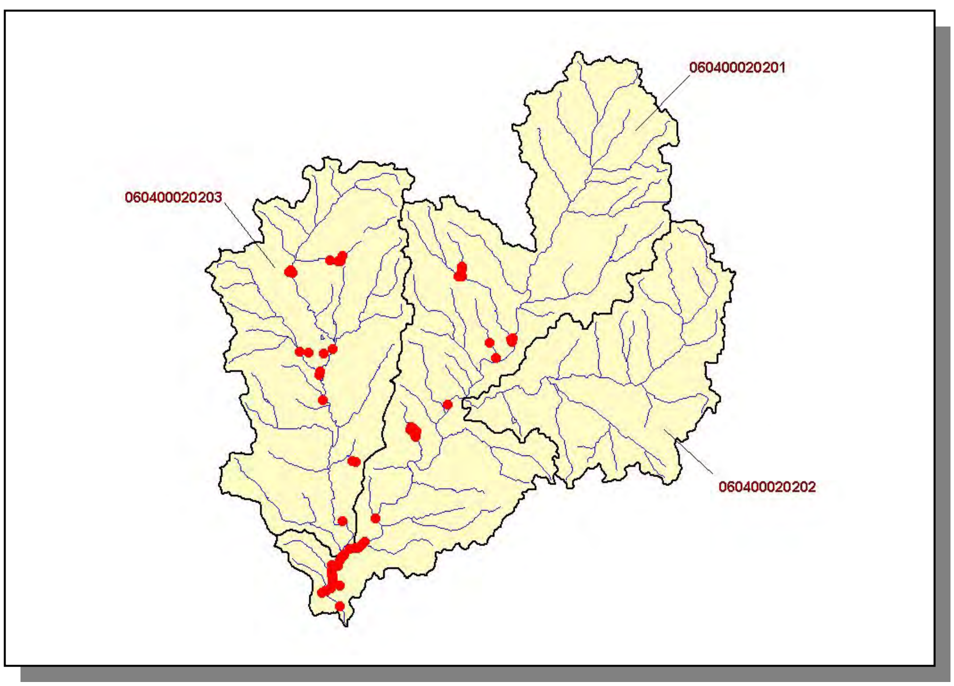


Figure 4-21. Location of STORET Monitoring Sites in Subwatershed 0604000202. *Subwatershed 060400020101, 060400020102, and 060400020103 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.B.ii. Point Source Contributions.

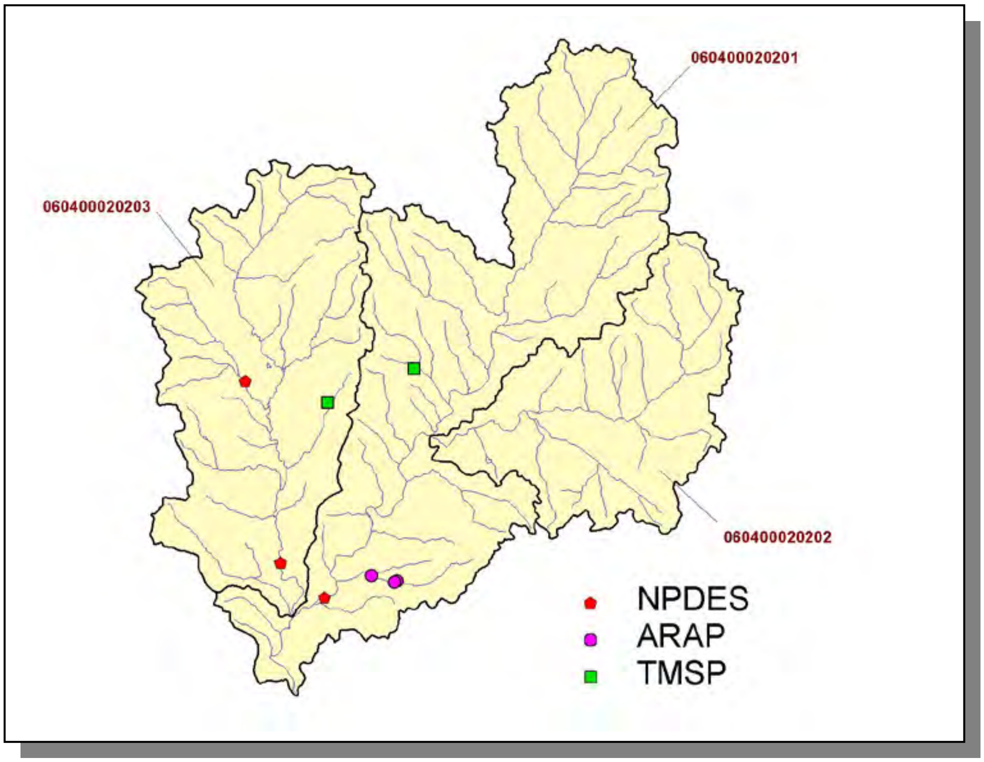


Figure 4-22. Location of Active Point Source Facilities in Subwatershed 0604000202. *Subwatershed 0604000202, 0604000202, and 0604000202 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

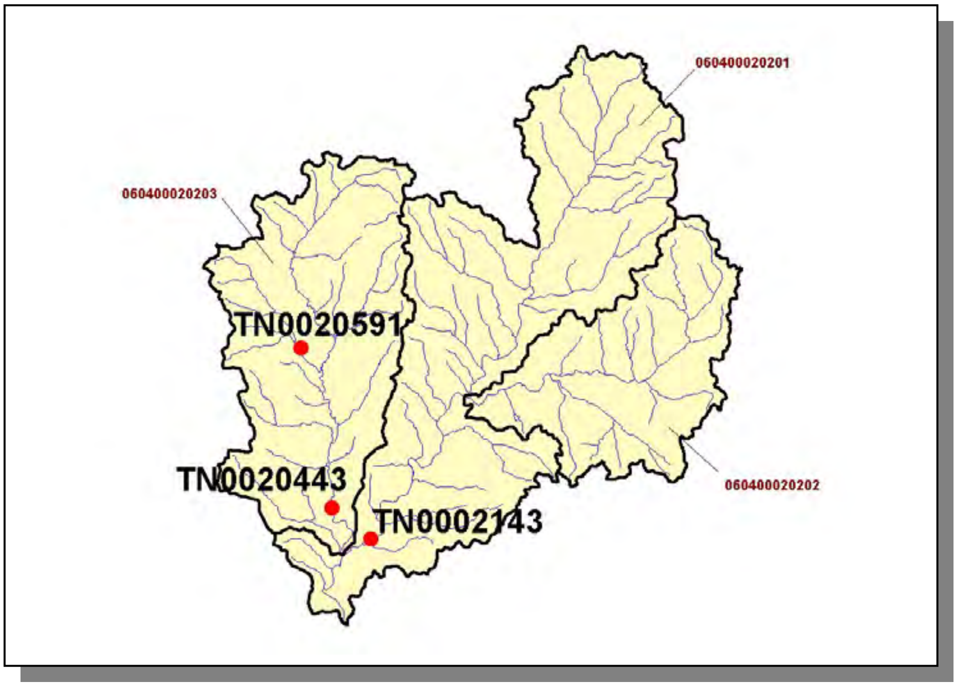


Figure 4-23. Location of NPDES Facilities in Subwatershed 0604000202. *Subwatershed 0604000202, 0604000202, and 0604000202 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

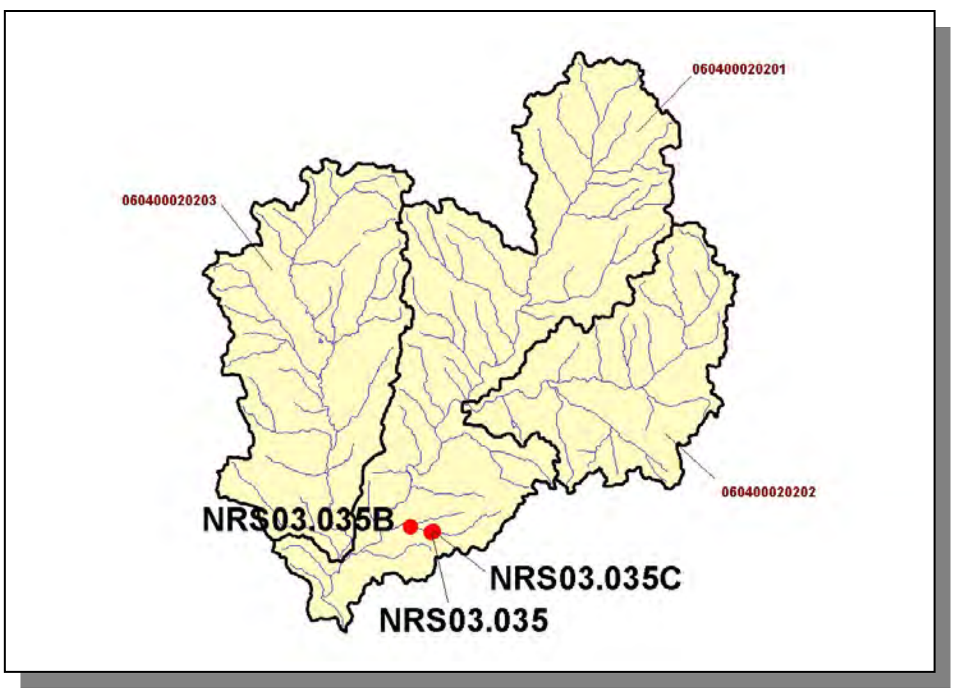


Figure 4-24. Location of ARAP Sites (Individual Permits) in Subwatershed 0604000202. *Subwatershed 0604000202, 0604000202, and 0604000202 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

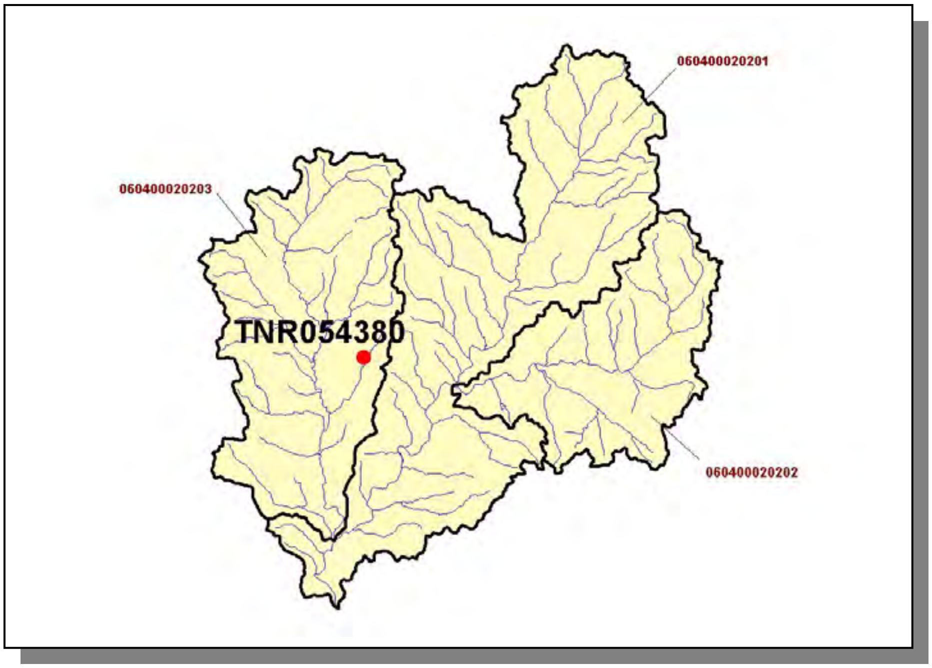


Figure 4-25. Location of TMSP Facilities in Subwatershed 0604000202. *Subwatershed 0604000202, 0604000202, and 0604000202 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

4.2.B.ii.a. <u>Dischargers to Water Bodies Listed on the 2002 303(d) List</u>

There is one NPDES facility discharging to water bodies listed on the 2002 303(d) list in Subwatershed 0604000202:

- TN0020591 (Bell Buckle STP) discharges to Bell Buckle Creek @ RM 0.8

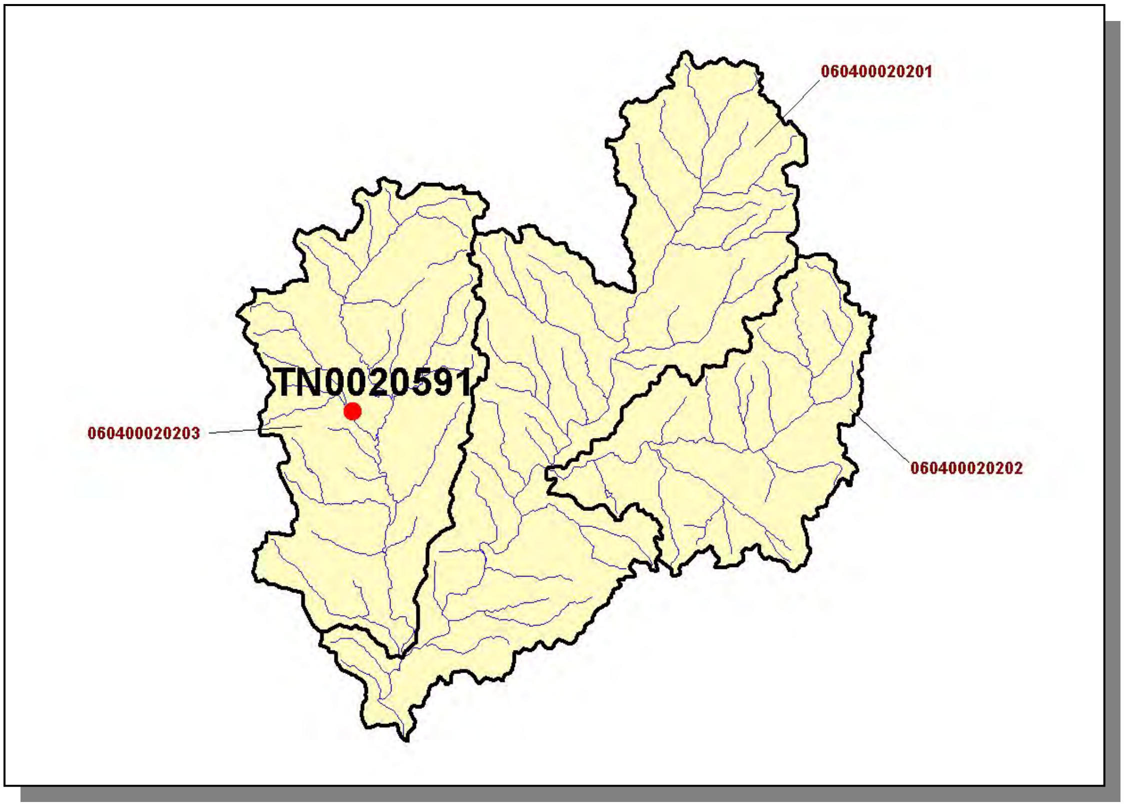


Figure 4-26. Location of NPDES Dischargers to Water Bodies Listed on the 2002 303(d) List in Subwatershed 0604000202. *Subwatershed 0604000202, 0604000202, and 0604000202 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

PERMIT #	1Q10	3Q10	7Q10	3Q20	QDESIGN
TN0020591			0	0	0.15

Table 4-13. Receiving Stream Flow Information for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000202. *Data are in million gallons per day (MGD). Data were obtained from the USGS publication Flow Duration and Low Flows of Tennessee Streams Through 1992 or from permit files.*

PERMIT #	$CBOD_5$	FECAL COLIFORM	*E. COLI*	NH_3	TRC	TSS	SETTLEABLE SOLIDS	DO	pH
TN0020591	X	X	X	X	X	X	X	X	X

Table 4-14. Parameters Monitored for Daily Maximum Limits for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000202. *$CBOD_5$, Carbonaceous Biochemical Oxygen Demand (5-Day); TRC, Total Residual Chlorine; TSS, Total Suspended Solids.*

4.2.B.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens (layers)	Chickens (Broilers Sold)	Hogs	Sheep
6,276	13,411	949	18	5,415,250	982	96

Table 4-15. Summary of Livestock Count Estimates in Subwatershed 0604000202. *According to the 1997 Census of Agriculture (http://www.nass.usda.gov/census/),* ***"****Cattle" includes heifers, heifer calves, steers, bulls and bull calves; "Chickens" are layers 20 weeks and older; "Chickens Sold" are all chickens used to produce meat.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Bedford	74.6	74.6	0.5	1.3
Coffee	114.4	114.4	2.8	12.7
Total	**189.0**	**189.0**	**3.3**	**14.0**

Table 4-16. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 0604000202.

CROPS	TONS/ACRE/YEAR
Legumes (Pastureland)	0.12
Grass (Pastureland)	0.98
Grass (Hayland)	1.05
Legumes (Hayland)	0.32
Legumes, Grass (Hayland)	0.42
Grass, Forbs, Legumes (Mixed Pasture)	0.36
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	6.52
Cotton (Row Crops)	4.07
Soybeans (Row Crops)	9.51
Wheat (Close-Grown Cropland)	6.32
Other Vegetable and Truck Crop	4.37
Summer Fallow (Other Cropland)	4.60
Other Cropland not Planted	6.68
Berry (Horticulture)	4.60
Conservation Reserve Program Lands	0.26
Non-Agricultural Land Use	0.00
Farmsteads and Ranch Headquarters	0.10

Table 4-17. Annual Estimated Total Soil Loss in Subwatershed 0604000202.

4.2.C. 0604000203 (Duck River).

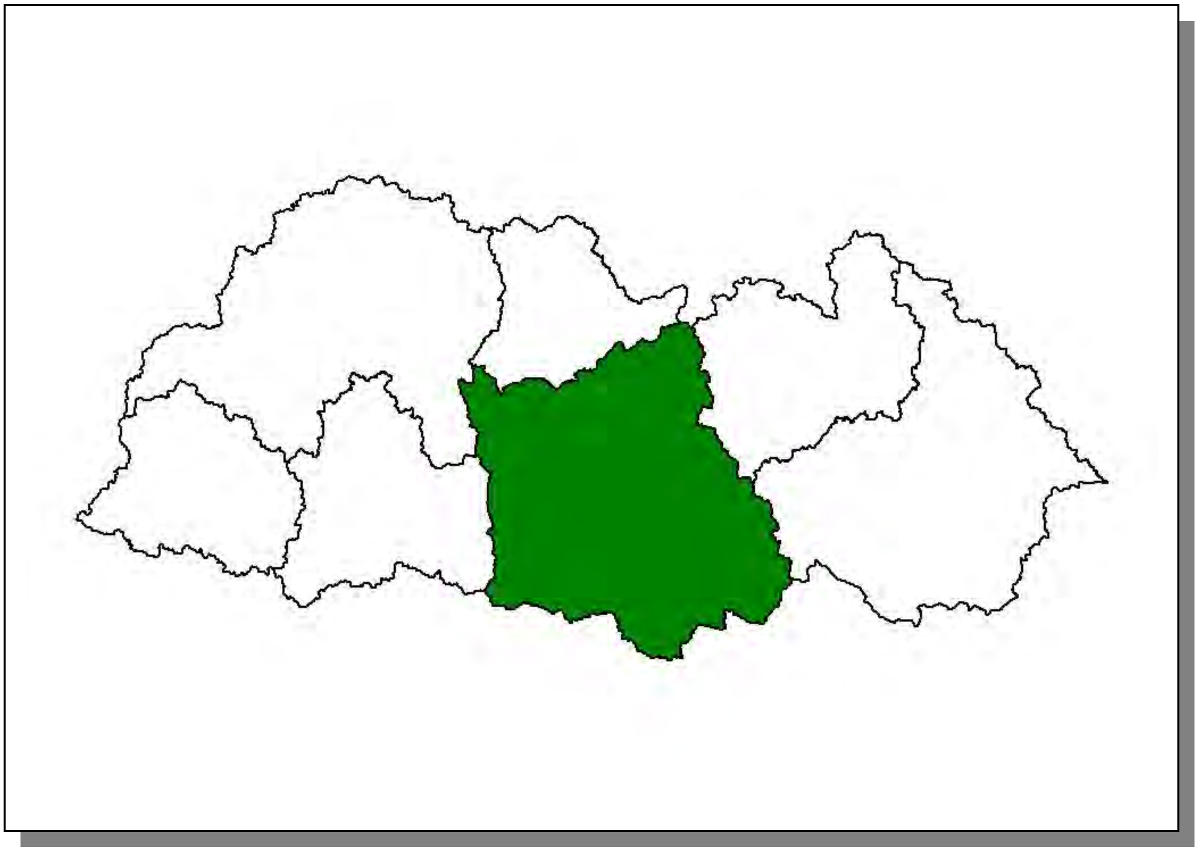


Figure 4-27. Location of Subwatershed 0604000203. *All Upper Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.C.i. General Description.

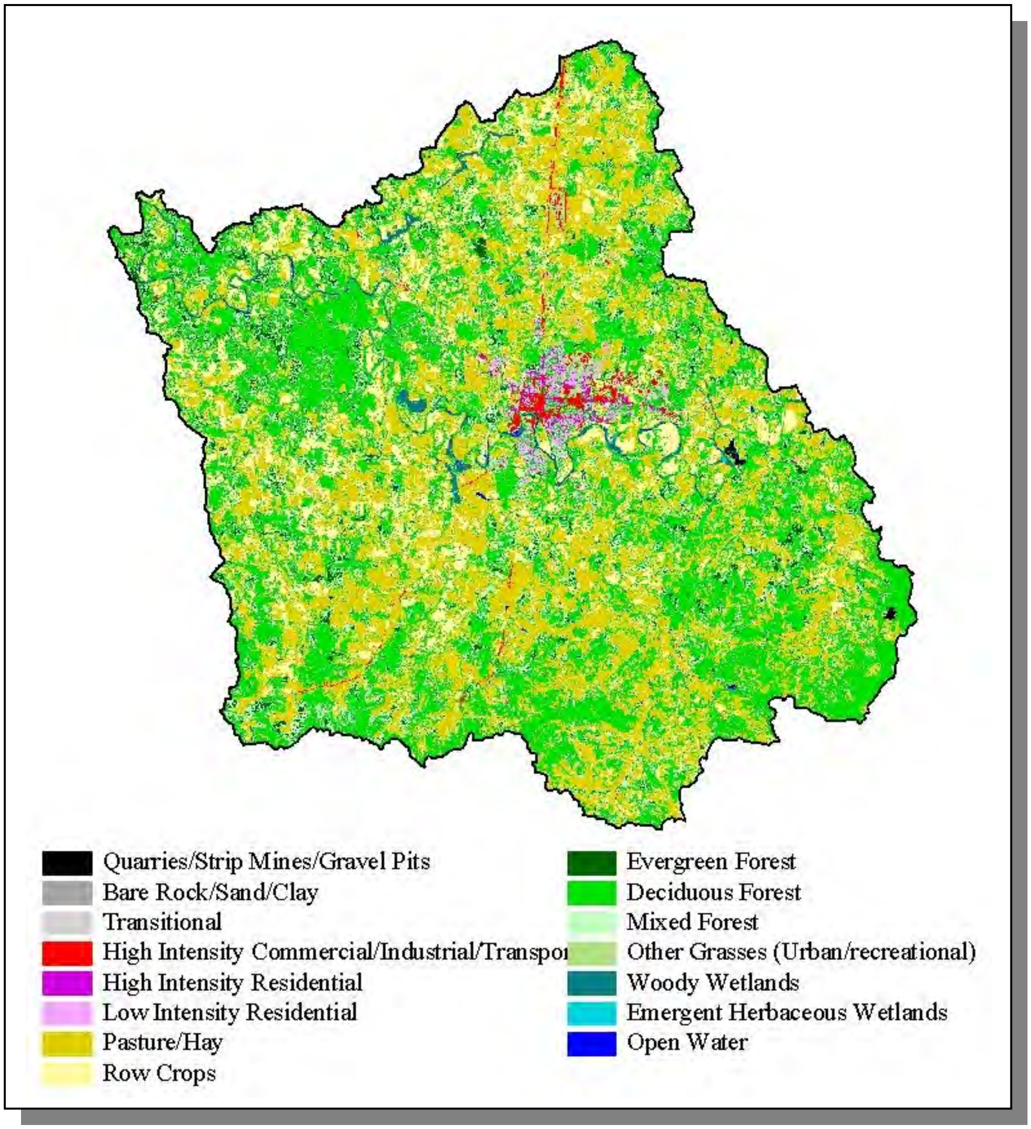


Figure 4-28. Illustration of Land Use Distribution in Subwatershed 0604000203.

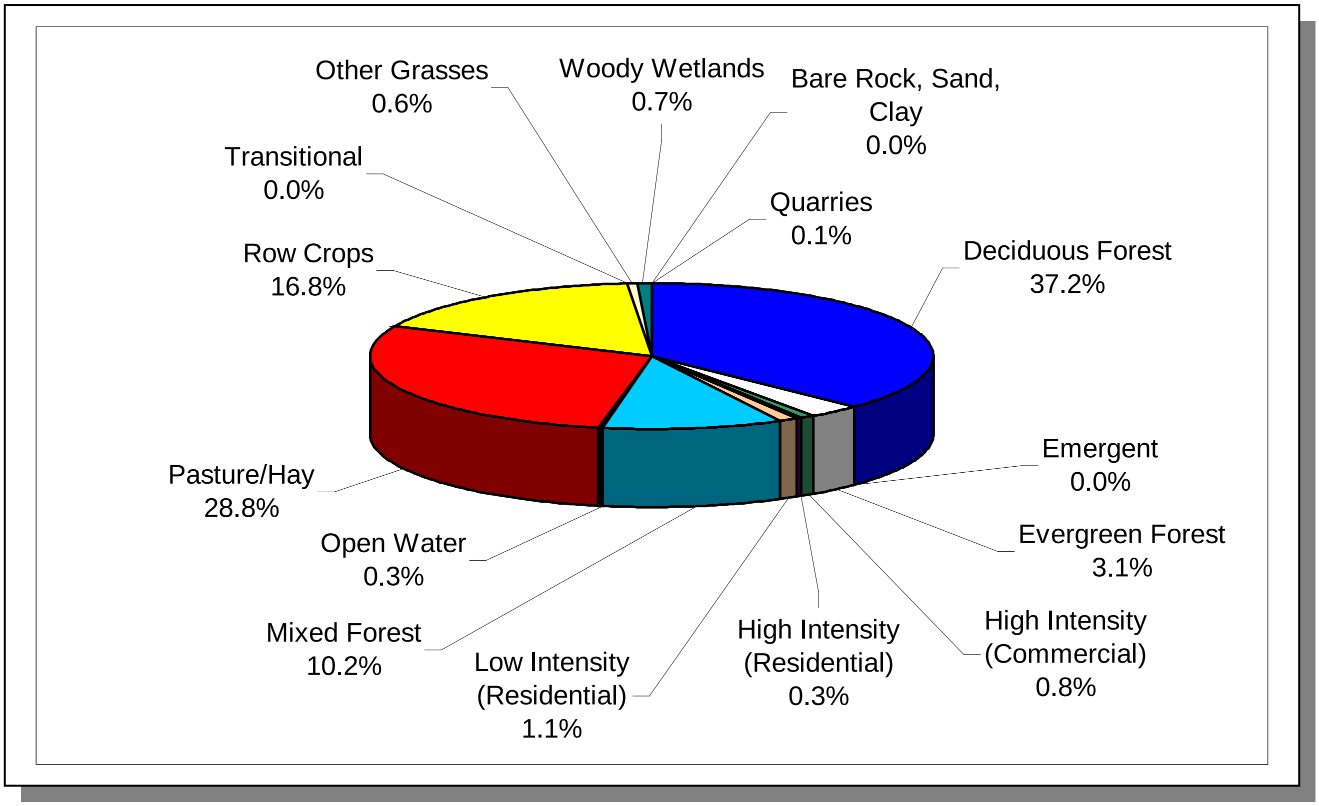


Figure 4-29. Land Use Distribution in Subwatershed 0604000203. *More information is provided in Appendix IV.*

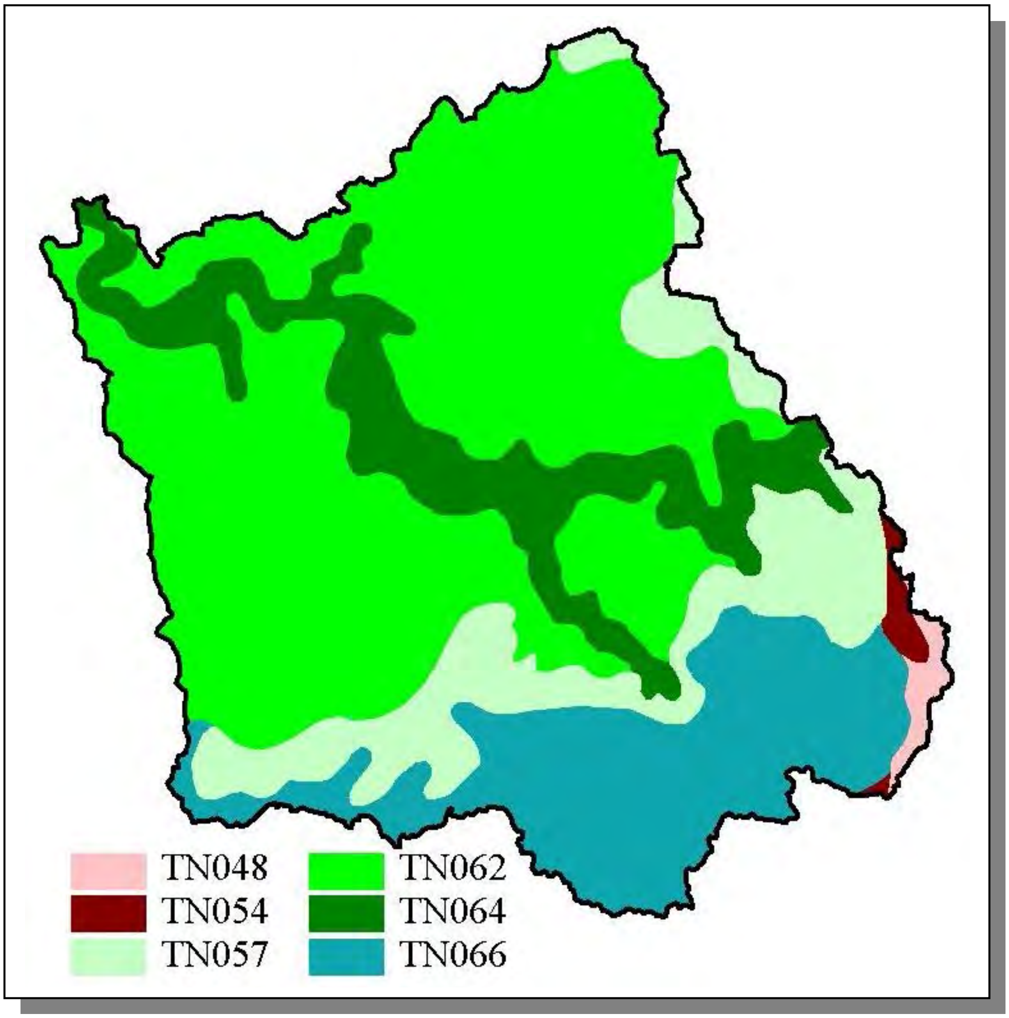


Figure 4-30. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000203.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN048	8.00	C	1.38	5.06	Silty Loam	0.42
TN054	0.00	C	3.04	4.84	Loam	0.32
TN057	8.00	C	1.14	5.01	Clayey Loam	0.33
TN062	0.00	C	0.98	4.40	Clayey Loam	0.26
TN064	7.00	C	1.19	5.82	Silty Loam	0.37
TN066	0.00	B	2.62	4.75	Loam	0.28

Table 4-18. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000203. *More information is provided in Appendix IV.*

	COUNTY POPULATION				ESTIMATED POPULATION IN WATERSHED			
County	1990	1997	2000	Portion of Watershed (%)	1990	1997	2000	% Change (1990-1997)
Bedford	30,411	34,203	37,586	53.97	16,412	18,458	20,284	23.6
Lincoln	28,157	29,336	31,340	0.48	135	141	150	11.1
Marshall	21,539	25,687	26,767	0.37	79	94	98	24.1
Moore	4,721	5,205	5,740	7.66	362	399	440	21.5
Totals	**84,828**	**94,431**	**101,433**		**16,986**	**19,092**	**20,972**	**23.5**

Table 4-19. Population Estimates in Subwatershed 0604000203.

			NUMBER OF HOUSING UNITS			
Populated Place	County	Population	Total	Public Sewer	Septic Tank	Other
Shelbyville	Bedford	14,049	6,163	5,846	299	18

Table 4-20. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 0602000203.

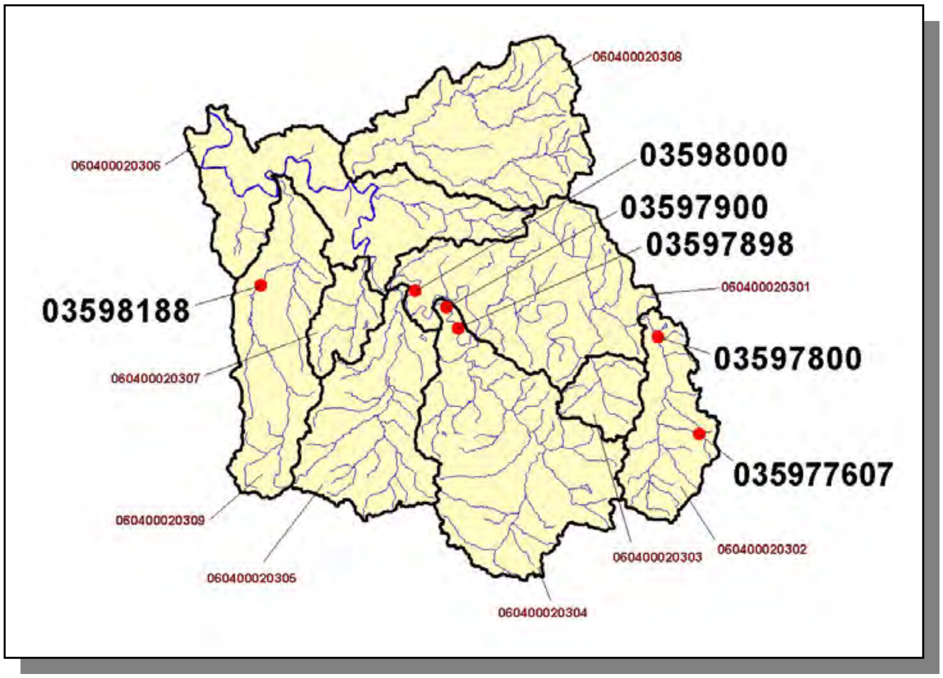


Figure 4-31. Location of Historical Streamflow Data Collection Sites in Subwatershed 0604000203. *Subwatershed 060400020301, 060400020302, 060400020303, 060400020304, 060400020305, 060400020306, 060400020307, 060400020308 and 060400020309 boundaries are shown for reference. More information is provided in Appendix IV.*

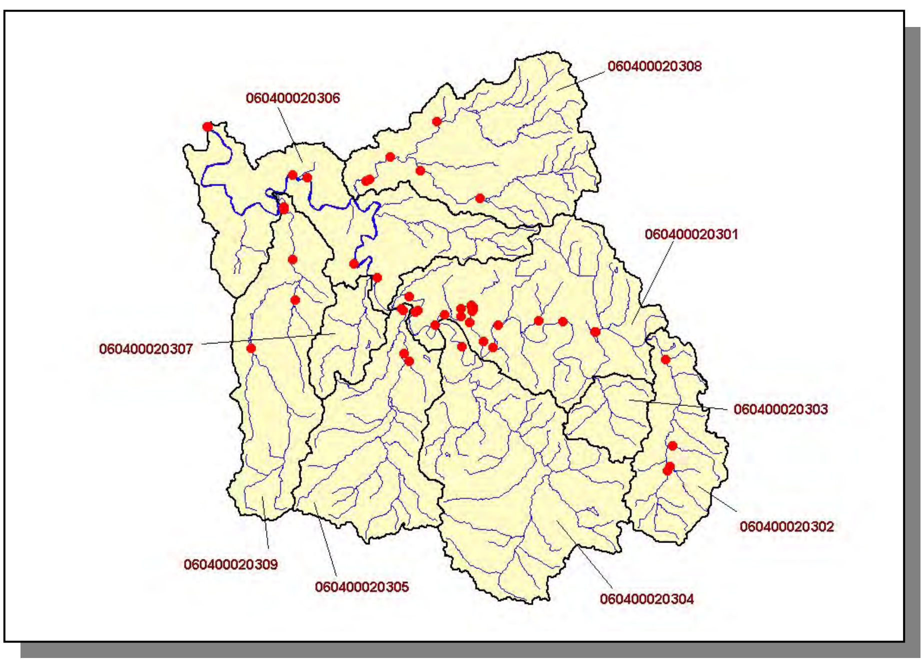


Figure 4-32. Location of STORET Monitoring Sites in Subwatershed 0604000203. *Subwatershed 060400020301, 060400020302, 060400020303, 060400020304, 060400020305, 060400020306, 060400020307, 060400020308 and 060400020309 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.C.ii. Point Source Contributions.

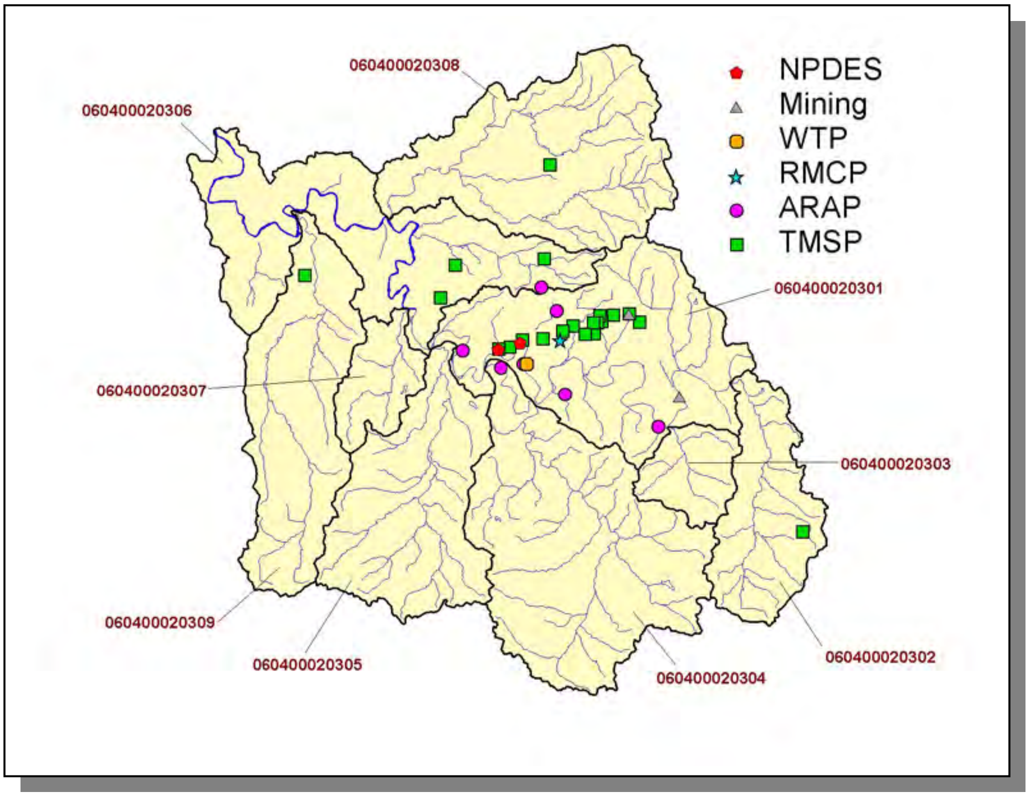


Figure 4-33. Location of Active Point Source Facilities in Subwatershed 0604000203. *Subwatershed 060400020301, 060400020302, 060400020303, 060400020304, 060400020305, 060400020306, 060400020307, 060400020308, and 060400020309 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-34. Location of NPDES Facilities in Subwatershed 0604000203. *Subwatershed 060400020301, 060400020302, 060400020303, 060400020304, 060400020305, 060400020306, 060400020307, 060400020308, and 060400020309 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-35. Location of Active Mining Facilities in Subwatershed 0604000203. *Subwatershed 060400020301, 060400020302, 060400020303, 060400020304, 060400020305, 060400020306, 060400020307, 060400020308, and 060400020309 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-36. Location of Water Treatment Plants in Subwatershed 0604000203. *Subwatershed 060400020301, 060400020302, 060400020303, 060400020304, 060400020305, 060400020306, 060400020307, 060400020308, and 060400020309 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-37. Location of Ready Mix Concrete Plants in Subwatershed 0604000203. *Subwatershed 060400020301, 060400020302, 060400020303, 060400020304, 060400020305, 060400020306, 060400020307, 060400020308, and 060400020309 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

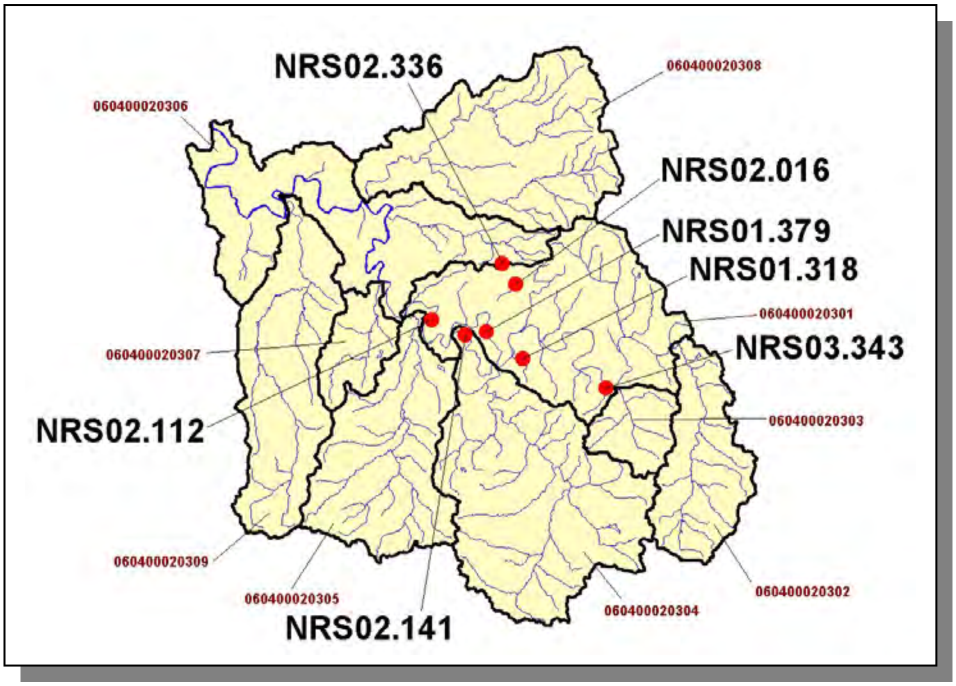


Figure 4-38. Location of ARAP Sites (Individual Permits) in Subwatershed 0604000203. *Subwatershed 060400020301, 060400020302, 060400020303, 060400020304, 060400020305, 060400020306, 060400020307, 060400020308, and 060400020309 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

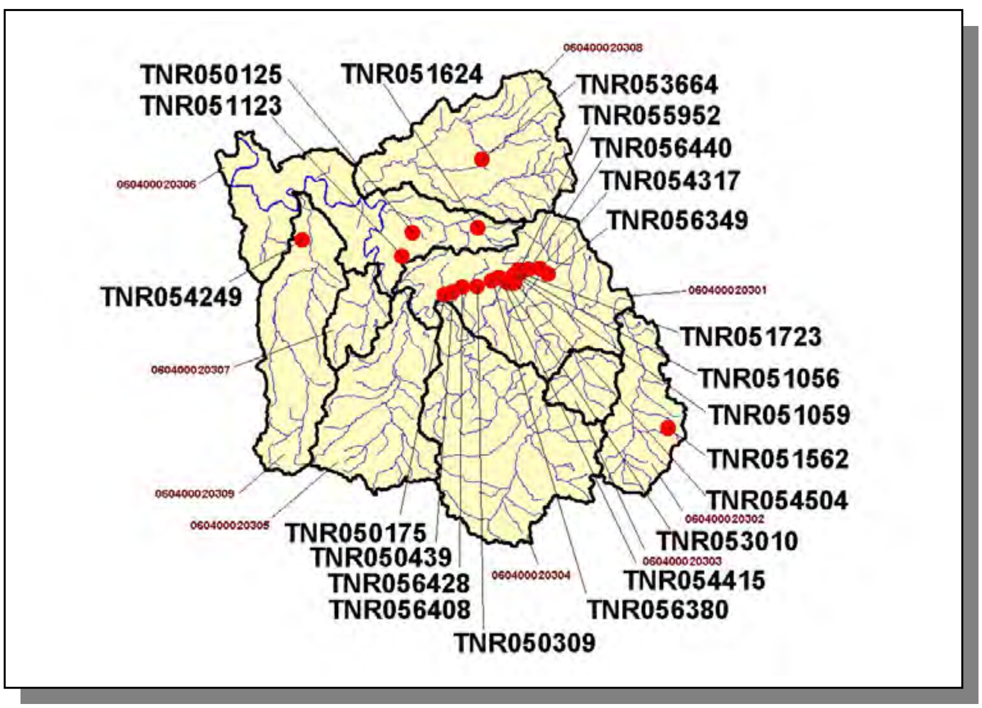


Figure 4-39. Location of TMSP Facilities in Subwatershed 0604000203. *Subwatershed 060400020301, 060400020302, 060400020303, 060400020304, 060400020305, 060400020306, 060400020307, 060400020308, and 060400020309 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

4.2.C.ii.a. Dischargers to Water Bodies Listed on the 2002 303(d) List

There are two NPDES facilities discharging to water bodies listed on the 2002 303(d) list in Subwatershed 0604000203:

- TN0024180 (Shelbyville STP) discharges to Duck River @ RM 221.3
- TN0002135 (Tyson Foods) discharges to Duck River @ RM 220.5

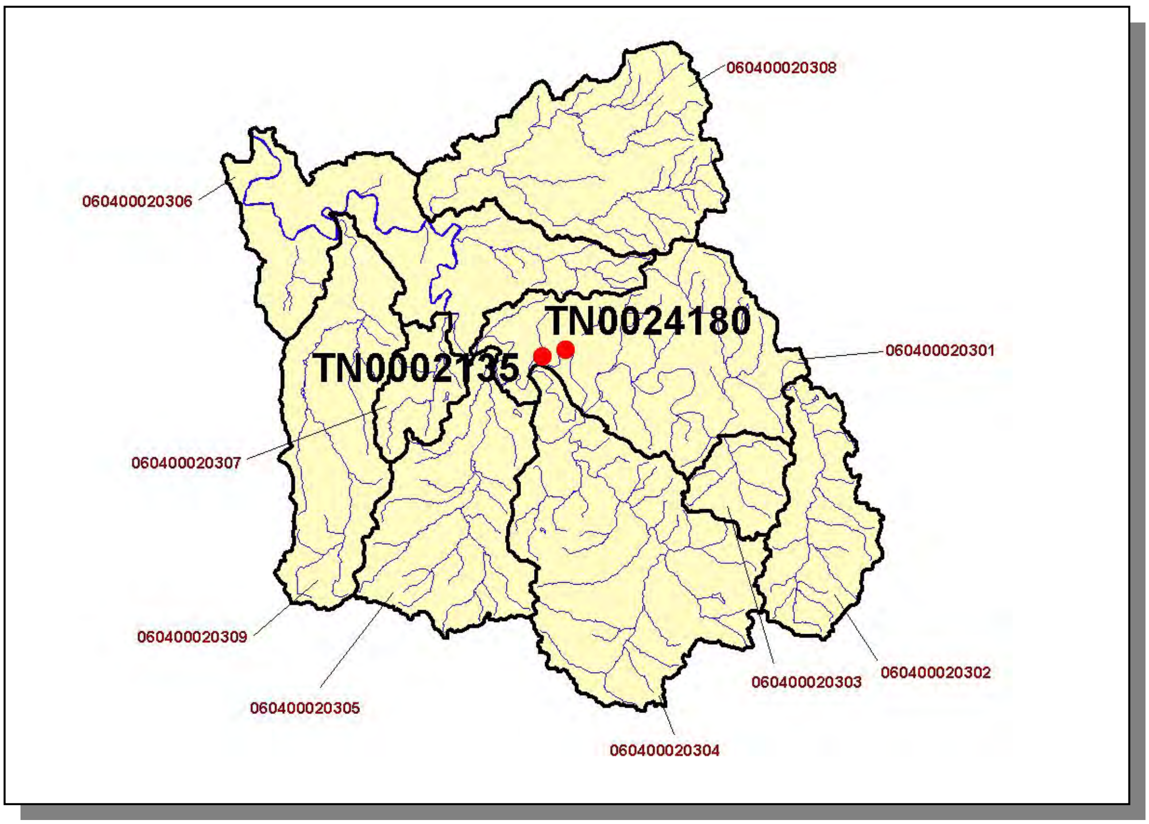


Figure 4-40. Location of NPDES Dischargers to Water Bodies Listed on the 2002 303(d) List in Subwatershed 0604000203. *Subwatershed 060400020301, 060400020302, 060400020303, 060400020304, 060400020305, 060400020306, 060400020307, 060400020308, and 060400020309 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

PERMIT #	1Q10	3Q10	7Q10	3Q20	QDESIGN
TN0024180	58.6	59.6	60.8	53.8	4.9
TN0002135	58.6	59.6	60.8	53.8	

Table 4-21. Receiving Stream Flow Information for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000203. *Data are in million gallons per day (MGD). Data were obtained from the USGS publication Flow Duration and Low Flows of Tennessee Streams Through 1992 or from permit files.*

PERMIT #	WET	$CBOD_5$	FECAL COLIFORM	NH_3	*E. COLI*	TRC	TSS	SETTLEABLE SOLIDS	DO	pH
TN0024180	X	X	X		X	X	X	X	X	X
TN0002135	X	X	X	X		X	X	X	X	X

Table 4-22. Parameters Monitored for Daily Maximum Limits for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000203. *WET, Whole Effluent Toxicity; $CBOD_5$, Carbonaceous Biochemical Oxygen Demand (5-Day); TRC, Total Residual Chlorine; TSS, Total Suspended Solids.*

4.2.C.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens (Layers)	Chickens (Broilers Sold)	Hogs	Sheep
13,302	27,478	1,815	38	12,432,564	1,850	189

Table 4-23. Summary of Livestock Count Estimates in Subwatershed 0604000203. *According to the 1997 Census of Agriculture (http://www.nass.usda.gov/census/), **"**Cattle" includes heifers, heifer calves, steers, bulls and bull calves; "Chickens" are layers 20 weeks and older; "Chickens Sold" are all chickens used to produce meat.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Bedford	74.6	74.6	0.5	1.3
Lincoln	136.7	136.7	1.1	3.2
Moore	36.6	36.6	0.0	0.0
Totals	**247.9**	**247.9**	**1.6**	**4.5**

Table 4-24. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 0604000203.

CROPS	TONS/ACRE/YEAR
Grass (Pastureland)	0.77
Grass (Hayland)	1.23
Legumes (Hayland)	0.30
Legumes, Grass (Hayland)	0.56
Grass, Forbs, Legumes (Mixed Pasture)	0.48
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	4.29
Potatoes (Row Crops)	3.04
Soybeans (Row Crops)	6.09
Tobacco (Row Crops)	9.27
Wheat (Close-Grown Cropland)	2.26
Other Vegetable and Truck Crop	2.52
Summer Fallow (Other Cropland)	4.62
Other Cropland not Planted	0.23
Other Lands in Farms	0,21
Conservation Reserve Program Lands	0.33
Non-Agricultural Land Use	0.00
Farmsteads and Ranch Headquarters	0.05

Table 4-25. Annual Estimated Total Soil Loss in Subwatershed 0604000203.

4.2.D. 0604000204 (North Fork Creek).

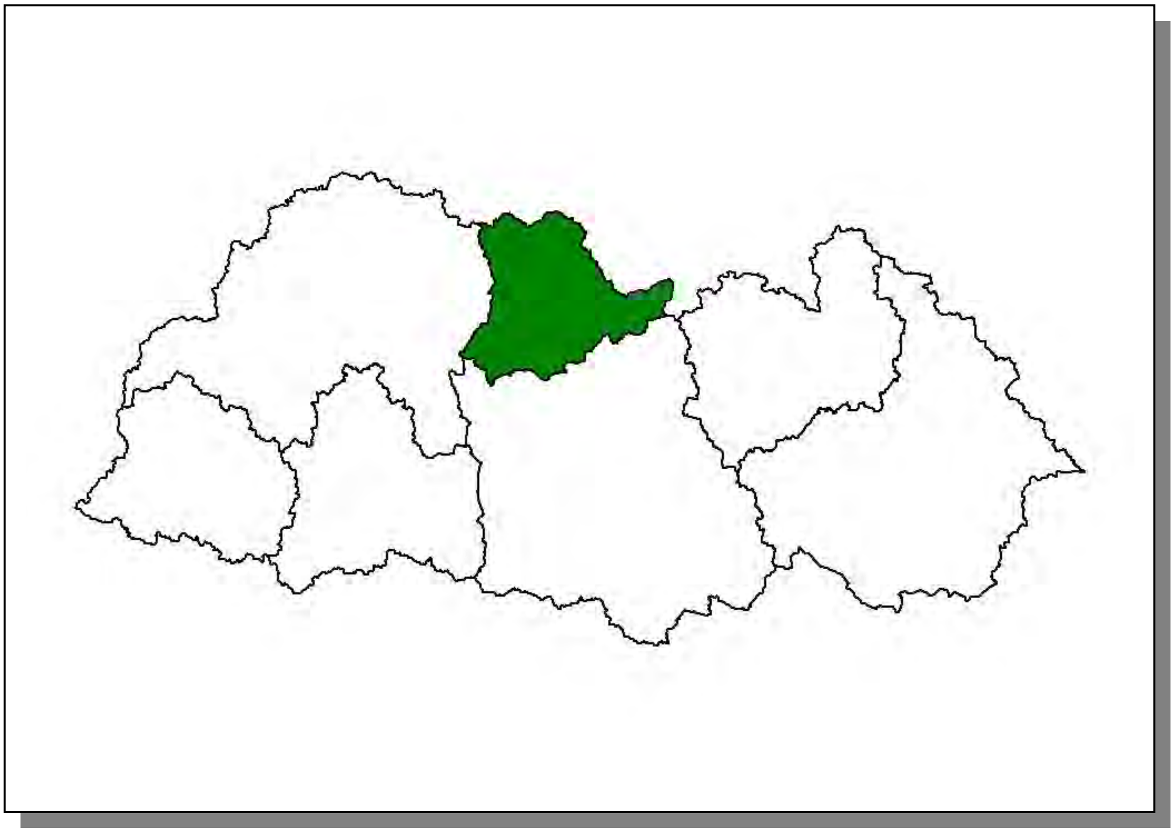


Figure 4-41. Location of Subwatershed 0604000204. *All Upper Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.D.i. General Description.

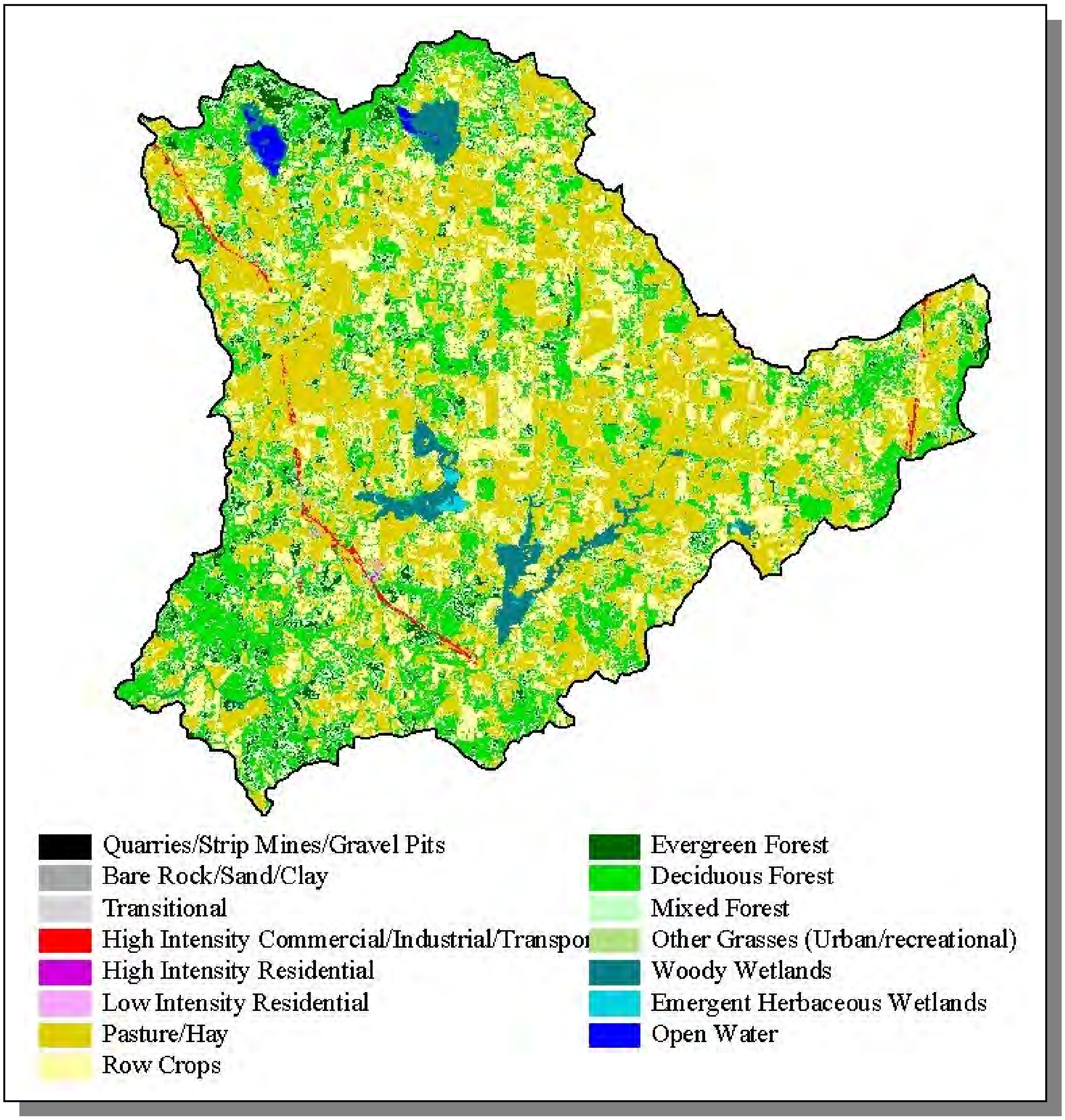


Figure 4-42. Illustration of Land Use Distribution in Subwatershed 0604000204.

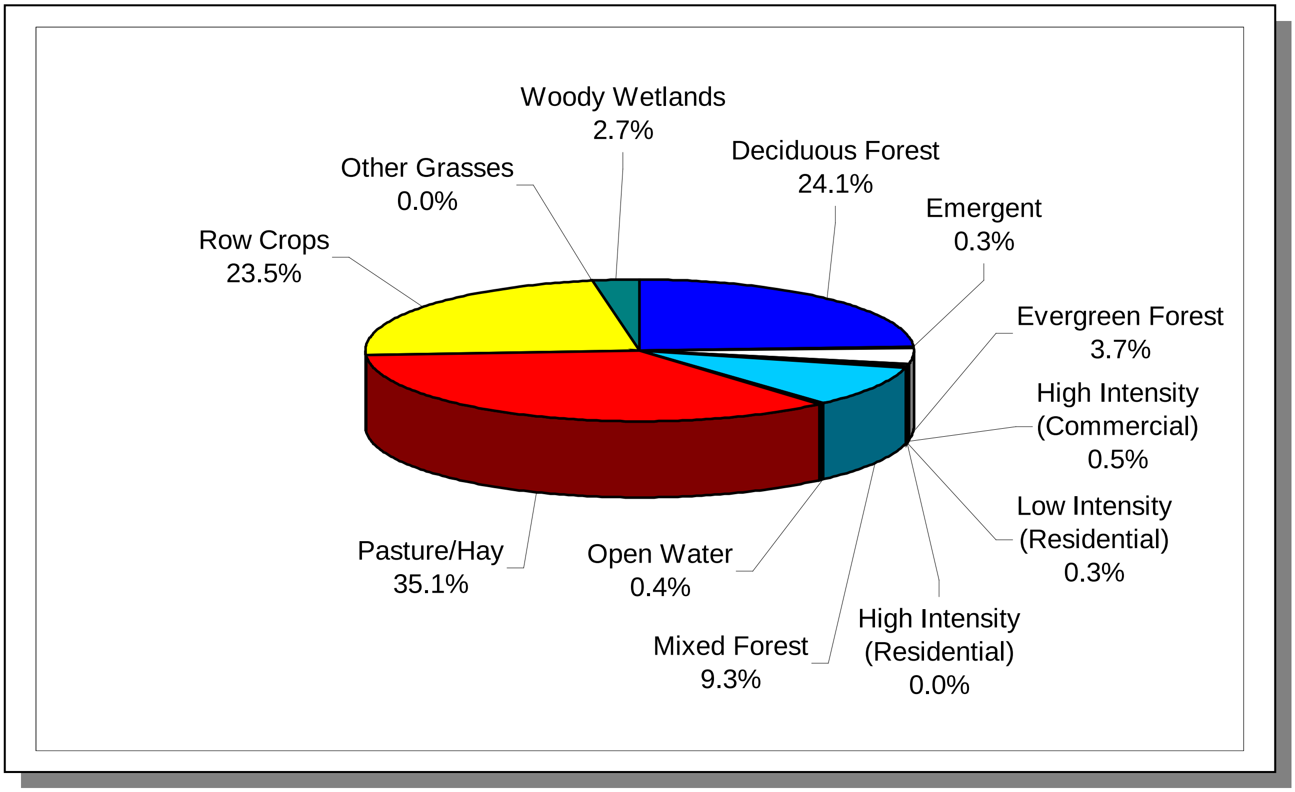


Figure 4-43. Land Use Distribution in Subwatershed 0604000204. *More information is provided in Appendix IV.*

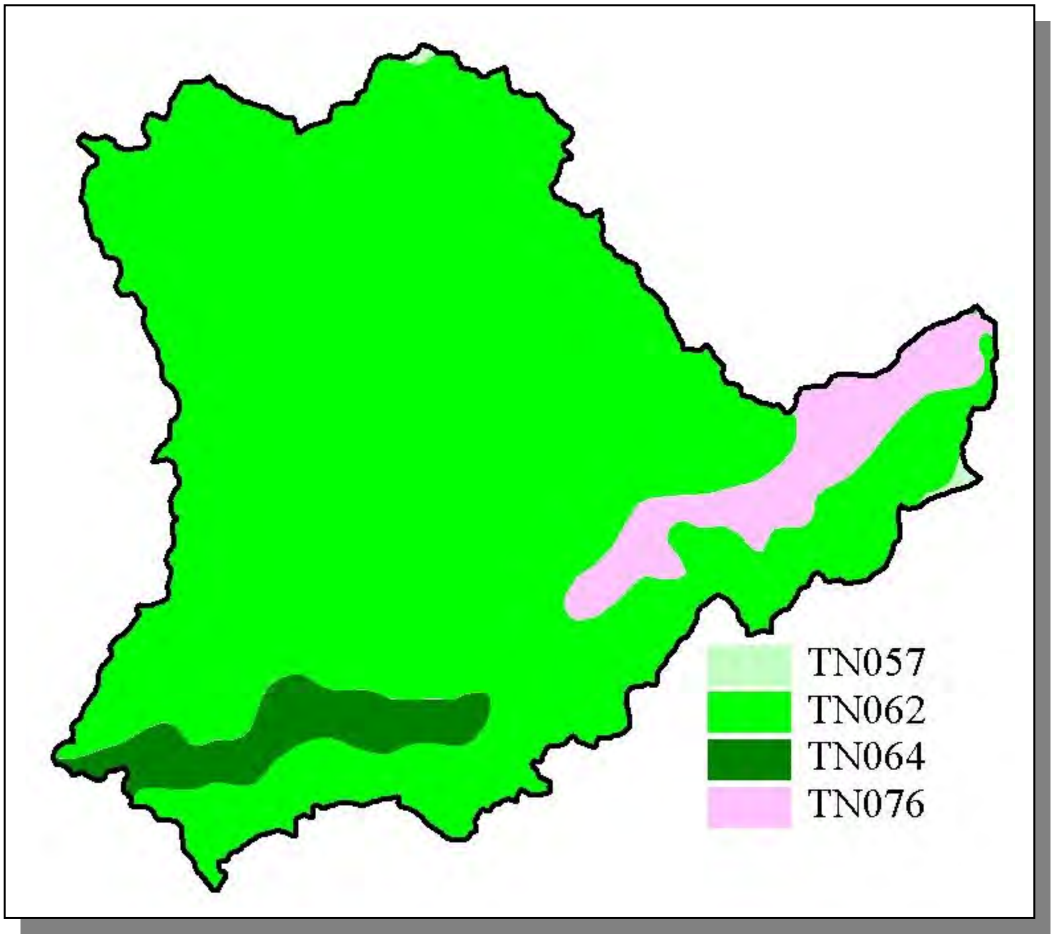


Figure 4-44. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000204.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN057	0.00	C	1.14	5.01	Clayey Loam	0.33
TN062	0.00	C	0.98	4.40	Clayey Loam	0.26
TN064	7.00	C	1.19	5.82	Silty Loam	0.37
TN076	28.00	C	0.73	6.26	Silty Loam	0.33

Table 4-26. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000204. *More information is provided in Appendix IV.*

	COUNTY POPULATION				ESTIMATED POPULATION IN WATERSHED			
County	1990	1997	2000	Portion of Watershed (%)	1990	1997	2000	% Change (1990-1997)
Bedford	30,411	34,203	37,586	16.18	4,920	5,533	6,081	23.6
Rutherford	118,570	159,987	182,023	0.6	711	960	1,092	53.6
Totals	**170,520**	**219,877**	**246,376**		**5,631**	**6,493**	**7,173**	**27.4**

Table 4-27. Population Estimates in Subwatershed 0604000204.

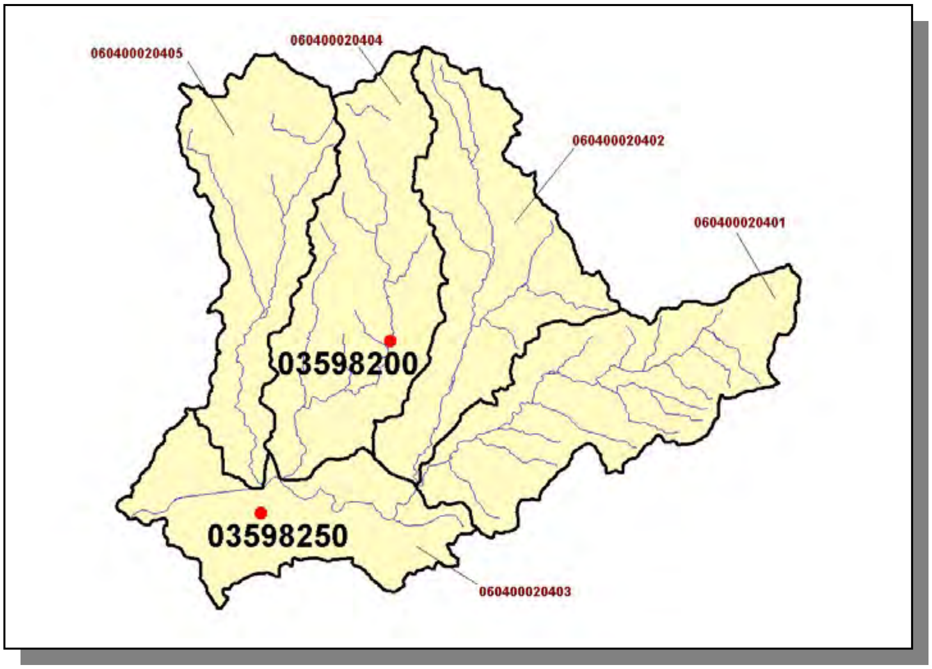


Figure 4-45. Location of Historical Streamflow Data Collection Sites in Subwatershed 0604000204. *Subwatershed 060400020401, 060400020402, 060400020403, 060400020404, and 060400020405 boundaries are shown for reference. More information is provided in Appendix IV.*

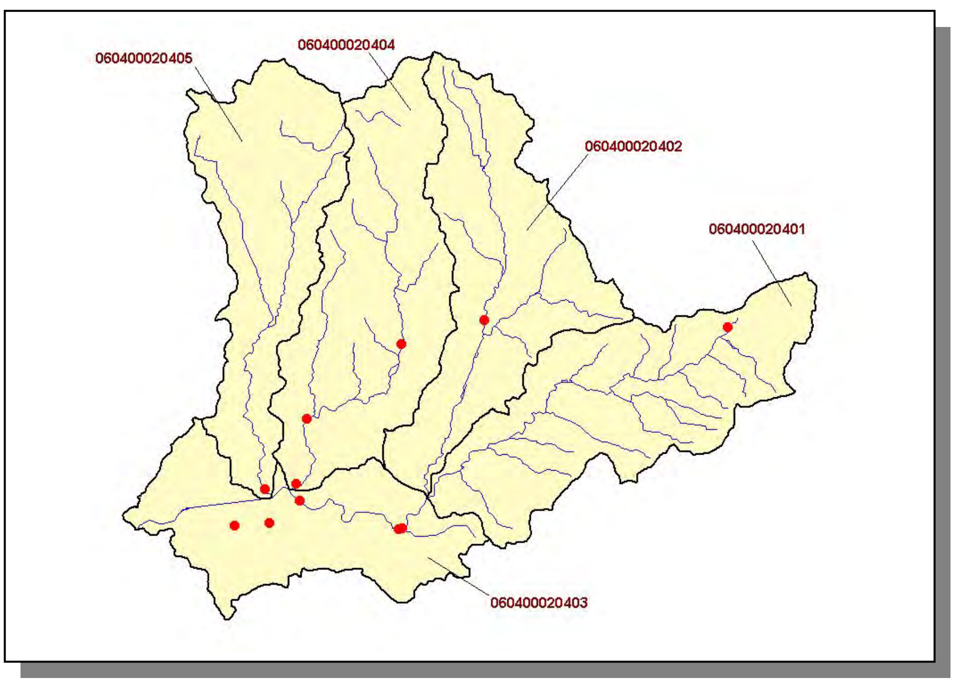


Figure 4-46. Location of STORET Monitoring Sites in Subwatershed 0604000204. *Subwatershed 060400020401, 060400020402, 060400020403, 060400020404, and 060400020405 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.D.ii. Point Source Contributions.

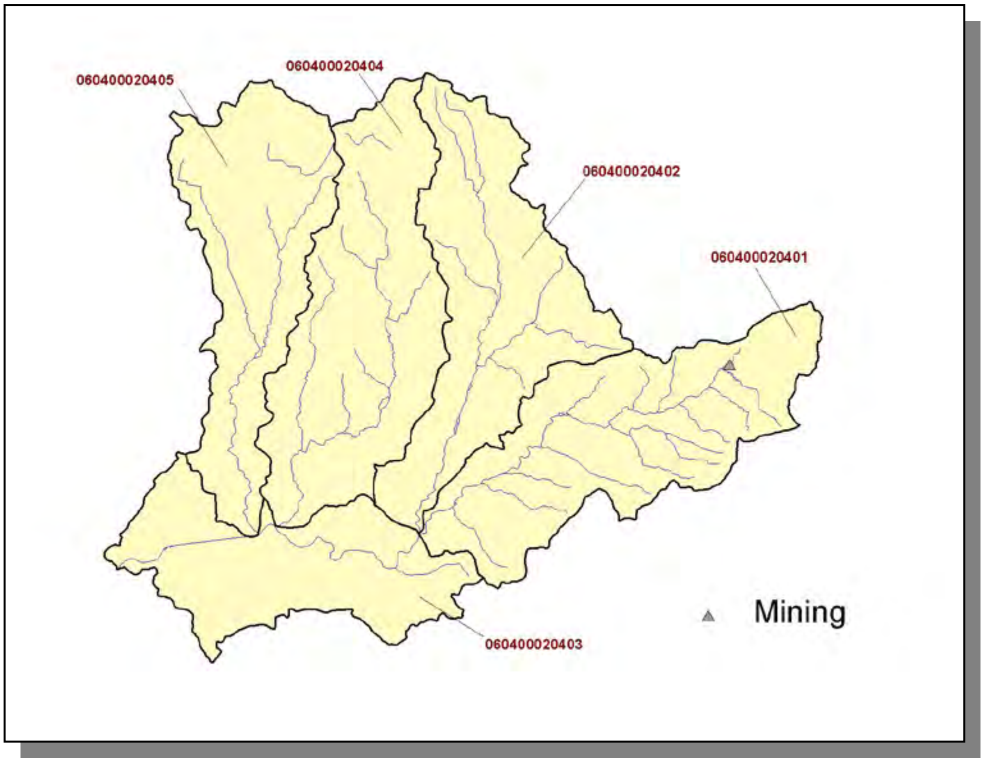


Figure 4-47. Location of Active Point Source Facilities in Subwatershed 0604000204. *Subwatershed 060400020401, 060400020402, 060400020403, 060400020404, and 060400020405 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

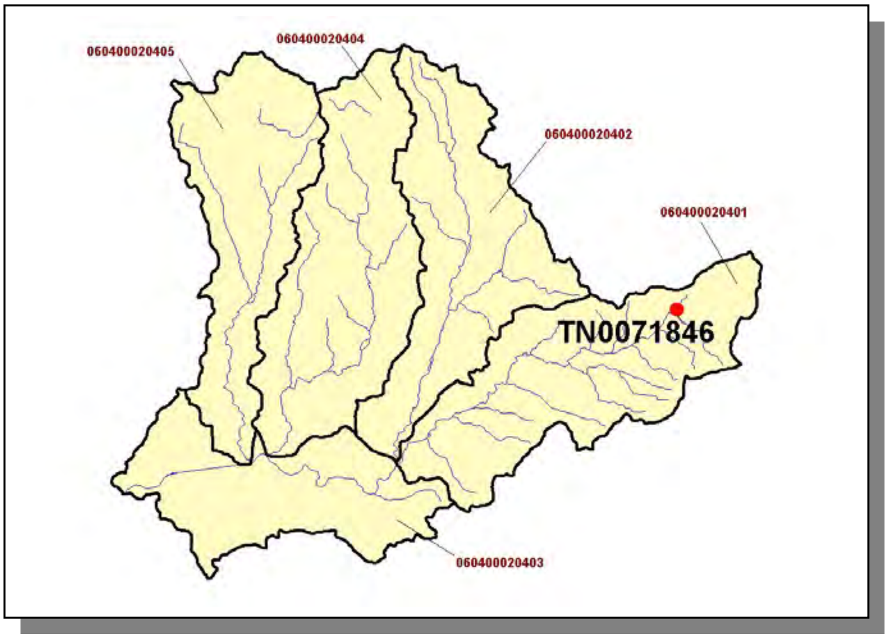


Figure 4-48. Location of Active Mining Facilities in Subwatershed 0604000204. *Subwatershed 060400020401, 060400020402, 060400020403, 060400020404, and 060400020405 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

4.2.D.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Milk Cow	Cattle	Chickens (Layers)	Chickens (Broilers Sold)	Hogs	Sheep
4,806	659	9,952	14	4,428,225	674	71

Table 4-28. Summary of Livestock Count Estimates in Subwatershed 0604000204*. According to the 1997 Census of Agriculture (http://www.nass.usda.gov/census/),* **"***Cattle" includes heifers, heifer calves, steers, bulls and bull calves; "Chickens" are layers 20 weeks and older; "Chickens Sold" are all chickens used to produce meat.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Bedford	74.6	74.6	0.5	1.3

Table 4-29. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 0604000204.

CROPS	TONS/ACRE/YEAR
Legumes (Pastureland)	0.12
Grass (Pastureland)	0.73
Grass (Hayland)	1.19
Legumes (Hayland)	0.32
Legumes, Grass (Hayland)	0.56
Grass, Forbs, Legumes (Mixed Pasture)	0.42
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	4.25
Cotton (Row Crops)	4.79
Soybeans (Row Crops)	5.93
Wheat (Close-Grown Cropland)	2.22
Summer Fallow (Other Cropland)	4.60
Other Cropland not Planted	0.23
Berry (Horticulture)	0.47
Conservation Reserve Program Lands	0.33
Non-Agricultural Land Use	0.00
Other Lands in Farm	0.05
Farmsteads and Ranch Headquarters	0.06

Table 4-30. Annual Soil Loss in Subwatershed 0604000204.

4.2.E. 0604000205 (Duck River).

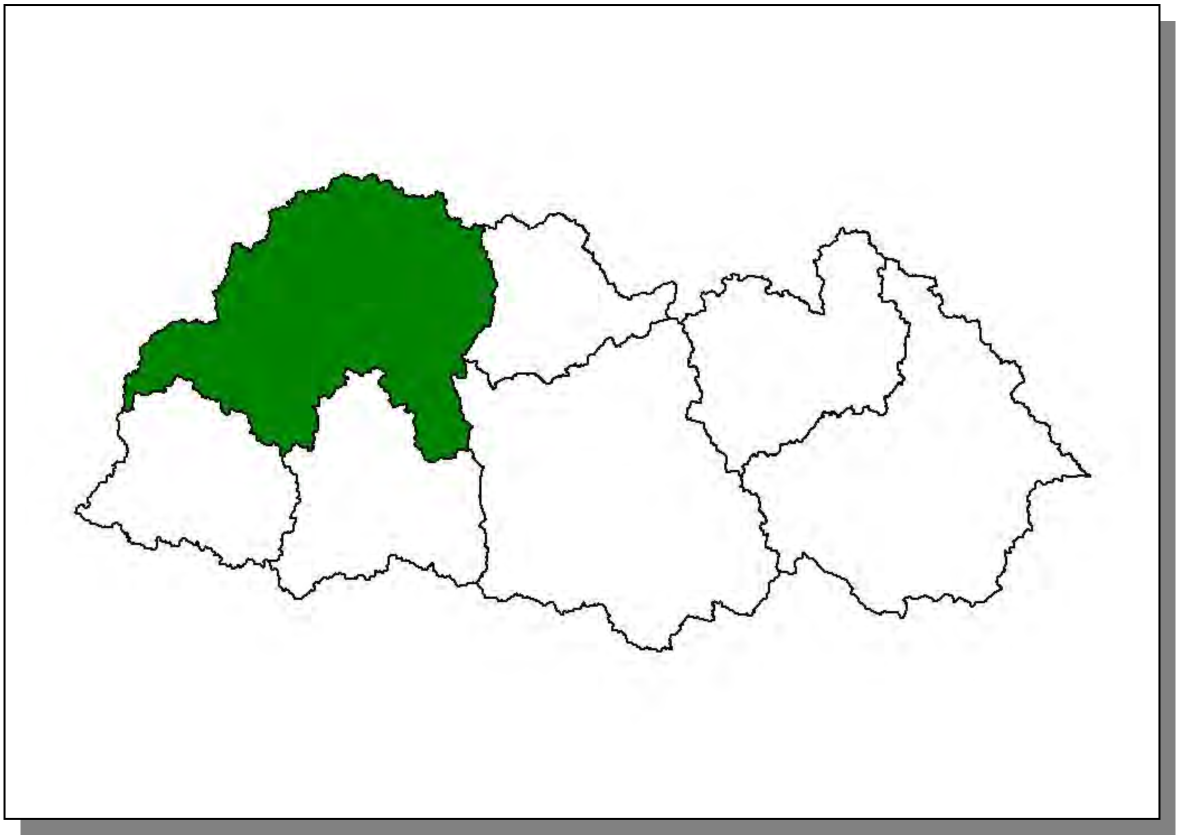


Figure 4-49. Location of Subwatershed 0604000205. *All Upper Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.E.i. General Description.

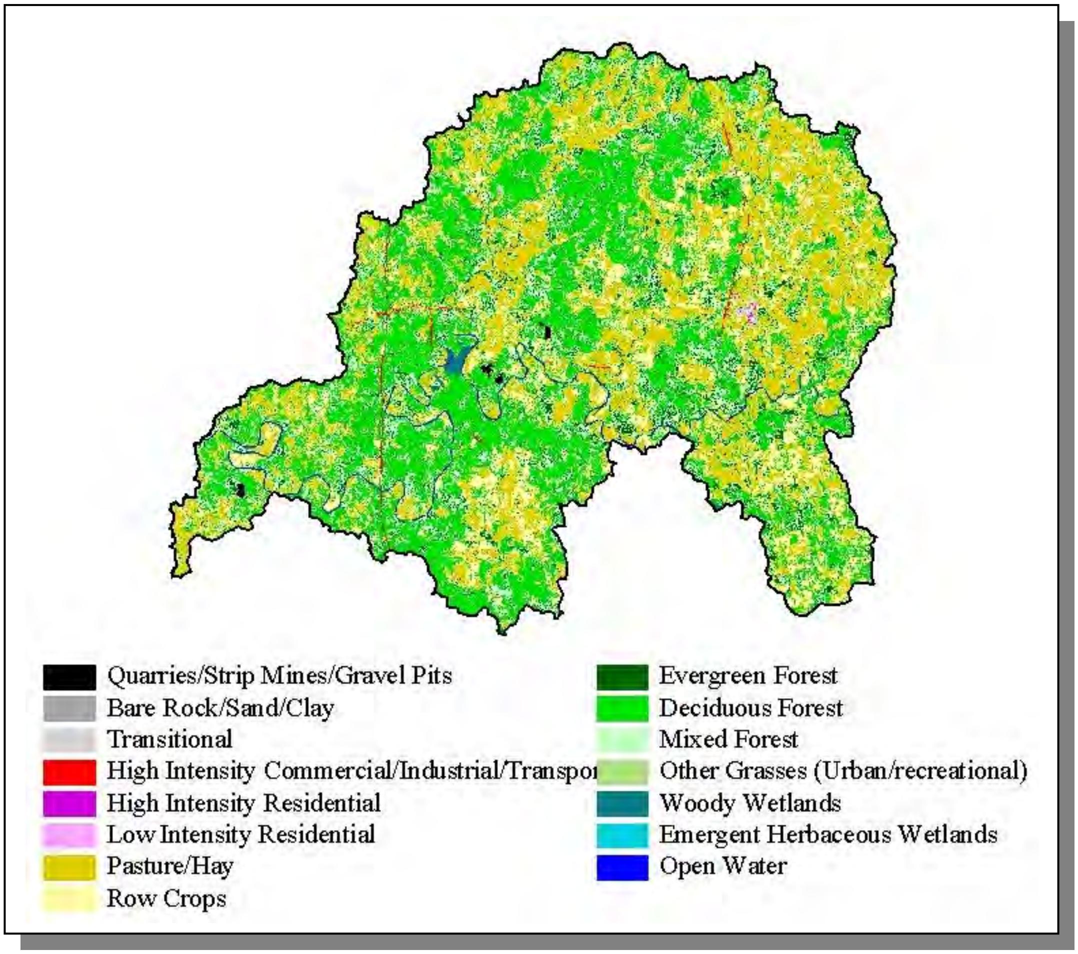


Figure 4-50. Illustration of Land Use Distribution in Subwatershed 0604000205.

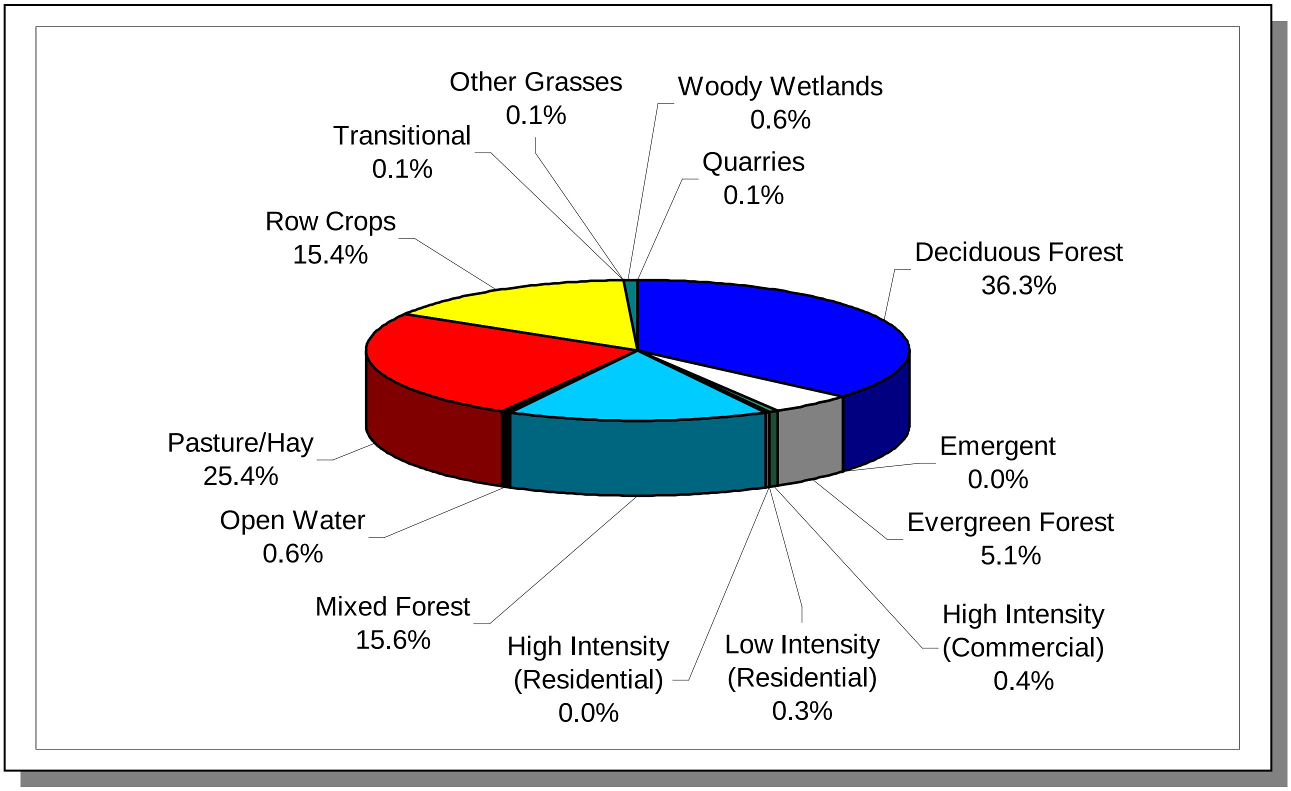


Figure 4-51. Land Use Distribution in Subwatershed 0604000205. *More information is provided in Appendix IV.*

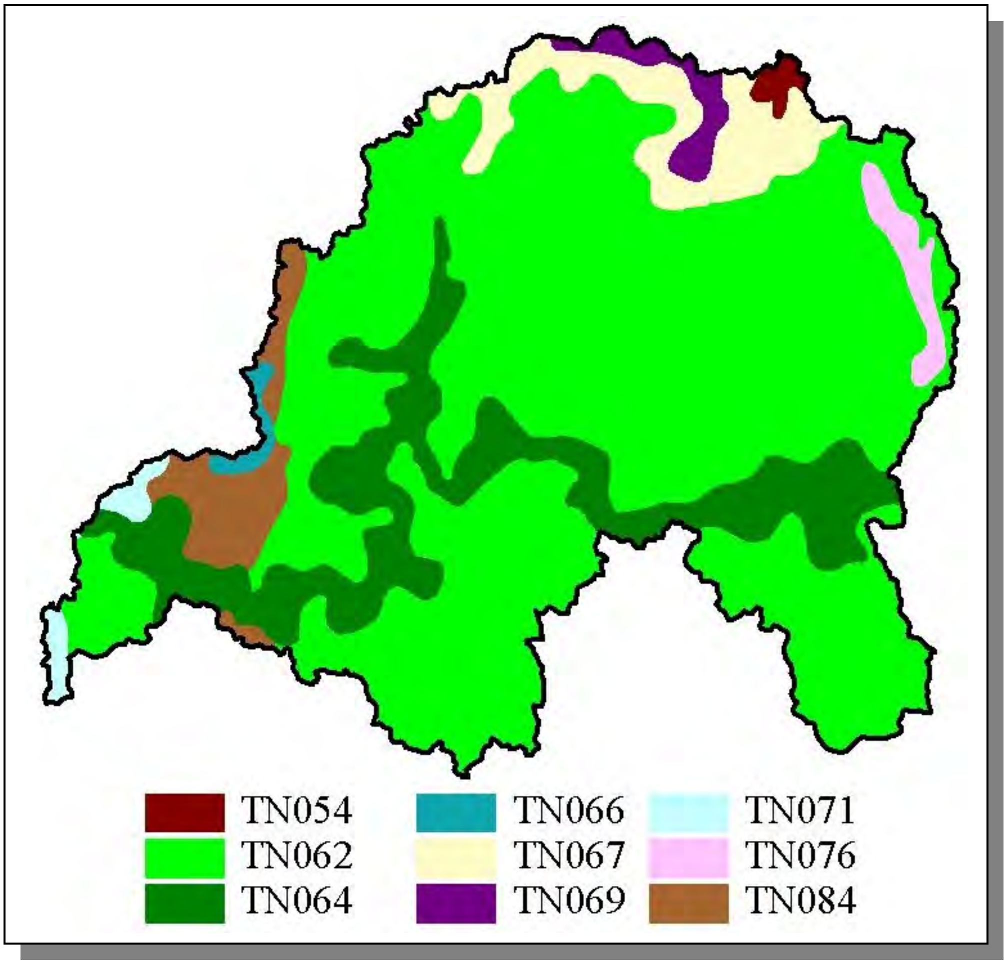


Figure 4-52. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000205.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hr)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN054	0.00	C	3.04	4.84	Loam	0.32
TN062	0.00	C	0.98	4.40	Clayey Loam	0.26
TN064	7.00	C	1.19	5.82	Silty Loam	0.37
TN066	0.00	B	2.62	4.75	Loam	0.28
TN067	2.00	C	2.69	5.51	Silty Loam	0.35
TN069	0.00	C	2.06	5.36	Loam	0.34
TN071	0.00	C	2.37	5.70	Silty Loam	0.33
TN076	28.00	C	0.73	6.26	Silty Clayey Loam	0.33
TN084	0.00	C	1.80	4.99	Silty Loam	0.28

Table 4-31. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000205. *More information is provided in Appendix IV.*

	COUNTY POPULATION				**ESTIMATED POPULATION IN WATERSHED**			
County	1990	1997	2000	Portion of Watershed (%)	1990	1997	2000	% Change (1990-1997)
Bedford	30,411	34,203	37,586	2.41	733	825	906	23.6
Marshall	21,539	25,687	26,767	13.37	7,188	8,573	8,933	24.3
Maury	54,812	68,268	69,498	14.86	8,145	10,144	10,327	26.8
Rutherford	118,570	159,987	182,023	0.6	717	968	1,101	53.6
Williamson	81,021	111,453	126,638	2.42	1,961	2,698	3,066	56.3
Totals	**306,353**	**399,598**	**442,512**		**18,744**	**23,208**	**24,333**	**29.8**

Table 4-32. Population Estimates in Subwatershed 0604000205.

			NUMBER OF HOUSING UNITS			
Populated Place	County	Population	Total	Public Sewer	Septic Tank	Other
Chapel Hill	Marshall	833	346	336	8	2
Columbia	Maury	28,583	12,142	11,303	826	13
Eagleville	Rutherford	491	220	5	211	4
Totals		**29,907**	**12,708**	**11,644**	**1,045**	**19**

Table 4-33. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 0604000205.

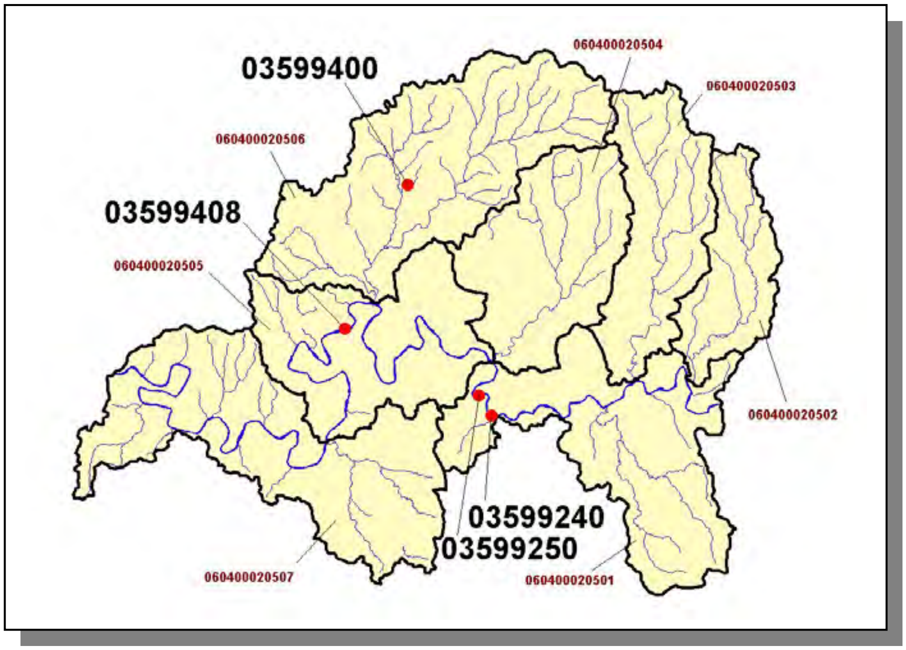


Figure 4-53. Location of Historical Streamflow Data Collection Sites in Subwatershed 0604000205. *Subwatershed 060400020501, 060400020502, 060400020503, 060400020504, 060400020505, 060400020506, and 060400020507 boundaries are shown for reference. More information is provided in Appendix IV.*

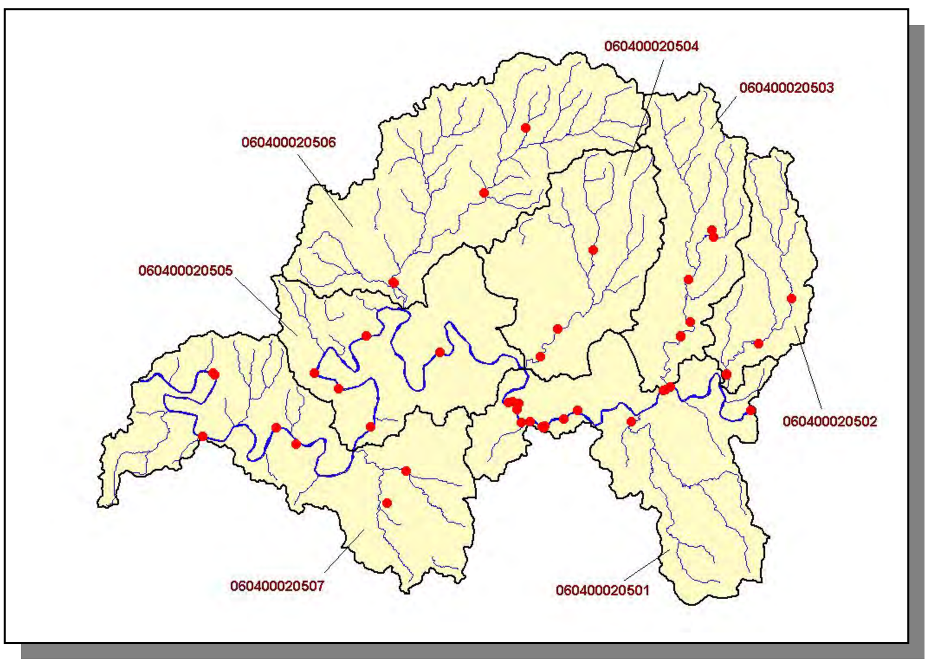


Figure 4-54. Location of STORET Monitoring Sites in Subwatershed 0604000205. *Subwatershed 060400020501, 060400020502, 060400020503, 060400020504, 060400020505, 060400020506, and 060400020507 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.E.ii. Point Source Contributions.

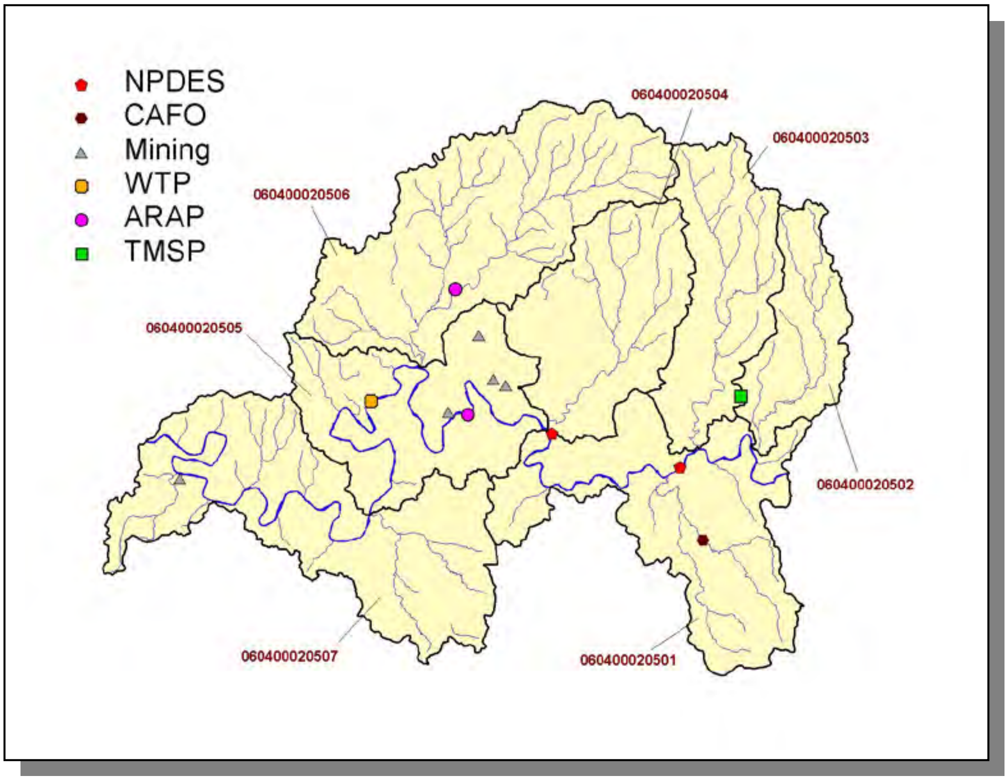


Figure 4-55. Location of Active Point Source Facilities in Subwatershed 0604000205. *Subwatershed 060400020501, 060400020502, 060400020503, 060400020504, 060400020505, 060400020506, and 060400020507 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-56. Location of NPDES Facilities in Subwatershed 0604000205. *Subwatershed 060400020501, 060400020502, 060400020503, 060400020504, 060400020505, 060400020506, and 060400020507 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-57. Location of Concentrated Animal Feeding Operations (CAFO) in Subwatershed 0604000205. *Subwatershed 060400020501, 060400020502, 060400020503, 060400020504, 060400020505, 060400020506, and 060400020507 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

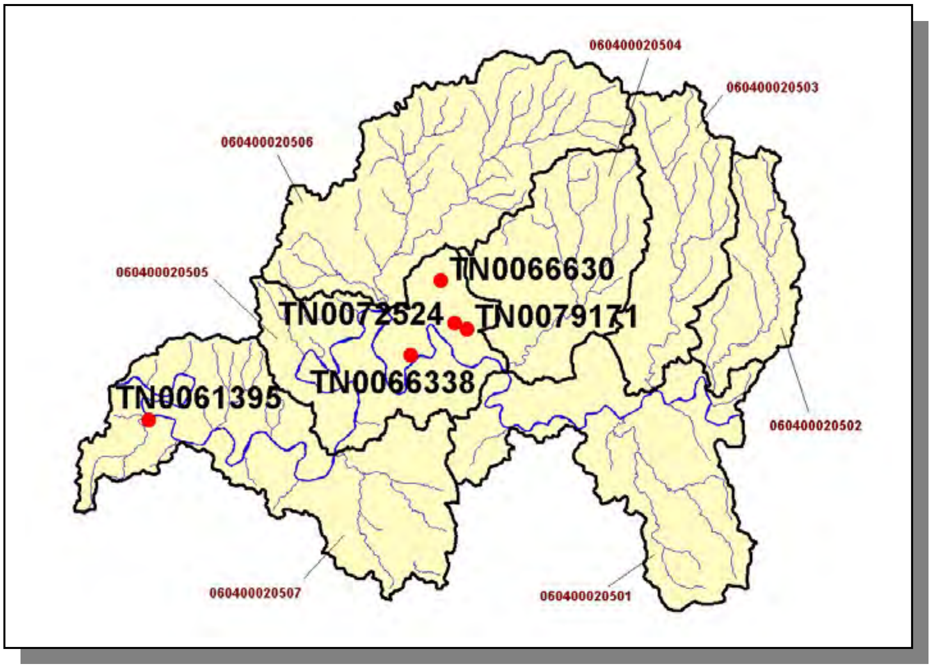


Figure 4-58. Location of Active Mining Facilities in Subwatershed 0604000205. *Subwatershed 060400020501, 060400020502, 060400020503, 060400020504, 060400020505, 060400020506, and 060400020507 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-59. Location of Water Treatment Plants in Subwatershed 0604000205. *Subwatershed 060400020501, 060400020502, 060400020503, 060400020504, 060400020505, 060400020506, and 060400020507 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-60. Location of ARAP Sites (Individual Permits) in Subwatershed 0604000205. *Subwatershed 060400020501, 060400020502, 060400020503, 060400020504, 060400020505, 060400020506, and 060400020507 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

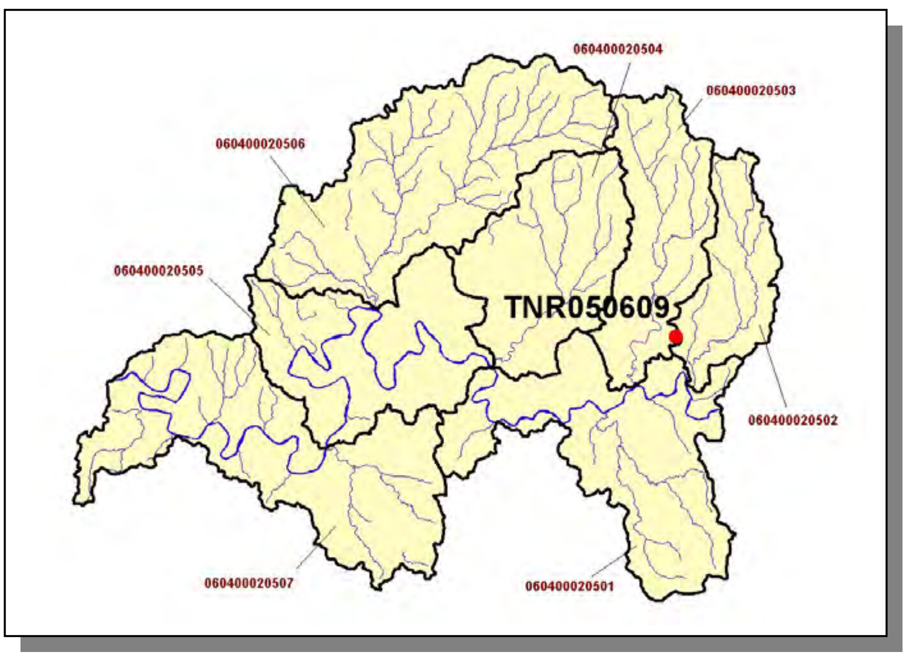


Figure 4-61. Location of TMSP Facilities in Subwatershed 0604000205. *Subwatershed 060400020501, 060400020502, 060400020503, 060400020504, 060400020505, 060400020506, and 060400020507 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

4.2.E.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Milk Cow	Cattle	Chickens (Layers)	Chickens (Broilers Sold)	Hogs	Sheep
13,283	2,135	28,226	36	636,949	1,641	198

Table 4-34. Summary of Livestock Count Estimates in Subwatershed 0604000205. *According to the 1997 Census of Agriculture (http://www.nass.usda.gov/census/),* ***"****Cattle" includes heifers, heifer calves, steers, bulls and bull calves; "Chickens" are layers 20 weeks and older; "Chickens Sold" are all chickens used to produce meat.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Bedford	74.6	74.6	0.5	1.3

Table 4-35. Forest Acreage and Annual Removal Rates (1987-1994) in Subwatershed 0604000205.

CROPS	TONS/ACRE/YEAR
Legumes (Pastureland)	0.29
Grass (Pastureland)	0.71
Grass (Hayland)	0.36
Legumes (Hayland)	0.62
Legumes, Grass (Hayland)	1.37
Grass, Forbs, Legumes (Mixed Pasture)	0.47
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	7.07
Cotton (Row Crops)	4.79
Soybeans (Row Crops)	6.39
Tobacco (Row Crops)	6.75
All Other Row Crops	11.45
Wheat (Close-Grown Cropland)	7.00
Summer Fallow (Other Cropland)	8.40
Other Cropland not Planted	2.30
Berry (Horticulture)	0.47
Conservation Reserve Program Lands	0.28
Non-Agricultural Land Use	0.00
Other Land in Farms	0.06
Farmsteads and Ranch Headquarters	0.22

Table 4-36. Annual Estimated Soil Loss in Subwatershed 0604000205.

4.2.F. 0604000206 (Rock Creek).

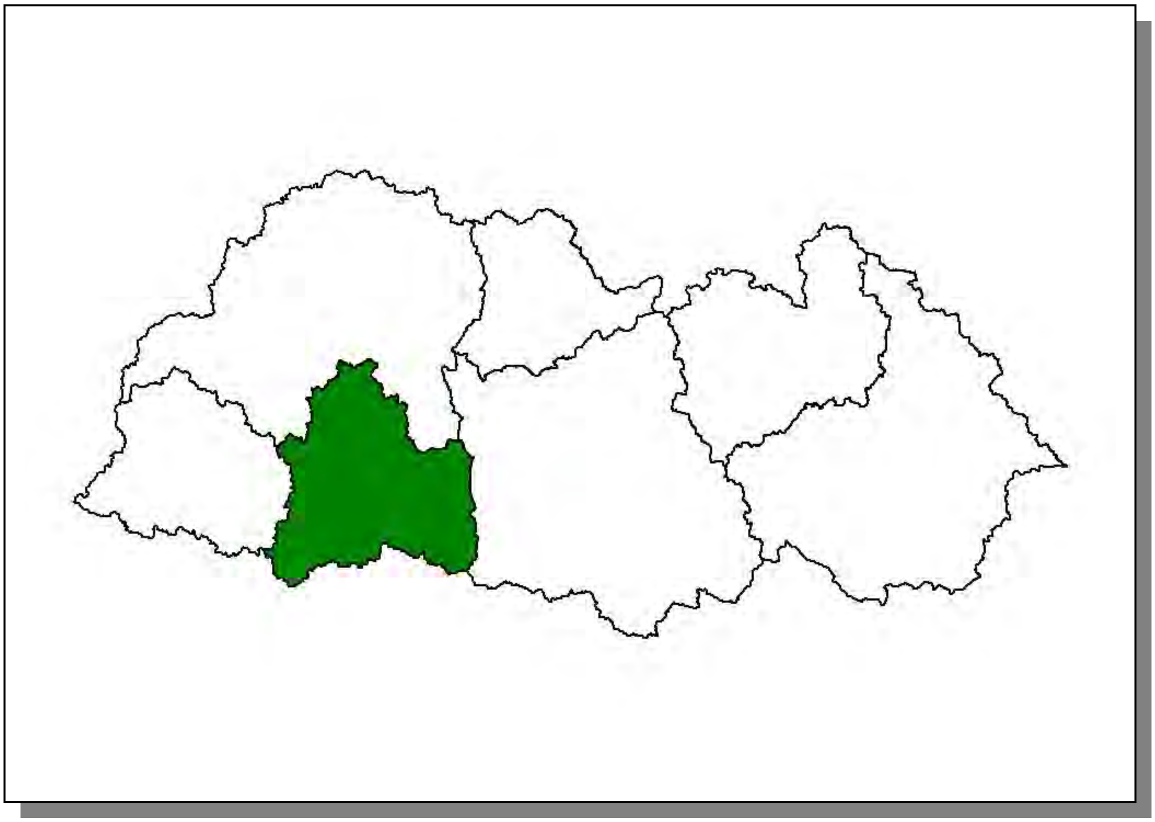


Figure 4-62. Location of Subwatershed 0604000206. *All Upper Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.F.i. General Description.

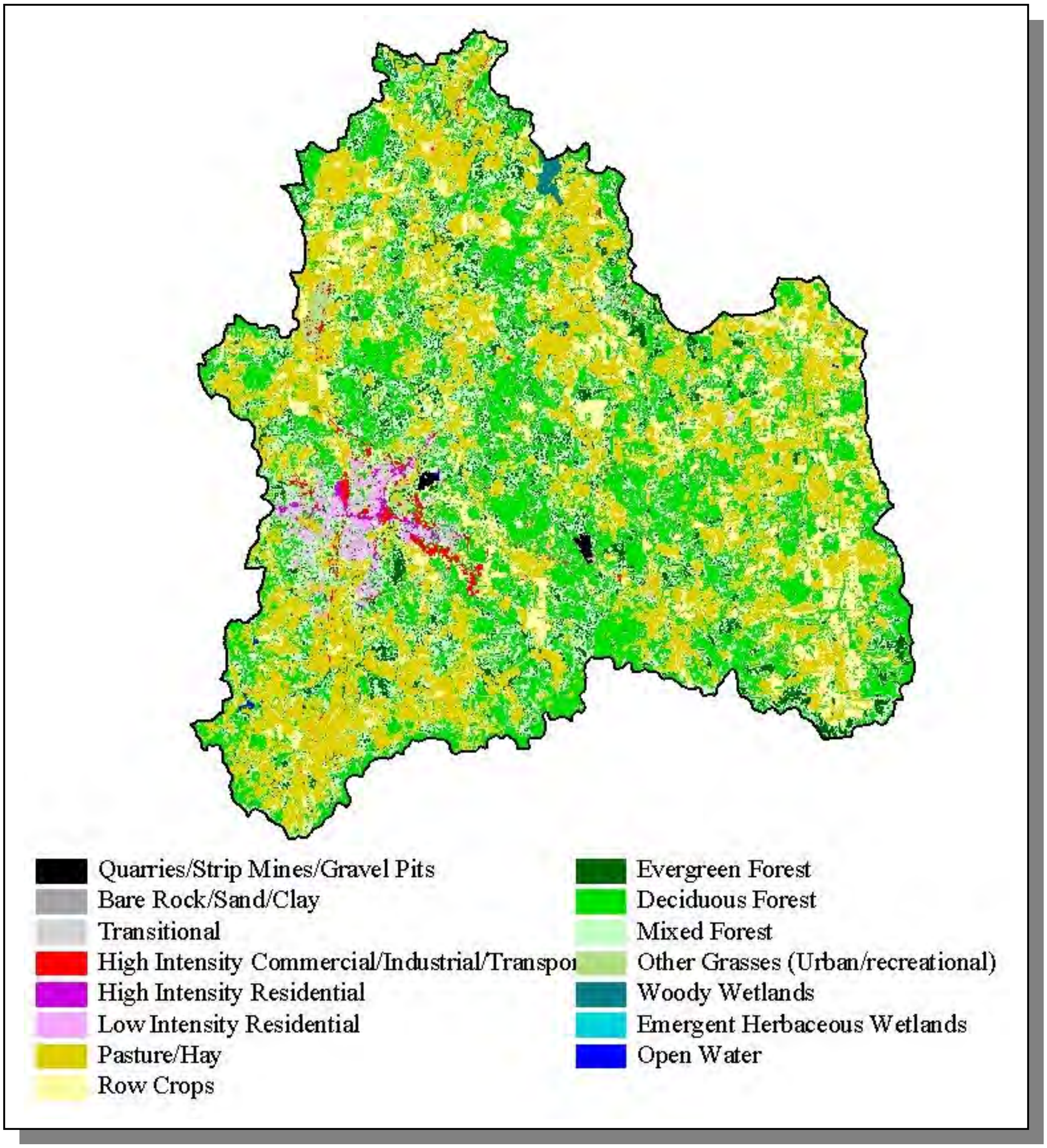


Figure 4-63. Illustration of Land Use Distribution in Subwatershed 0604000206.

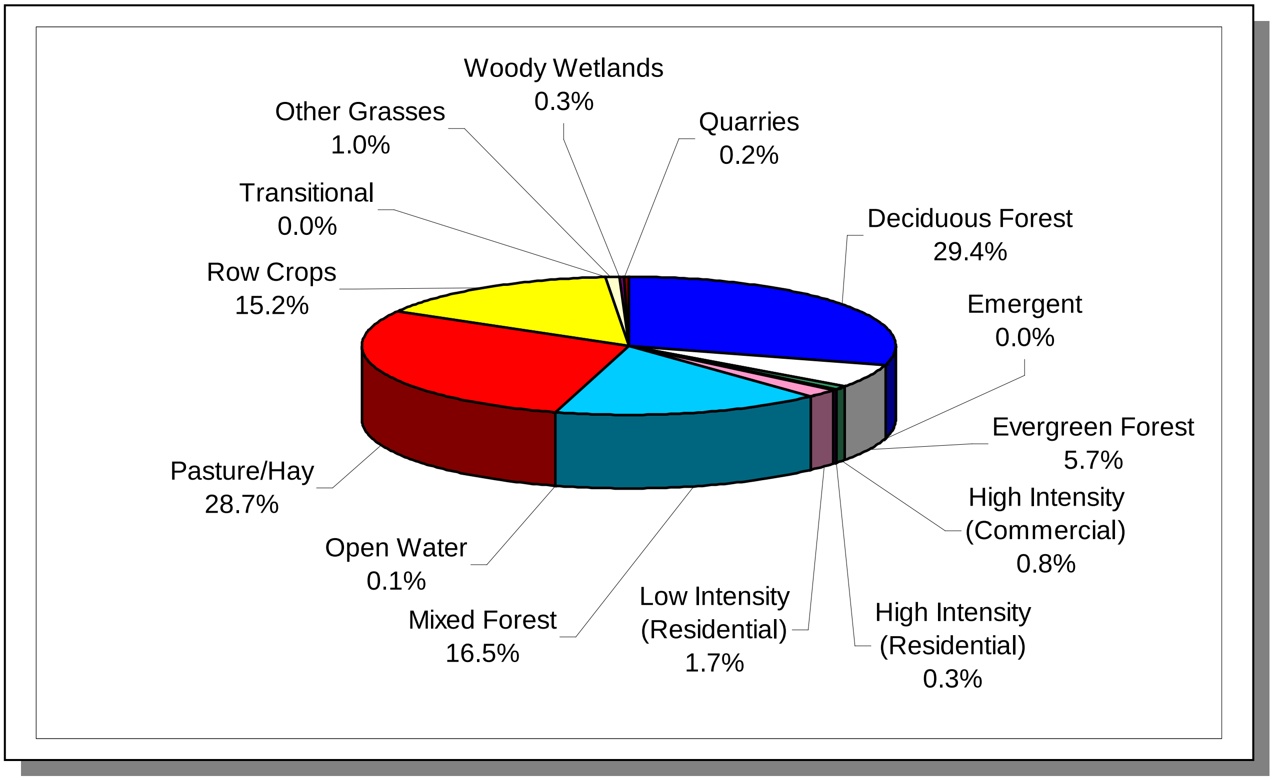


Figure 4-64. Land Use Distribution in Subwatershed 0604000206. *More information is provided in Appendix IV.*

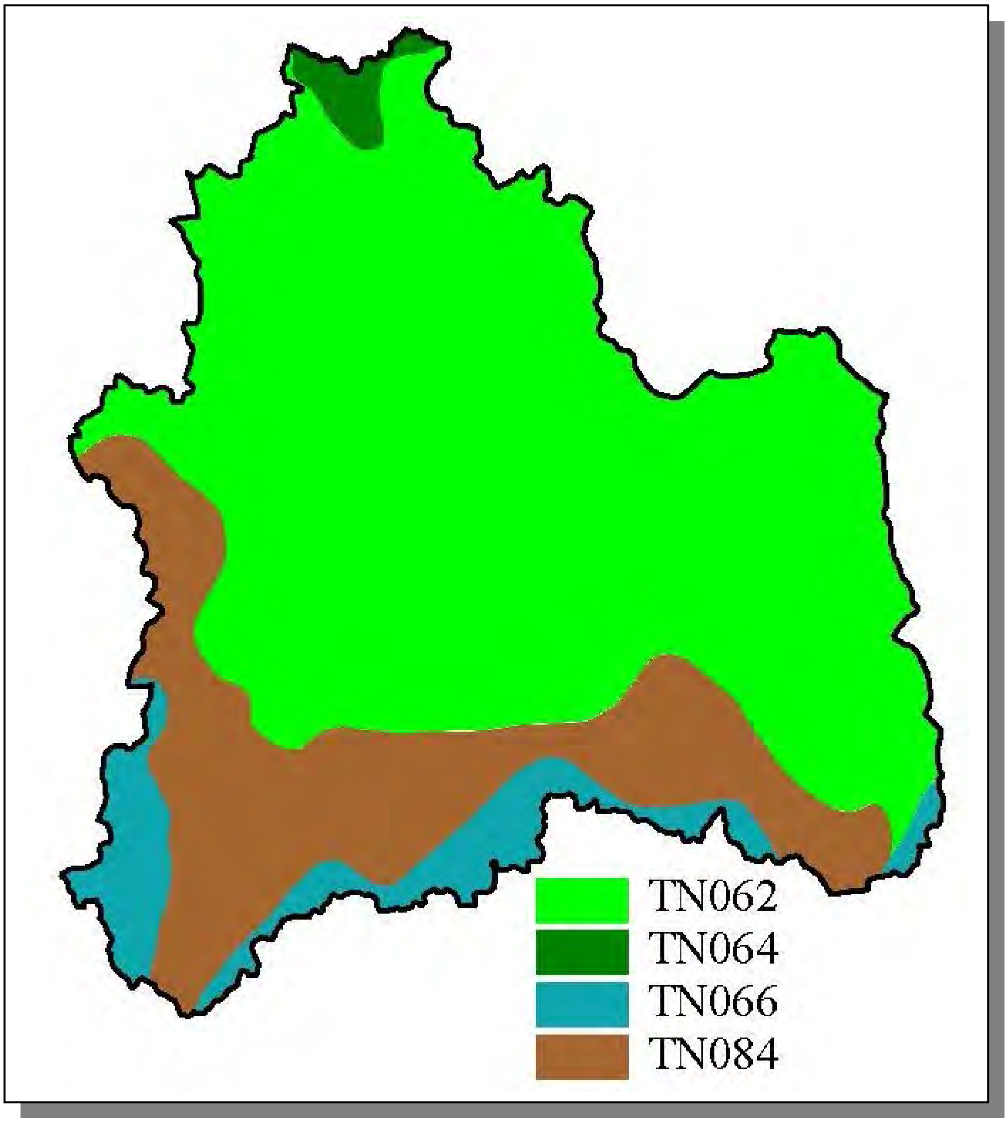


Figure 4-65. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000206.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hr)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN062	0.00	C	0.98	4.40	Clayey Loam	0.26
TN064	7.00	C	1.19	5.82	Silty Loam	0.37
TN066	0.00	B	2.62	4.75	Loam	0.28
TN084	0.00	C	1.80	4.99	Silty Loam	0.28

Table 4-37. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000206. *More information is provided in Appendix IV.*

	COUNTY POPULATION				**ESTIMATED POPULATION IN WATERSHED**			
County	1990	1997	2000	Portion of Watershed (%)	1990	1997	2000	% Change (1990-1997)
Bedford	30,411	34,203	37,586	2.44	741	833	916	23.6
Marshall	21,539	25,687	26,767	29.89	6,439	7,679	8,002	24.3
Totals	**51,950**	**59,890**	**64,353**		**7,180**	**8,512**	**8,918**	**24.2**

Table 4-38. Population Estimates in Subwatershed 0604000206.

			NUMBER OF HOUSING UNITS			
Populated Place	County	Population	Total	Public Sewer	Septic Tank	Other
Cornersville	Marshall	677	312	54	255	3
Lewisburg	Marshall	9,879	4,275	3,990	285	0
Totals		**10,556**	**4,587**	**4,044**	**540**	**3**

Table 4-39. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 0604000206.

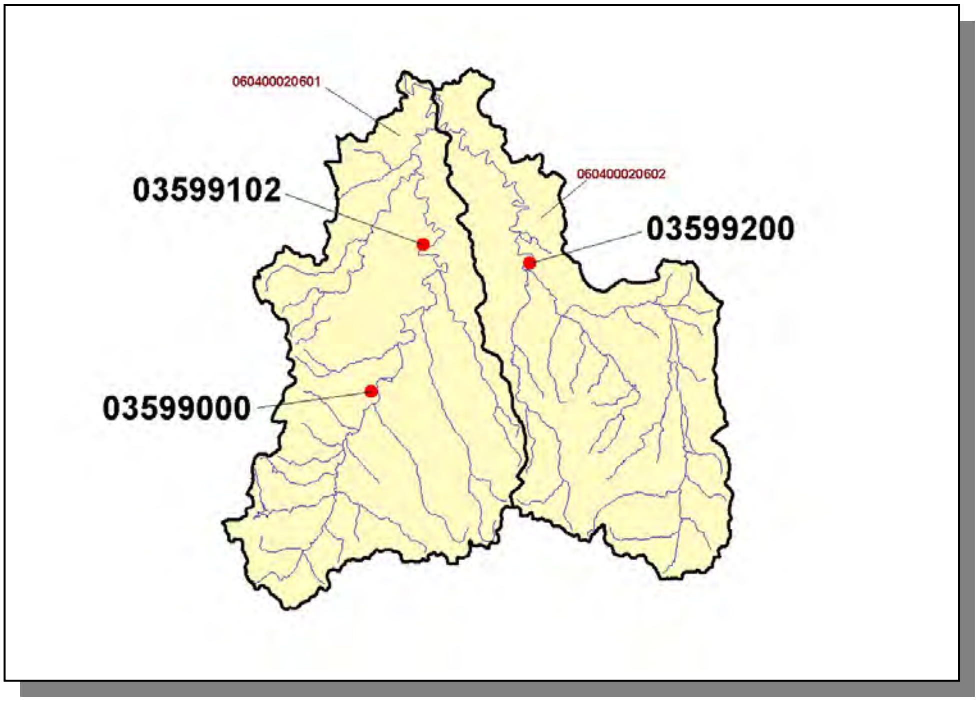


Figure 4-66. Location of Historical Streamflow Data Collection Sites in Subwatershed 0604000206. *Subwatershed 060400020601 and 060400020602 boundaries are shown for reference. More information is provided in Appendix IV.*

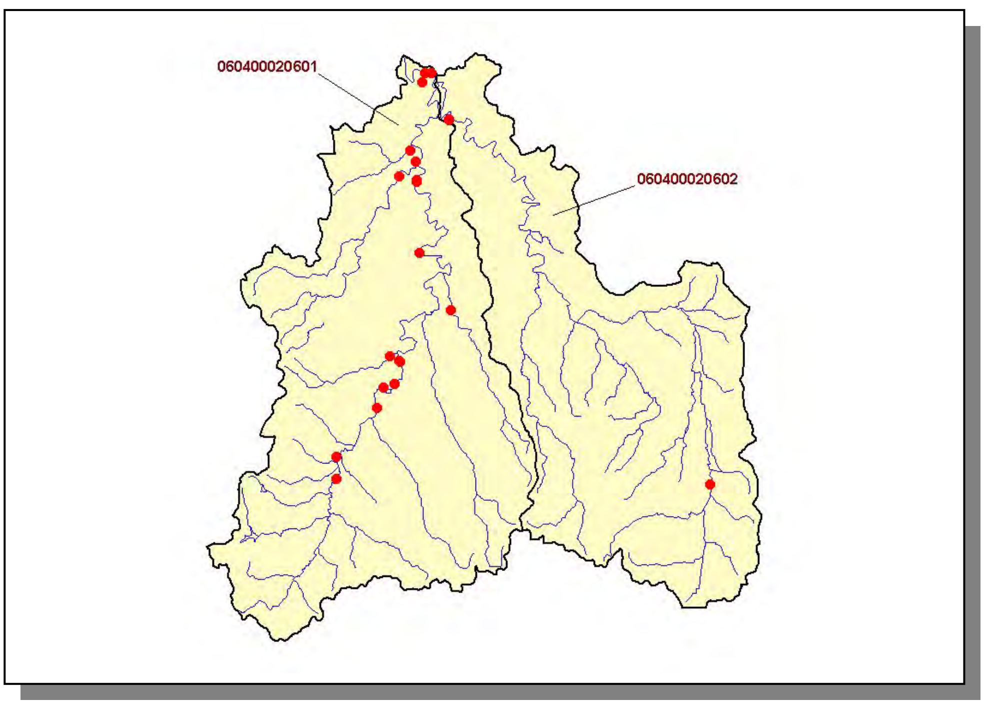


Figure 4-67. Location of STORET Monitoring Sites in Subwatershed 0604000206. *Subwatershed 060400020601 and 060400020602 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.F.ii. Point Source Contributions.

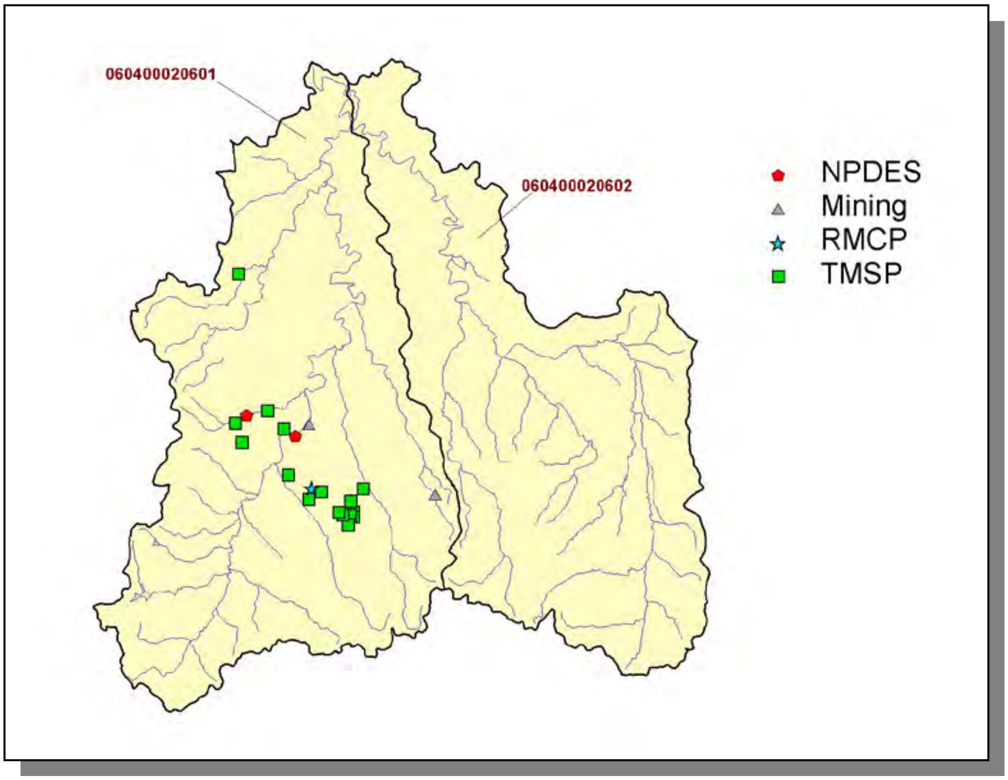


Figure 4-68. Location of Active Point Source Facilities in Subwatershed 0604000206. *Subwatershed 060400020601 and 060400020602 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-69. Location of NPDES Facilities in Subwatershed 0604000206. *Subwatershed 060400020601 and 060400020602 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

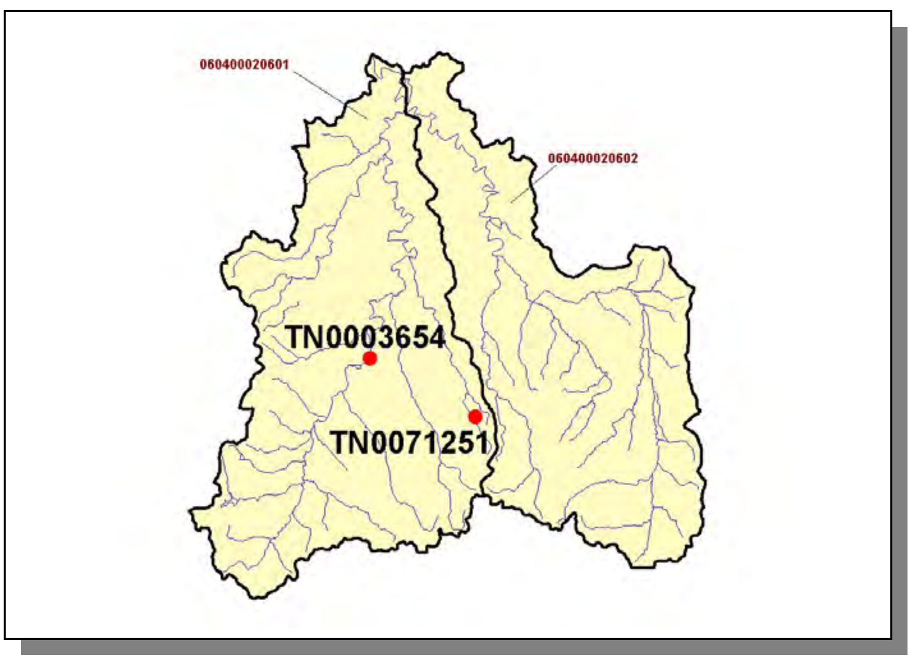


Figure 4-70. Location of Active Mining Facilities in Subwatershed 0604000206. *Subwatershed 060400020601 and 060400020602 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-71. Location of Ready Mix Concrete Plants in Subwatershed 0604000206. *Subwatershed 060400020601 and 060400020602 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

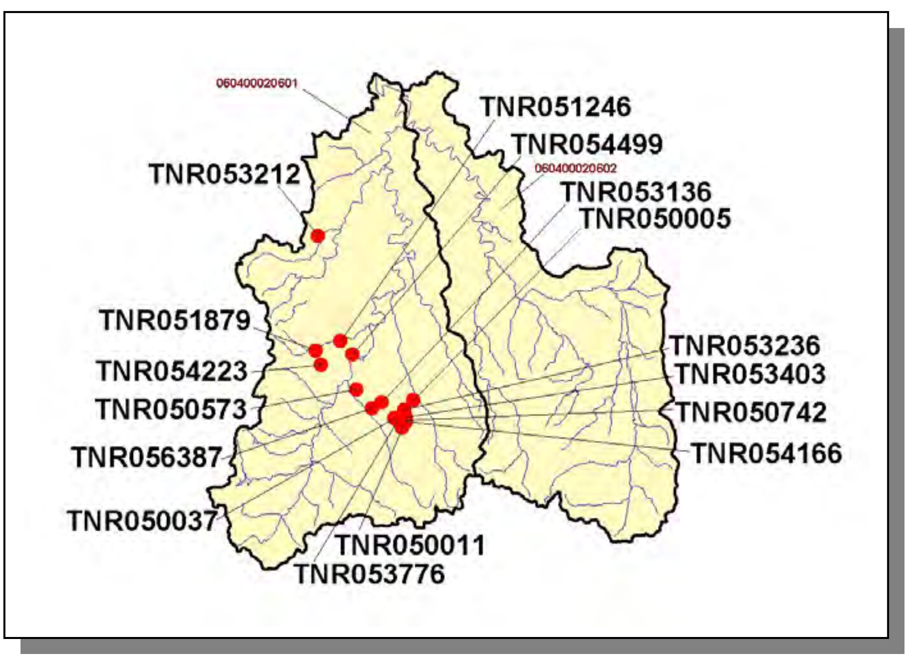


Figure 4-72. Location of TMSP Facilities in Subwatershed 0604000206. *Subwatershed 060400020601 and 060400020602 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

4.2.F.ii.a. Dischargers to Water Bodies Listed on the 2002 303(d) List

There are two NPDES facilities discharging to water bodies listed on the 2002 303(d) list in Subwatershed 0604000206:

- TN0022888 (Lewisburg STP) discharges to Big Rock Creek @ RM 16.8
- TN0002445 (International Comfort Products Corporation) discharges to Snell Branch @ RM 1.6 to Big Rock Creek @ RM 15.5

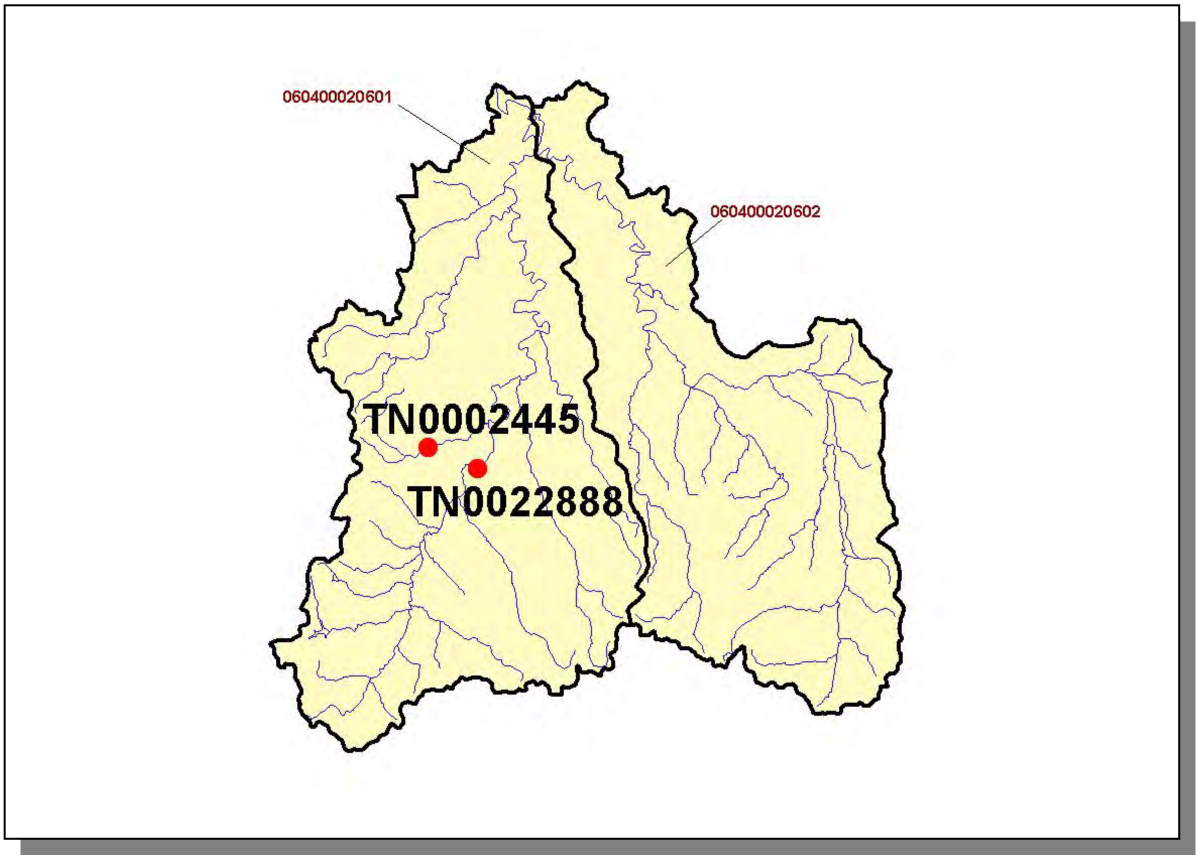


Figure 4-73. Location of NPDES Dischargers to Water Bodies Listed on the 2002 303(d) List in Subwatershed 0604000206. *Subwatershed 060400020601 and 060400020602 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

PERMIT #	1Q10	3Q10	7Q10	3Q20	QDESIGN
TN0022888	0	0	0	0	3.024
TN0002445			0		

Table 4-40. Receiving Stream Flow Information for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000206. *Data are in million gallons per day (MGD). Data were obtained from the USGS publication Flow Duration and Low Flows of Tennessee Streams Through 1992 or from permit files.*

PERMIT #	WET	$CBOD_5$	FECAL COLIFORM	*E. COLI*	NH_3	TRC	TSS	SETTLEABLE SOLIDS	DO	pH
TN0022888	X	X	X	X	X	X	X	X	X	X
TN0002445	X						X			X

Table 4-41. Parameters Monitored for Daily Maximum Limits for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000206. *WET, Whole Effluent Toxicity; $CBOD_5$, Carbonaceous Biochemical Oxygen Demand (5-Day); TRC, Total Residual Chlorine; TSS, Total Suspended Solids.*

PERMIT #	TRICHLOROETHYLENE	1,1-DICHLOROETHYLENE
TN0002445	X	X

Table 4-42. Organic Parameters Monitored for Daily Maximum Limits for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000206.

4.2.F.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Milk Cow	Cattle	Chickens (Layers)	Chickens (Broilers Sold)	Hogs	Sheep
5,739	1,369	12,910	17	546,037	1,161	70

Table 4-43. Summary of Livestock Count Estimates in Subwatershed 0604000206. *According to the 1997 Census of Agriculture (http://www.nass.usda.gov/census/),* ***"****Cattle" includes heifers, heifer calves, steers, bulls and bull calves; "Chickens" are layers 20 weeks and older; "Chickens Sold" are all chickens used to produce meat.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Bedford	74.6	74.6	0.5	1.3

Table 4-44. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 0604000206.

CROPS	TONS/ACRE/YEAR
Grass (Pastureland)	0.75
Grass (Hayland)	0.43
Legumes (Hayland)	0.59
Legumes, Grass (Hayland)	2.24
Grass, Forbs, Legumes (Mixed Pasture)	0.62
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	8.91
Soybeans (Row Crops)	5.66
Wheat (Close-Grown Cropland)	7.54
Summer Fallow (Other Cropland)	8.36
Other Cropland not Planted	0.23
Conservation Reserve Program Lands	0.18
Non-Agricultural Land Use	0.00
Other Land in Farms	0.05
Farmsteads and Ranch Headquarters	0.04

Table 4-45. Annual Estimated Total Soil Loss in Subwatershed 0604000206.

4.2.G. 0604000207 (Silver Creek).

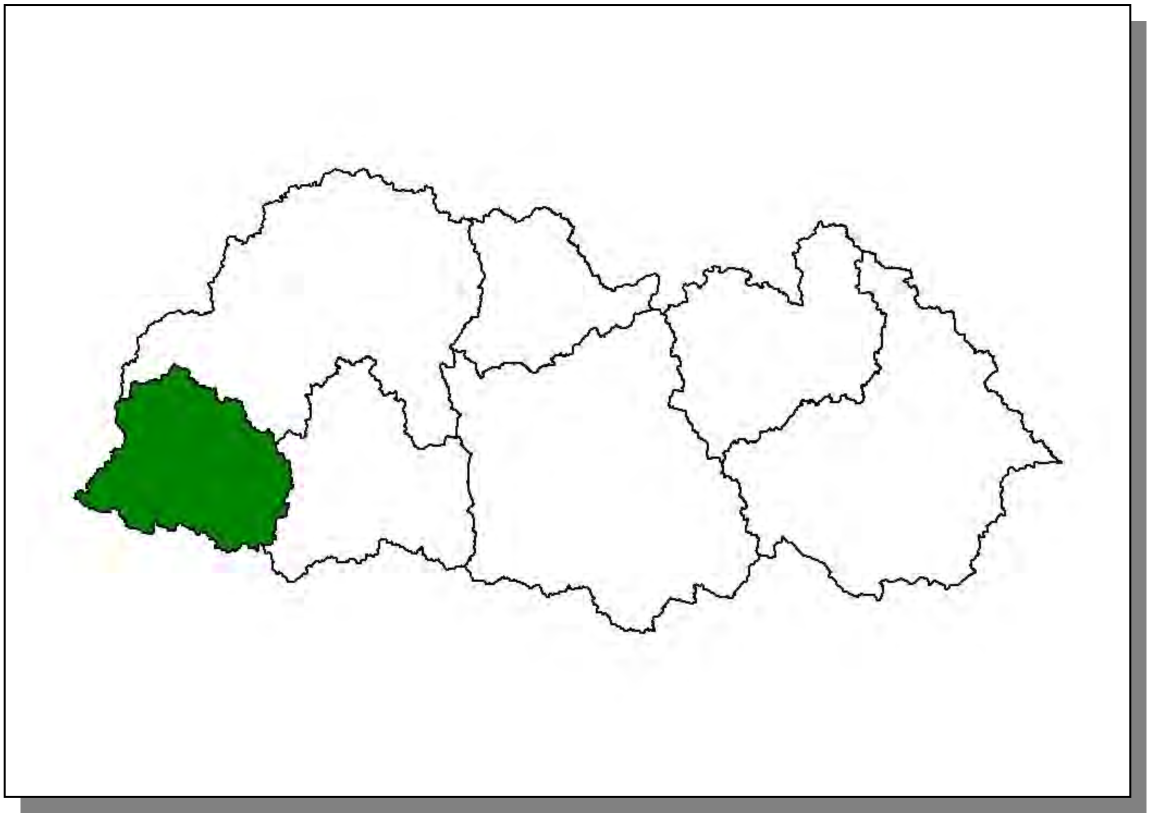


Figure 4-74. Location of Subwatershed 0604000207. *All Upper Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.G.i. General Description.

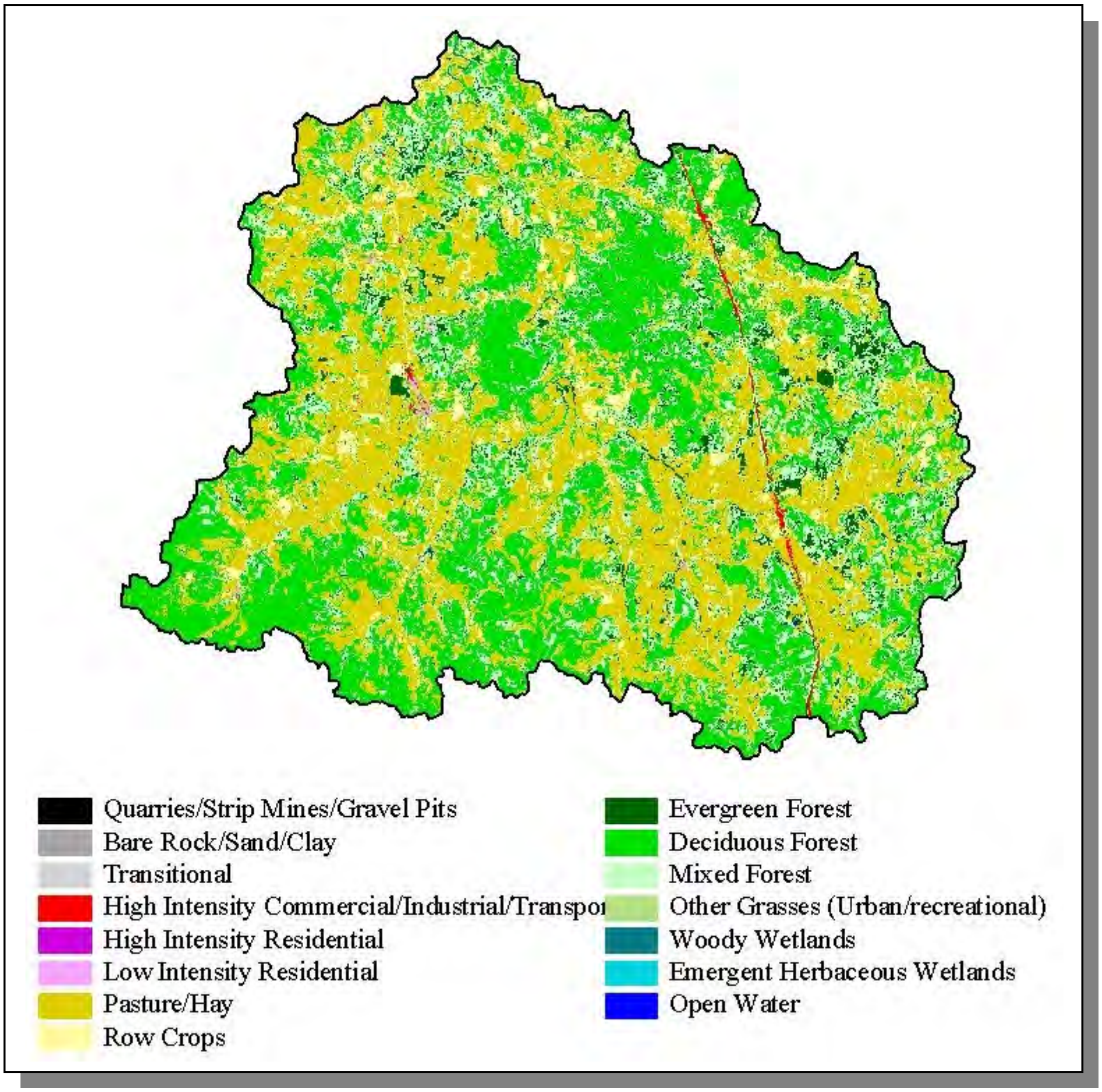


Figure 4-75. Illustration of Land Use Distribution in Subwatershed 0604000207.

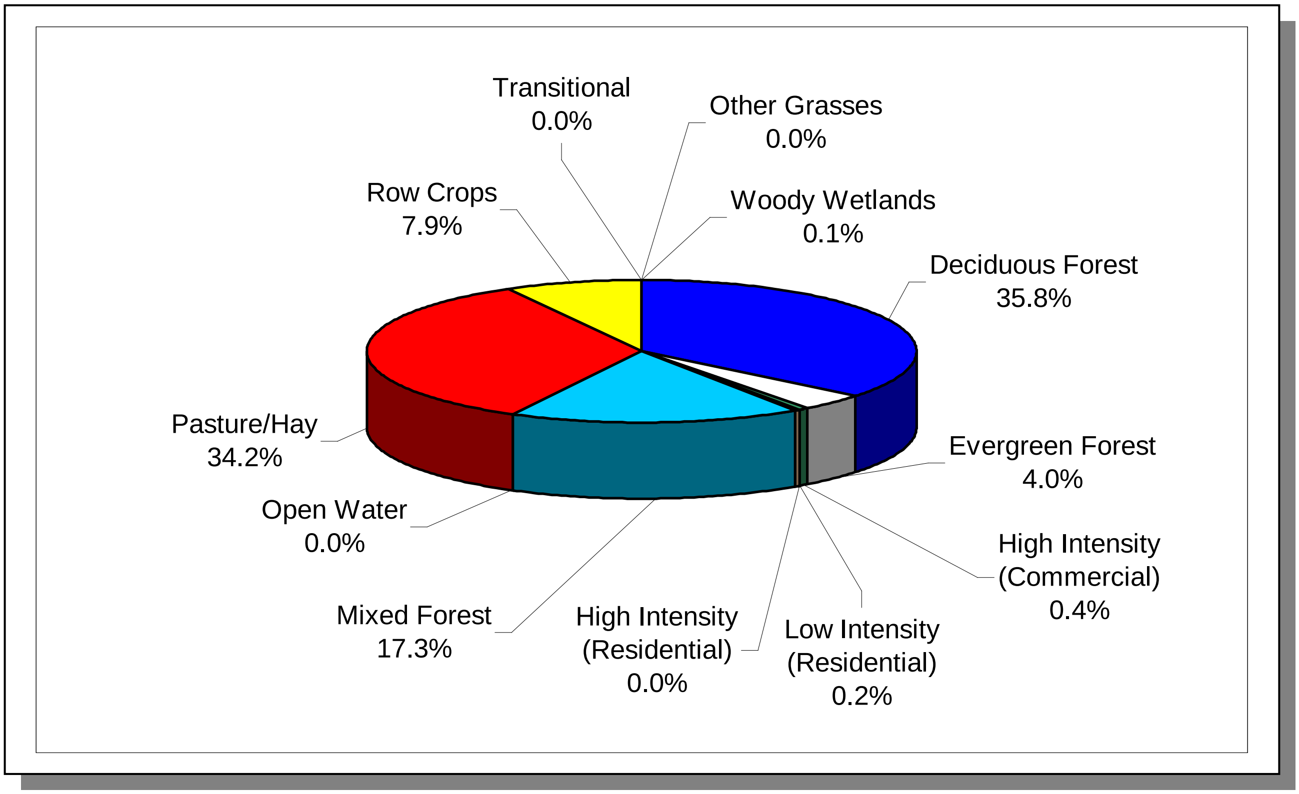


Figure 4-76. Land Use Distribution in Subwatershed 0604000207. *More information is provided in Appendix IV.*

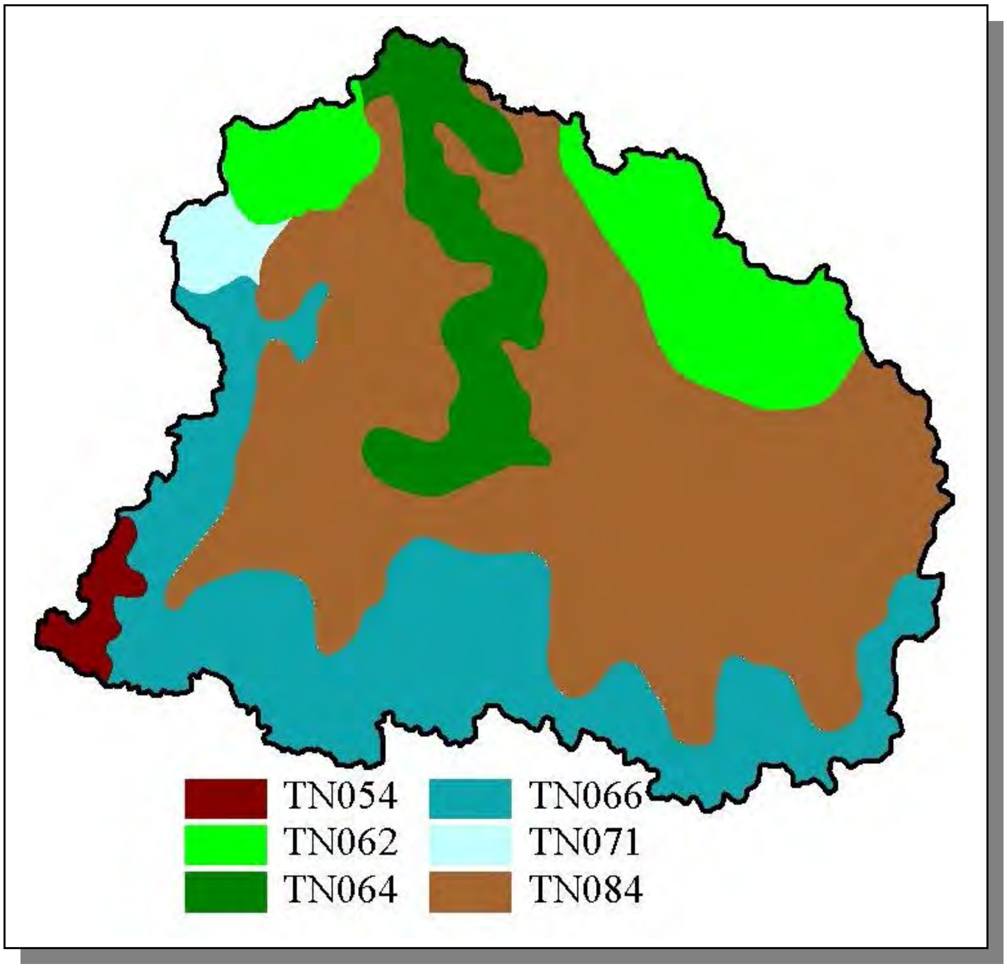


Figure 4-77. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000207.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hr)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN054	0.00	C	3.04	4.84	Loam	0.32
TN062	0.00	C	0.98	4.40	Clayey Loam	0.26
TN064	7.00	C	1.19	5.82	Silty Loam	0.37
TN066	0.00	B	2.62	4.75	Loam	0.28
TN071	0.00	C	2.37	5.70	Silty Loam	0.33
TN084	0.00	C	1.80	4.99	Silty Loam	0.28

Table 4-46. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000207. *More information is provided in Appendix IV.*

	COUNTY POPULATION				ESTIMATED POPULATION IN WATERSHED			
County	1990	1997	2000	Portion of Watershed (%)	1990	1997	2000	% Change (1990-1997)
Giles	25,741	28,515	29,447	1.3	334	370	382	14.4
Marshall	21,539	25,687	26,767	9.43	2,031	2,423	2,525	24.3
Maury	54,812	68,268	69,498	9.82	5,385	6,707	6,828	26.8
Totals	**102,092**	**122,470**	**125,712**		**7,750**	**9,500**	**9,735**	**25.6**

Table 4-47. Population Estimates in Subwatershed 0604000207.

			NUMBER OF HOUSING UNITS			
Populated Place	County	Population	Total	Public Sewer	Septic Tank	Other
Lewisburg	Marshall	9,879	4,275	3,990	285	0

Table 4-48. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 0604000207.

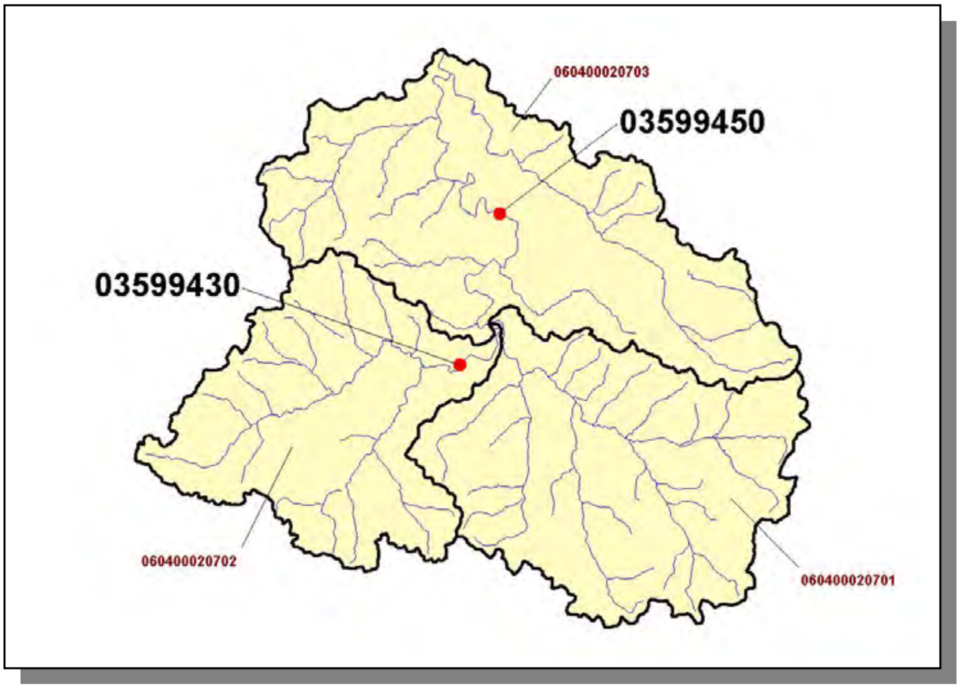


Figure 4-78. Location of Historical Streamflow Data Collection Sites in Subwatershed 0604000207. *Subwatershed 060400020701, 060400020702, and 060400020703 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

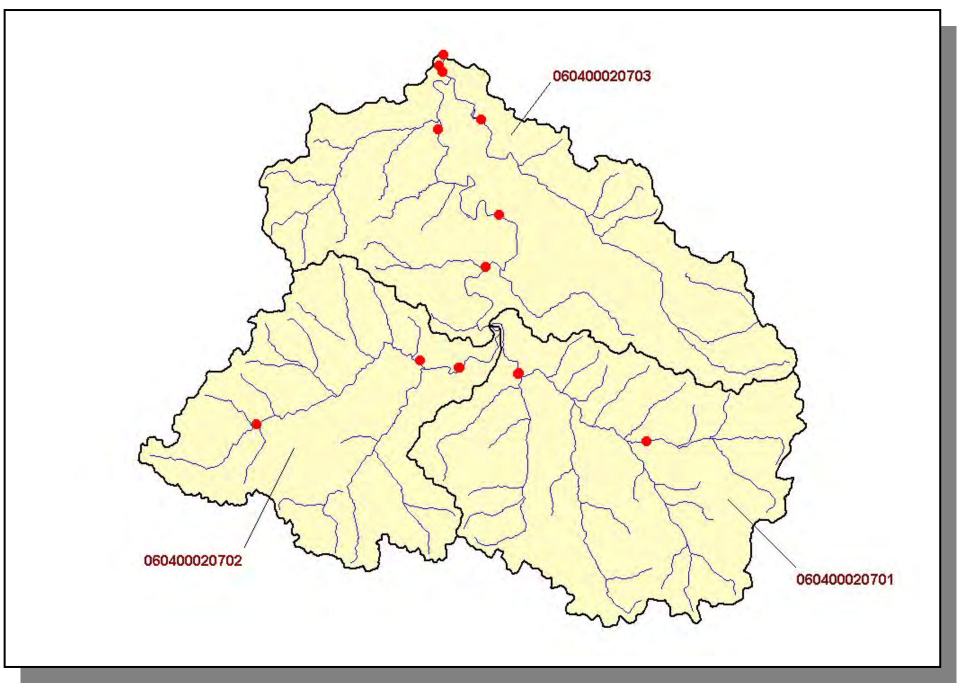


Figure 4-79. Location of STORET Monitoring Sites in Subwatershed 0604000207. *Subwatershed 060400020701, 060400020702, and 060400020703 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.G.ii. Point Source Contributions.

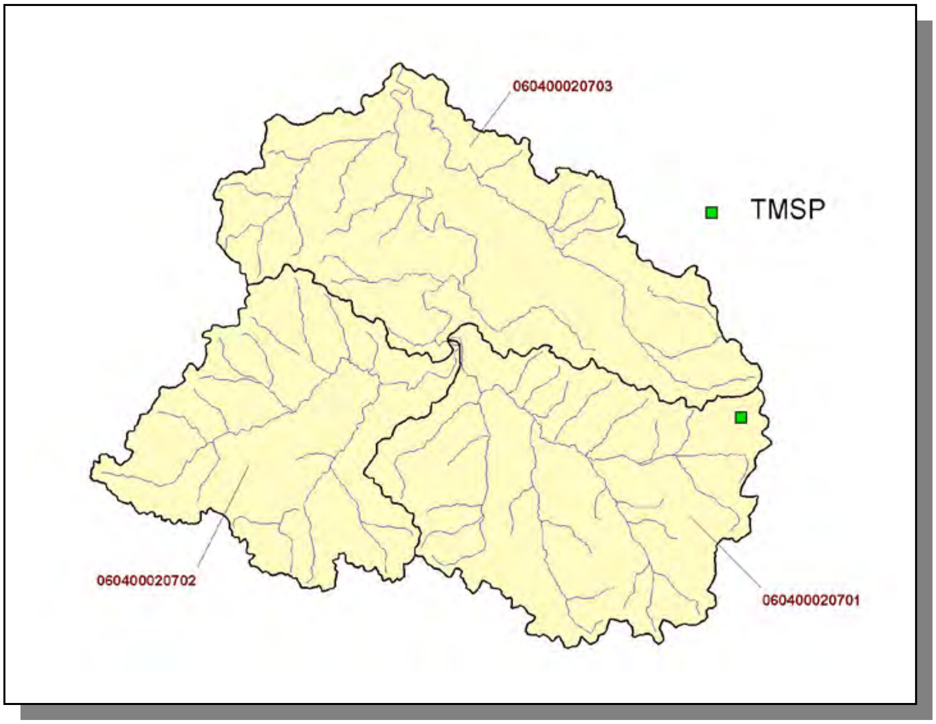


Figure 4-80. Location of Active Point Source Facilities in Subwatershed 0604000207. *Subwatershed 060400020701, 060400020702, and 060400020703 boundaries are shown for reference. More information is provided in Appendix IV.*

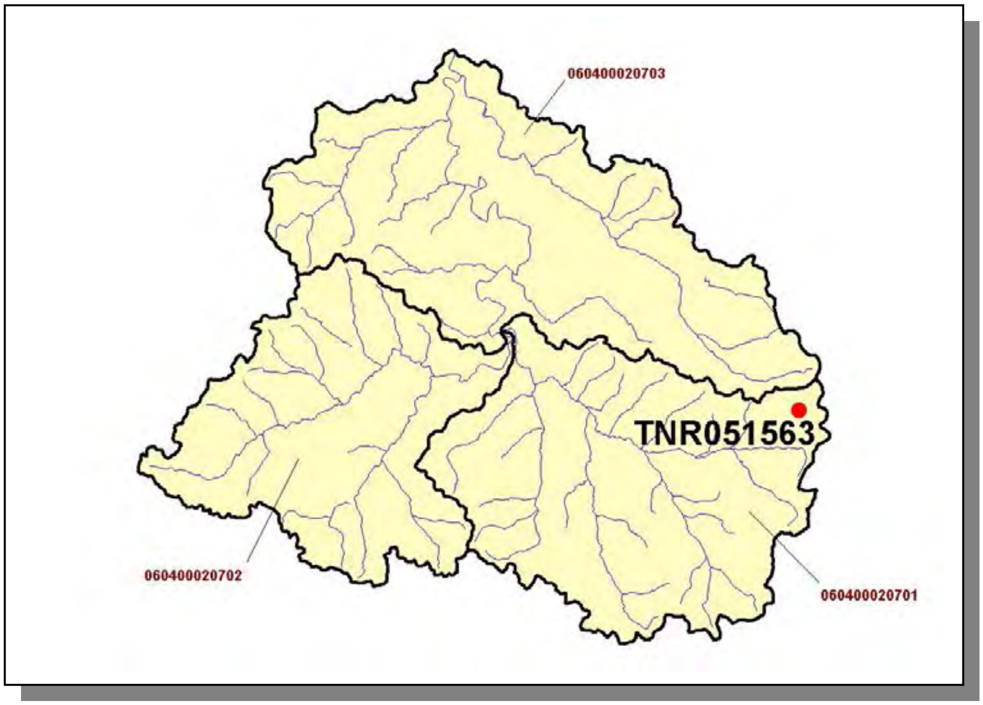


Figure 4-81. Location of TMSP Facilities in Subwatershed 0604000207. *Subwatershed 060400020701, 060400020702, and 060400020703 boundaries are shown for reference. More information is provided in Appendix IV.*

4.2.G.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens (Layers)	Chickens (Broilers Sold)	Hogs	Sheep
8,046	17,189	1,115	22	<5	898	94

Table 4-49. Summary of Livestock Count Estimates in Subwatershed 0604000207. *According to the 1997 Census of Agriculture (http://www.nass.usda.gov/census/),* ***"****Cattle" includes heifers, heifer calves, steers, bulls and bull calves; "Chickens" are layers 20 weeks and older; "Chickens Sold" are all chickens used to produce meat.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Giles	171.8	171.8	3.3	11.4

Table 4-50. Forest Acreage and Average Removal Rates (1987-1994) in Subwatershed 0604000207.

CROPS	TONS/ACRE/YEAR
Grass (Pastureland)	0.73
Grass (Hayland)	0.32
Legumes (Hayland)	0.59
Legumes, Grass (Hayland)	0.99
Grass, Forbs, Legumes (Mixed Pasture)	0.43
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	6.24
Soybeans (Row Crops)	6.86
All Other Row Crops	10.41
Barley (Close-Grown Cropland)	1.08
Summer Fallow (Other Cropland)	7.16
Other Cropland not Planted	2.69
Other Vegetable and Truck Crop	4.29
Conservation Reserve Program Lands	0.34
Non-Agricultural Land Use	0.00
Other Land in Farms	0.05
Farmsteads and Ranch Headquarters	0.29

Table 4-51. Annual Estimated Total Soil Loss in Subwatershed 0604000207.

CHAPTER 5

WATER QUALITY PARTNERSHIPS IN THE UPPER DUCK RIVER WATERSHED

5.1. BACKGROUND. The Watershed Approach relies on participation at the federal, state, local and nongovernmental levels to be successful. Two types of partnerships are critical to ensure success:

- Partnerships between agencies
- Partnerships between agencies and landowners

This chapter describes both types of partnerships in the Upper Duck River Watershed. The information presented is provided by the agencies and organizations described.

5.2. FEDERAL PARTNERSHIPS.

5.2.A. Natural Resources Conservation Service. The Natural Resources Conservation Service (NRCS), an agency of the U.S. Department of Agriculture, provides technical assistance, information, and advice to citizens in their efforts to conserve soil, water, plant, animal, and air resources on private lands.

Performance Results System (PRS) is a Web-based database application providing USDA Natural Resources Conservation Service, conservation partners, and the public fast and easy access to accomplishments and progress toward strategies and performance. The PRS may be viewed at http://prms.nrcs.usda.gov/prs. From the opening menu, select "Reports" in the top tool bar. Next, select "2004 Reports" if it's active, and "2003 PRMS Reports" if it's not. Pick the conservation treatment of interest on the page that comes up and reset the date to 2004 Reports if it is not set there. Pick the conservation practice of interest. In the location drop box of the page that comes up, select "Tennessee" and click on the "Refresh" button. In the "By" drop box that comes up, select "Hydrologic Unit" and click on the "Refresh" button. The report of interest can now be viewed.

The data can be used to determine broad distribution trends in service provided to customers by NRCS conservation partnerships. These data do not show sufficient detail to enable evaluation of site-specific conditions (e.g., privately-owned farms and ranches) and are intended to reflect general trends.

CONSERVATION PRACTICE	TOTAL		
	FEET	ACRES	NUMBER
Comprehensive Nutrient Management Plans		3,404	
Water Supply	2,500		6
Water Detention/Retention			2
Pest Management		3,206	
Land Treatment: Buffers	25,547	25	
Land Treatment: Surface Water Management		14	
Grazing/Forages Practices	38,691	4,517	

Table 5-1. Landowner Conservation Practices in Partnership with NRCS in the Upper Duck River Watershed. *Data are from PRMS for October 1, 2003 through September 30, 2004 reporting period. More information is provided in Appendix V.*

5.2.B. United States Geological Survey Water Resources Programs – Tennessee District The U.S. Geological Survey (USGS) provides relevant and objective scientific studies and information for public use to evaluate the quantity, quality, and use of the Nation's water resources. In addition to providing National assessments, the USGS also conducts hydrologic studies in cooperation with numerous Federal, State, and local agencies to address issues of National, regional, and local concern. Please visit http://water.usgs.gov/ for an overview of the USGS, Water Resources Discipline.

The USGS collects hydrologic data to document current conditions and provide a basis for understanding hydrologic systems and solving hydrologic problems. In Tennessee, the USGS records streamflow continuously at more than 102 gaging stations equipped with recorders and makes instantaneous measurements of streamflow at many other locations. Ground-water levels are monitored Statewide, and the physical, chemical, and biologic characteristics of surface and ground waters are analyzed. USGS activities also include the annual compilation of water-use records and collection of data for National baseline and water-quality networks. National programs conducted by the USGS include the National Atmospheric Deposition Program (http://bqs.usgs.gov/acidrain/), National Stream Quality Accounting Network (http://water.usgs.gov/nasqan/), and the National Water-Quality Assessment Program (http://water.usgs.gov/nawqa/). For specific information on the Upper and Lower Tennessee NAWQA studies, please visit http://tn.water.usgs.gov/lten/tenn.html

USGS Water Resources Information on the Internet. Real-time and historical streamflow, water levels, and water-quality data at sites operated by the Tennessee District can be accessed at http://waterdata.usgs.gov/tn/nwis/nwis. Data can be retrieved by county, hydrologic unit code, or major river basin using drop-down menus. Contact Donna Flohr at (615) 837-4730 or dfflohr@usgs.gov for specific information about streamflow data. Recent publications by the USGS staff in Tennessee can be accessed by visiting http://tn.water.usgs.gov/pubpg.html. This web page provides searchable bibliographic information to locate reports and other products about specific areas.

5.2.C. U.S. Fish and Wildlife Service. The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. Sustaining our nation's fish and wildlife resources is a task that can be accomplished only through the combined efforts of governments, businesses, and private citizens. The U.S. Fish and Wildlife Service (Service) works with State and Federal agencies and Tribal governments, helps corporate and private landowners conserve habitat, and cooperates with other nations to halt illegal wildlife trade. The Service also administers a Federal Aid program that distributes funds annually to States for fish and wildlife restoration, boating access, hunter education, and related projects across America. The funds come from Federal excise taxes on fishing, hunting, and boating equipment.

Endangered Species Program

Through the Endangered Species Program, the Service consults with other federal agencies concerning their program activities and their effects on endangered and threatened species. Other Service activities under the Endangered Species Program include the listing of rare species under the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended: 16 U.S.C. 1531 et seq.) and the recovery of listed species. Once listed, a species is afforded the full range of protections available under the ESA, including prohibitions on killing, harming or otherwise taking a species. In some instances, species listing can be avoided by the development of Candidate Conservation Agreements, which may remove threats facing the candidate species, and funding efforts such as the Private Stewardship Grant Program. Federally endangered and threatened species in this portion of the Duck River watershed include the gray bat (*Myotis* grisescens), bald eagle (*Haliaeetus leucocephalus*), oyster mussel (*Epioblasma capsaeformis*), Cumberlandian combshell (*Epioblasma brevidens*), orange-foot pimpleback (*Plethobasus cooperianus*), Cumberland monkeyface (*Quadrula intermedia*), birdwing pearlymussel (*Conradilla caelata*), tan riffleshell (*Epioblasma floerntina walkeri*), and Eggert's sunflower (*Helianthus eggertii*). Federally designated critical habitat for the endangered oyster mussel and Cumberlandian combshell exists in the mainstem Duck River, from the First Street bridge in Columbia (milepoint 133) upstream to Lillard Mill Dam (milepoint 179), in Maury and Marshall Counties. For a complete listing of endangered and threatened species in Tennessee, please visit the Service's website at http://www.fws.gov/cookeville/.

Recovery is the process by which the decline of an endangered or threatened species is stopped and reversed, and threats to the species' survival are eliminated, so that long-term survival in nature can be ensured. The goal of the recovery process is to restore listed species to a point where they are secure and self-sustaining in the wild and can be removed from the endangered species list. Under the ESA, the Service and National Marine Fisheries Service were delegated the responsibility of carrying out the recovery program for all listed species.

Utilizing funding provided through the Service's Landowner Incentives Program (LIP), the Tennessee Wildlife Resources Agency (TWRA), the Tennessee Nature Conservancy (TNC), and private landowners are implementing habitat restoration activities in the Duck River watershed. The LIP is a new effort of the Service's endangered species recovery program focusing on the enhancement of in-stream aquatic habitats and the protection and restoration of riparian habitats for the numerous federally listed species which occur in the watershed.

In a partnership with the TNC, TWRA, and Tennessee Department of Environment and Conservation (TDEC) Division of Natural Heritage, the Service developed a State Conservation Agreement for Cave Dependent Species in Tennessee (SCA). The SCA targets unlisted but rare species and protects these species through a suite of proactive conservation agreements. The goal is to preclude the need to list these species under the ESA. This agreement covers middle and eastern Tennessee and will benefit water quality in many watersheds within the State.

The Service is actively involved with the Duck River Agency in addressing existing water quality impairments of the watershed and the water supply needs of the local region.

In an effort to preclude the listing of a rare species, the Service engages in proactive conservation efforts for unlisted species. The program covers not only formal candidates but other rare species that are under threat. Early intervention preserves management options and minimizes the cost of recovery.

Partners for Fish and Wildlife Program

The U.S. Fish and Wildlife Service established the Partners for Fish and Wildlife Program to restore historic habitat types that benefit native fishes and wildlife. The program adheres to the concept that restoring or enhancing habitats such as wetlands or other unique habitat types will substantially benefit federal trust species on private lands by providing food and cover or other essential needs. Federal trust species include threatened and endangered species, as well as migratory birds (e.g. waterfowl, wading birds, shorebirds, neotropical migratory songbirds).

Participation is voluntary and various types of projects are available. Projects include livestock exclusion fencing, alternate water supply construction, streambank stabilization, restoration of native vegetation, wetland restoration/enhancement, riparian zone reforestation, and restoration of in-stream aquatic habitats.

The Service is actively involved with the Natural Resources Conservation Service and private landowners in the Duck River watershed to protect riparian habitats for the numerous federally listed aquatic species that occur. Specific projects have included the installation of livestock exclusion fencing and alternate water supply sources.

HOW TO PARTICIPATE

- Interested landowners contact a Partners for Fish and Wildlife Biologist to discuss the proposed project and establish a site visit.
- A visit to the site is then used to determine which activities the landowner desires and how those activities will enhance habitat for trust resources. Technical advice on proposed activities is provided by the Service, as appropriate.
- Proposed cost estimates are discussed by the Service and landowner.
- A detailed proposal which describes the proposed activities is developed by the Service biologist and the landowner. Funds are competitive, therefore the

proposal is submitted to the Service's Ecosystem team for ranking and then to the Regional Office for funding.

- After funding is approved, the landowner and the Service co-sign a Wildlife Extension Agreement (minimum 10-year duration).
- Project installation begins.
- When the project is completed, the Service reimburses the landowner after receipts and other documentation are submitted according to the Wildlife Extension Agreement.

For more information regarding the Endangered Species and Partners for Fish and Wildlife programs, please contact the Tennessee Ecological Services Field Office at (931)-528-6481 or visit their website at http://www.fws.gov/cookeville/.

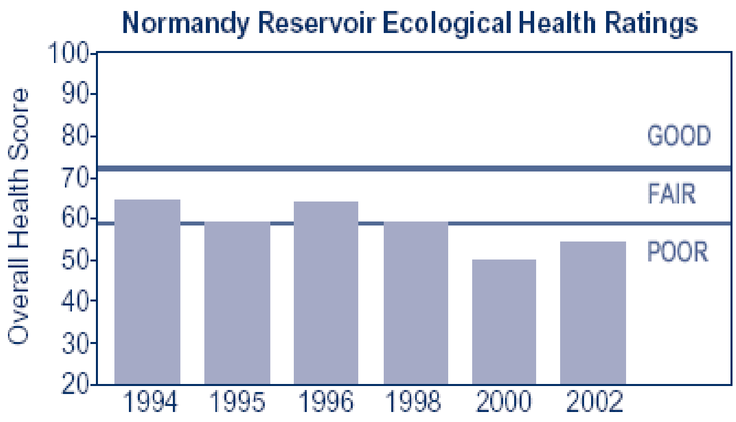
5.2.D. Tennessee Valley Authority (TVA). The Tennessee Valley Authority's (TVA) goals for the 21st century are to generate prosperity for the Tennessee Valley by promoting economic development, supplying low-cost, reliable power, and supporting a thriving river system. TVA is committed to the sustainable development of the region and is engaged in a wide range of watershed protection activities. TVA has seven multidisciplinary Watershed Teams to help communities across the Tennessee Valley actively develop and implement protection and restoration activities in their local watersheds. These teams work in partnership with business, industry, government agencies, and community groups to manage, protect, and improve the quality of the Tennessee River and its tributaries. TVA also operates a comprehensive monitoring program to provide real-time information to the Watershed Teams and other entities about the conditions of these resources. The following is a summary of TVA's resource stewardship activities in the Upper Duck River watershed.

Reservoir Monitoring

Reservoir Ecological Health. TVA's Reservoir Ecological Health Monitoring program is designed to provide the necessary information from five key ecological indicators (dissolved oxygen, chlorophyll, fish community, bottom life, and sediment contaminants [PCBs, Pesticides, and Metals]) to evaluate current conditions, provide data for comparing future water quality conditions, and provide for assessments as needed for current and future operations and development. The ecological health evaluation system examines each indicator separately and then combines those ratings into a single, composite score for each reservoir. TVA monitored the quality of water resources in Normandy Reservoir annually from 1993 through 1996 to establish baseline data on the reservoir's ecological health under a range of weather and flow conditions. Normandy is now evaluated every other year.

Normandy Reservoir rated poor in 2002. Little variation in reservoir condition or individual indicators was observed during the first four years (1993 - 1996). However, three indicators (dissolved oxygen, chlorophyll, and bottom life) exhibited a marked change between the 1993-1996 and 1998-2002 periods. These changes were primarily the result of improvements made in June of 1997 to the aeration system located in the forebay. A new, larger compressor and four new diffuser lines were added to the aeration system. Two of these new diffuser lines extended upstream beyond the sampling location. The results for each indicator are discussed below.

The following charts show the Reservoir Ecological Health score for each year for which data are comparable.



In 2002, Improvements were made in the method of assessing the condition of reservoir fish. These improvements were applied to all past assessments, resulting in changes to some previously reported reservoir scores.

The table below shows the ratings for individual ecological health indicators at Normandy in 2002. These ratings are briefly explained in the paragraphs that follow.

Ratings for Ecological Health Indicators for Normandy Reservoir, 2002					
Monitoring location	**Dissolved oxygen**	**Chlorophyll**	**Fish**	**Bottom life**	**Sediment**
Forebay	Poor	Poor	Good	Fair	Fair

- Dissolved oxygen: As in previous years, dissolved oxygen levels near Normandy Dam rated poor. However, the volume of water affected in 1998, 2000, and 2002 was significantly smaller than in previous years. This is the result of an aeration system that added oxygen to the water and helped reduce the difference in temperature between the oxygen-rich water near the surface and the low dissolved oxygen water near the reservoir bottom, allowing the two layers to remain mixed for a longer period of time.

- Chlorophyll: Ratings for chlorophyll dropped from good in previous years to poor in 1998, 2000, and 2002 because of a substantial increase in concentrations.

- Fish: The fish community rated good, as in all previous years.

- Bottom life: Bottom life rated fair in 1998, 2000, and 2002 compared to poor in previous years, probably because of improved dissolved oxygen conditions. Both the number and variety of organisms collected showed improvement, although the lack of dissolved oxygen on the reservoir bottom during much of the summer continues to impact the density and composition of the community of animals present.

- Sediment: Sediment quality rated fair in 2002, compared to good in previous years. Sediment samples contained low levels of chlordane, and arsenic concentrations were slightly higher than the expected background concentration. Chlordane is a pesticide previously used to control termites and crop pests.

More information about monitoring on Normandy Reservoir can be obtained by contacting Tyler Baker at (423)-876-6733 or tfbaker@tva.gov or http://www.tva.gov .

Bacteriological Monitoring

Swimming Advisories. TVA develops, maintains, and promotes public use of several recreational sites. Increased public knowledge about bacterial contamination has heightened the interest in bacteriological levels in recreational waters by both TVA and our stakeholders. Each summer, about 250 swimming areas and informal water contact recreational sites throughout the Tennessee Valley are tested for fecal coliform and/or *Escherichia coli* (*E. coli*) bacteria by TVA's Resource Stewardship. These sites include those operated by TVA and many operated by other agencies. The site list is reexamined annually by the appropriate watershed teams and other TVA organizations to ensure the most heavily used sites are monitored.

TVA monitored four sites on or around Normandy Reservoir for *E.coli* in 2004. Bacteriological water sampling is conducted between Memorial Day and Labor Day when people are most likely to be recreating. The results from Cedar Point Public Use Area beach, Barton Springs Public Use Area beach and Normandy Tailwater site were below the state of Tennessee’s bacteriological criteria for water contact recreation with the exception of a one time exceedance at each site from samples collected after a rainfall event. The sampling site at Dement Bridge had elevated *E.coli* concentrations.

Data from this sampling effort is shared in a timely manner with TDEC's Division of Water Pollution Control.

Fish Flesh Monitoring

Fish Flesh Toxic Contaminants. State agencies are responsible for advising the public of health risks from eating contaminated fish. TVA assists the states by collecting fish from TVA reservoirs and checking the tissue for metals, pesticides, PCBs, and other chemicals that could affect human health. TVA collected channel catfish and largemouth bass from Normandy reservoir and the Duck River (DRM 26.0) for tissue analysis in the autumn of 2002. All contaminant levels were either below detectable levels or below the levels used by the state of Tennessee to issue fish consumption advisories. TVA will analyze fish from Normandy again in the autumn of 2006.

More information on bacteriological sampling or fish flesh monitoring on Normandy Reservoir and the Duck River can be obtained by contacting Rebecca Hallman at (423)-876-6736 or rlhallman@tva.gov or http://www.tva.gov .

Sport Fish Monitoring

Sport Fishing Index Ratings. To help anglers decide where they have the best chance of catching their favorite types of fish, TVA and state fisheries agencies have created a Sport Fishing Index that reflects fishing quality for different species in the TVA reservoirs. The Sport Fishing Index scores for different species are based both on population measures (the size and health of the individual fish, along with the number of fish present) and angler use and success information (the number of anglers looking for a particular type of fish, and the number of that type that they actually catch).

The Sport Fishing Index score ranges from a high of 60 (excellent) to a low of 20 (very poor).

Normandy Reservoir:

Fish Species	2003 Score	2003 Valley wide Average
Black Bass	31	36
Bluegill	30	30
Channel Catfish	28	29
Crappie	40	36
Hybrid Striped/White Bass	46	35
Largemouth Bass	30	32
Smallmouth Bass	24	32
Spotted Bass	43	31
Walleye	20	27
White Bass	20	29

Spring Sportfish Survey. TVA conducts its annual spring (March through early June) sportfish survey to help determine the number, age, and general health of black bass and crappie populations in TVA reservoirs. The survey includes twelve 30-minute electro-fishing runs covering the various habitat types present. An electric current is used to temporarily stun the fish so that they float to the surface, where they are collected by TVA crews. Fish are then weighed, measured, marked, and released.

This approach to determining fish abundance is used by state game and fish agencies and academia. The sample sites are selected using the shoreline habitat characteristics employed by the Watershed Teams. The results from the 2004 survey, which will be provided to state agencies in Tennessee, are expected in fall 2004.

Spring Sport fish Survey Results from 1999 through 2003:

Parameter	**2003**	**2001**	**2000**	**1999**
Hours electrofished	6	5	5	7
Total number of black bass	312	87	125	170
Percent harvestable (over 10 inches)	60.5	0.46	76	78
Number of largemouth bass	183	67	95	115
Number of smallmouth bass	14	3	30	2
Number of spotted bass	115	17	29	53
Electrofishing catch rate (per hour)	52	28.5	30	39
Average weight (pounds)	1.9	1.1	2	2
Largest black bass (pounds)	5.9	3.3	6	4
Number of fish with disease/parasites	N/A	1	10	16
Number of recaptures (from previous years)	N/A	7	20	5
Number weighing more than 5 pounds	3	0	4	2
Number weighing more than 4 pounds	12	0	8	7

More information about fish sampling on Normandy Reservoir can be obtained by contacting Donny Lowery at (256)-386-2729 or drlowery@tva.gov or http://www.tva.gov

Stream Monitoring

The condition of water resources in the Duck River watershed streams is measured using three independent methods; Index of Biotic Integrity (IBI), number of mayfly, stonefly, and caddisfly taxa (EPT), and Habitat Assessment. Not all of these tools were used at each stream sample site.

IBI. The index of biotic integrity (IBI) assesses the quality of water resources in flowing water by examining a stream's fish assemblage. Fish are useful in determining long-term (several years) effects and broad habitat conditions because they are relatively long lived and mobile. Twelve metrics address species richness and composition, trophic structure (structure of the food chain), fish abundance, and fish health. Each metric reflects the condition of one aspect of the fish assemblage and is scored against reference streams in the region known to be of very high quality. Potential scores for each of the twelve metrics is 1-poor, 3-intermediate, or 5-the best to be expected. Scores for the 12 metrics are summed to produce the IBI for the site. The following table associates IBI ranges with attributes of fish assemblages.

Attributes	IBI Range
Comparable to the best situations without influence of man; all regionally expected species for the habitat and stream size, including the most intolerant forms, are present with full array of age and sex classes; balanced trophic structure.	58-60
Species richness somewhat below expectation, especially due to loss of most intolerant forms; some species with less than optimal abundance or size distribution; trophic structure shows some signs of stress.	48-52
Signs of additional deterioration include fewer intolerant forms, more skewed trophic structure (e.g., increasing frequency of omnivores); older age classes of top predators may be rare.	40-44
Dominated by omnivores, pollution-tolerant forms, and habitat generalists; few top carnivores; growth rates and condition factors commonly depressed; hybrids and diseased fish often present.	28-34
Few fish present, mostly introduced or tolerant forms; hybrids common; disease, parasites, fin damage, and other anomalies regular.	12-22

EPT. The number and types of aquatic insects, like fish, are indicative of the general quality of the environment in which they live. Unlike fish, aquatic insects are useful in determining short-term and localized impacts because they are short-lived and have limited mobility. The method TVA uses involves only qualitative sampling and field identification of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) to the family taxonomic level (EPT). The score for each site is simply the number of EPT families. The higher EPT scores are indicative of high quality streams because these insect larvae are intolerant of poor water quality.

Habitat Assessment. The quality and quantity of habitat (physical structure) directly affect aquatic communities. Habitat assessments are done at most stream sampling sites to help interpret IBI and EPT results. If habitat quality at a site is similar to that found at a good reference site, any impacts identified by IBI and EPT scores can reasonably be attributed to water quality problems. However, if habitat at the sample site differs considerably from that at a reference site, lower than expected IBI and EPT scores might be due to degraded habitat rather than water quality impacts.

The habitat assessment method used by TVA (modified EPA protocol) compares observed instream, channel, and bank characteristics at a sample site to those expected at a similar high-quality stream in the region. Each of the stream attributes listed below is given a score of 1 (poorest condition) to 4 (best condition). The habitat score for the sample site is simply the sum of these attributes. Scores can range from a low of 10 to a high of 40.

1. Instream cover (fish)
2. Epifaunal substrate
3. Embeddedness
4. Channel Alteration
5. Sediment Deposition
6. Frequency of Riffle
7. Channel Flow Status
8. Bank vegetation protection - Left bank and right bank, separately
9. Bank stability - Left bank and right bank, separately
10. Riparian vegetation zone width - Left bank and right bank, separately

Sample Site Selection. EPT sampling and fish community assessment (IBI) are conducted at the same sites. Site selection is governed primarily by study objectives, stream physical features, and stream access. TVA's objective is to characterize the quality of water resources within a sub-watershed (11-digit hydrologic unit). Sites are typically located in the lower end of sub-watersheds and at intervals on the mainstem to integrate the effects of land use. A total of 44 sites have been sampled in the Upper Duck River watershed since 1994. These sites are typically sampled every five years to keep a current picture of watershed condition.

Details about stream bio-assessment sampling sites and scores in the Upper Duck Watershed can be obtained by contacting Amy Wales at (423)-876-6748 or akwales@tva.gov or http://www.tva.gov .

Coalition Support

Inter-agency Partnerships. The benefits of watershed partnerships are well documented. No one unit of government, agency, group or individual has all the knowledge, expertise or resources to address all watershed issues. Partnerships can tap a diversity of energy, talent, and ideas. Watershed partnerships can also promote a more efficient use of limited financial and human resources and can identify innovative and efficient means of improving or protecting water quality. The Guntersville-Tims Ford Watershed Team assists an inter-agency partnership, the Duck River Water Resource Council, with efforts to improve and protect water resources in the Tims Ford watershed.

Outreach

Tennessee Growth Readiness Initiative. The Tennessee Growth Readiness Initiative (TGRI) is an educational program developed by TVA to teach local officials, and other decision makers about the sources and impacts of non-point source pollution, how different land uses affect water quality, and what communities can do to protect water quality. To date participants from Lewisburg and Columbia have been through the initial training for TGRI.

For more information on the Tennessee Growth Readiness Program you can contact Joel Haden at (865)-632-2132 or e-mail jmhaden@tva.gov or http://www.tva.gov.

Protection And Restoration Activities

Promote Best Management Practices. TVA provides funding and technical expertise to assist with installation of best management practices (BMPs) that will reduce non-point pollution. TVA also works with partners to promote use of BMPs. After projects are installed they are used to educate local farming communities by providing tours and fields. Since 1998 TVA has worked with the local NRCS offices and Soil Conservation Districts in the headwaters of the Duck River to establish several miles of stream buffers.

Support Clean-Up Efforts. TVA has supported the Duck River Clean-up that is in its fifth year. The clean-up is a local community (civic clubs, Chamber of Commerce, etc.) led effort that is based out of Shelbyville, TN. Each year approximately 100 to 150 volunteers participate in picking up litter by floating and driving to areas along the river. Approximately 40 miles of the Duck River are cleaned-up during this weekend. This clean-up event is usually held in June or July with breakfast and lunch provided for participates. The goal of the group is to challenge other communities along the Duck River to do the same.

Promote Riparian Buffers. An effective line of water quality protection is maintaining the vegetative plant cover along water bodies. TVA encourages waterfront property owners to maintain or establish vegetated riparian buffers by providing information to the riparian property owner. TVA has also developed a series of 11 fact sheets that will enable riparian property owners to restore, manage, and be better stewards of riparian land. The fact sheets are available on the TVA internet site at: http://www.tva.com/river/landandshore/index.htm.

Further information on TVA's Watershed Assistance activities in the Upper Duck River Watershed can be obtained by writing the Guntersville-Tims Ford Watershed Team at: Tennessee Valley Authority, 3696 Alabama HWY 69, Guntersville, AL 35976 or calling the Guntersville-Tims Ford Office at (256)-571-4280. Also, contact can be made by calling 1-800-TVA-Land or http://www.tva.gov .

5.3. STATE PARTNERSHIPS.

5.3.A. TDEC Division of Water Supply. The Source Water Protection Program, authorized by the 1996 Amendments to the Safe Drinking Water Act, outline a comprehensive plan to achieve maximum public health protection. According to the plan, it is essential that every community take these six steps:

1) Delineate the drinking water source protection area
2) Inventory known and potential sources of contamination within these areas
3) Determine the susceptibility of the water supply system to these contaminants
4) Notify and involve the public about threats identified in the contaminant source inventory and what they mean to their public water system
5) Implement management measures to prevent, reduce or eliminate threats
6) Develop contingency planning strategies to deal with water supply contamination or service interruption emergencies (including natural disaster or terrorist activities).

Source water protection has a simple objective: to prevent the pollution of the lakes, rivers, streams, and ground water (wells and springs) that serve as sources of drinking water before they become contaminated. This objective requires locating and addressing potential sources of contamination to these water supplies. There is a growing recognition that effective drinking water system management includes addressing the quality and protection of the water sources.

Source Water Protection has a significant link with the Watershed Management Program goals, objectives and management strategies. Watershed Management looks at the health of the watershed as a whole in areas of discharge permitting, monitoring and protection. That same protection is important to protecting drinking water as well. Communication and coordination with a multitude of agencies is the most critical factor in the success of both Watershed Management and Source Water Protection.

Watershed management plays a role in the protection of both ground water and surface water systems. Watershed Management is particularly important in areas with karst (limestone characterized by solution features such as caves and sinkholes as well as disappearing streams and spring), since the differentiation between ground water and surface water is sometimes nearly impossible. What is surface water can become ground water in the distance of a few feet and vice versa.

Source water protection is not a new concept, but an expansion of existing wellhead protection measures for public water systems relying on ground water to now include surface water. This approach became a national priority, backed by federal funding, when the Safe Drinking Water Act amendments (SDWA) of 1996 were enacted. Under this Act, every public drinking water system in the country is scheduled to receive an assessment of both the sources of potential contamination to its water source of the threat these sources may pose by the year 2003 (extensions were available until 2004). The assessments are intended to enhance the protection of drinking water supplies within existing programs at the federal, state and local levels. Source water assessments were mandated and funded by Congress. Source water protection will be left up to the individual states and local governments without additional authority from Congress for that progression.

As a part of the Source Water Assessment Program, public water systems are evaluated for their susceptibility to contamination. These individual source water assessments with susceptibility analyses are available to the public at http://www.state.tn.us/environment/dws as well as other information regarding the Source Water Assessment Program and public water systems.

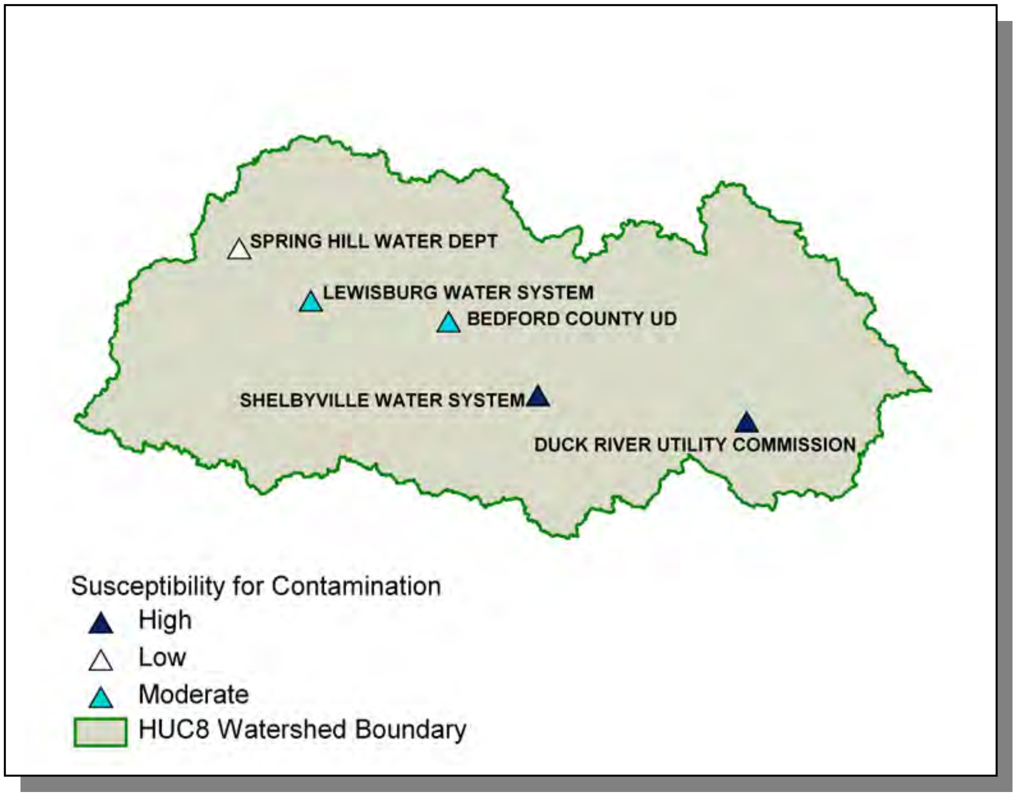


Figure 5-1. Susceptibility for Contamination in the Upper Duck River Watershed.

For further discussion on ground water issues in Tennessee, the reader is referred to the Ground Water Section of the 305(b) Water Quality Report at http://www.tdec.net/water.shtml.

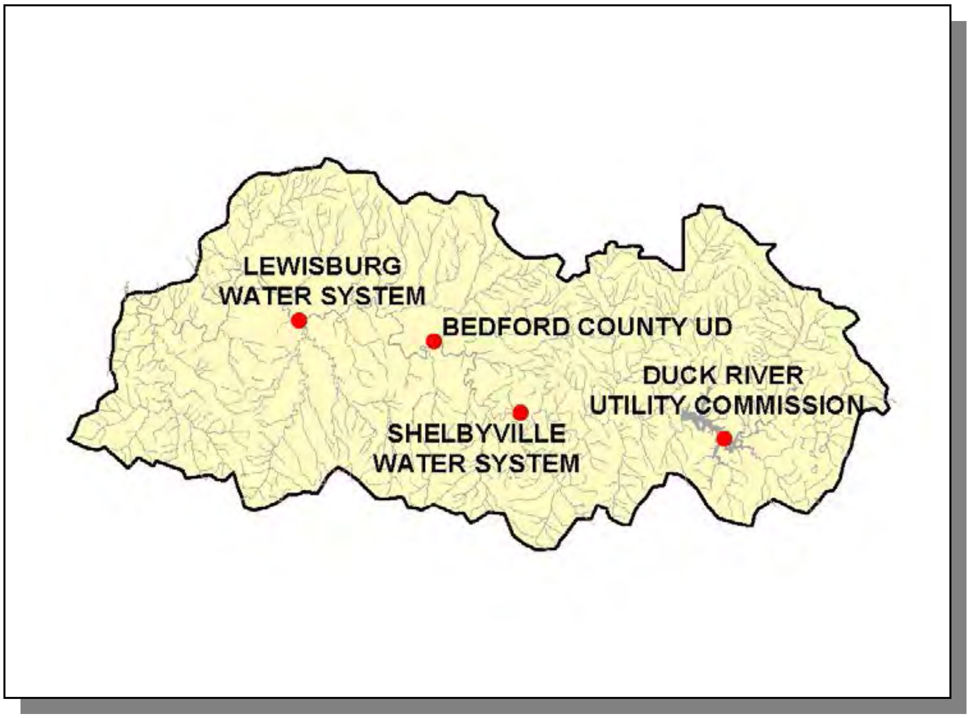


Figure 5-2. Locations of Community and Non-Community Public Water Supply Intakes in the Upper Duck River Watershed.

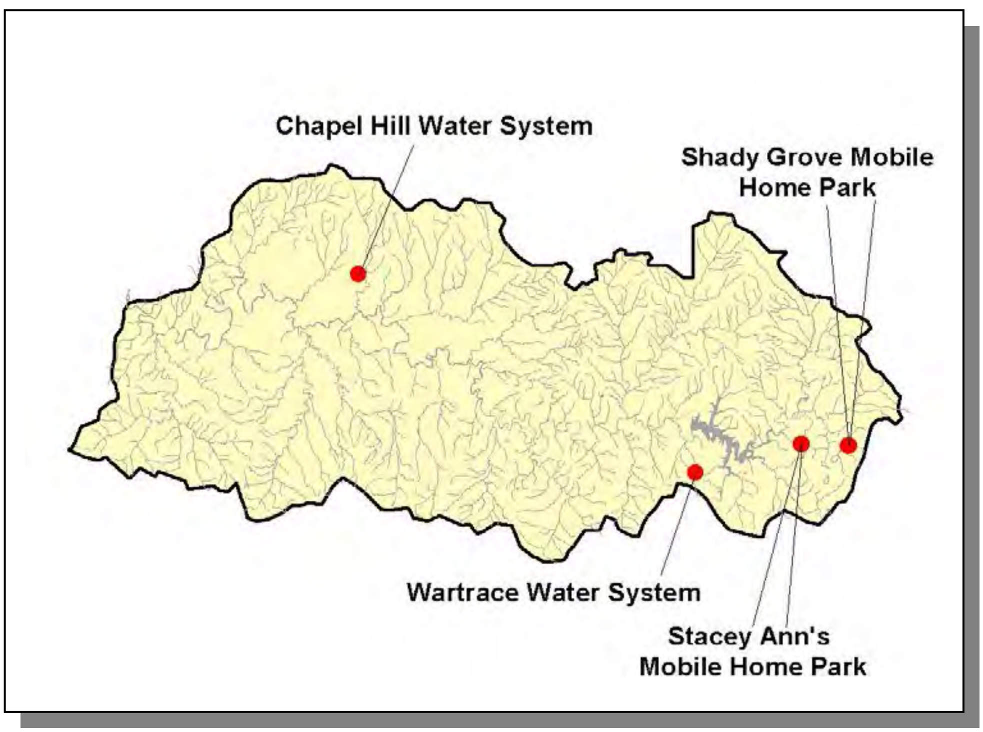


Figure 5-3. Locations of Community and Public Groundwater Supply Intakes in the Upper Duck River Watershed.

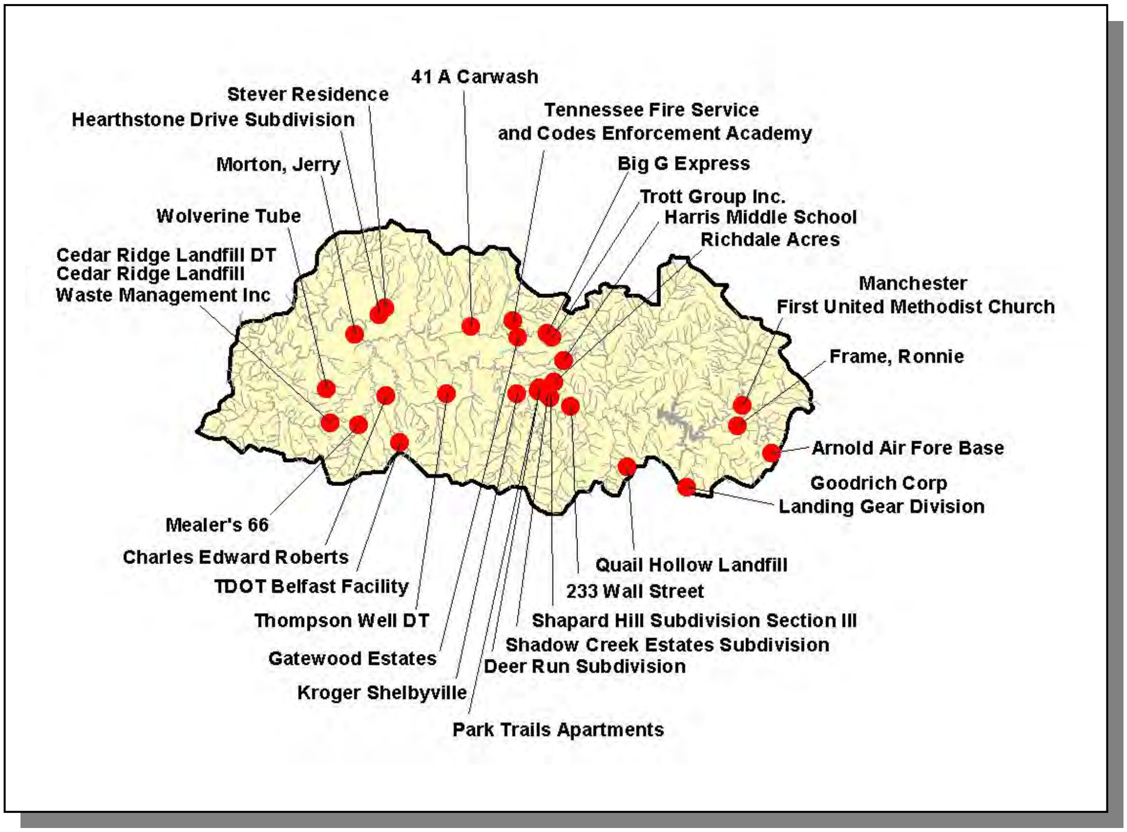


Figure 5-4. Locations of UIC (Underground Injection Control) Sites in the Upper Duck River Watershed. *Injection wells include stormwater sinkholes modified for drainage, commercial/industrial septic tanks, and large capacity septic tanks.*

5.3.B. State Revolving Fund. TDEC administers the state's Clean Water State Revolving Fund Program. Amendment of the Federal Clean Water Act in 1987 created the Clean Water State Revolving Fund (SRF) Program 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. TDEC has awarded loans totaling approximately $550 million since the creation of the SRF Program. SRF loan repayments are returned to the program and used to fund future SRF loans.

SRF loans are available for planning, design, and construction of wastewater facilities, or any combination thereof. Eligible projects include new construction or upgrading/expansion of existing facilities, including wastewater treatment plants, pump stations, force mains, collector sewers, interceptors, elimination of combined sewer overflows, and nonpoint source pollution remedies.

SRF loan applicants must pledge security for loan repayment, agree to adjust user rates as needed to cover debt service and fund depreciation, and maintain financial records that follow governmental accounting standards. SRF loan interest rates range from zero percent to market rate, depending on the community's per-capita income, taxable sales, and taxable property values. Most SRF loan recipients qualify for interest rates between 2 and 4 percent. Interest rates are fixed for the life of the term of the loan. The maximum loan term is 20 years or the design life of the proposed wastewater facility, whichever is shorter.

TDEC maintains a Priority Ranking System and Priority List for funding the planning, design, and construction of wastewater facilities. The Priority Ranking List forms the basis for funding eligibility determinations and allocation of Clean Water SRF loans. Each project's priority rank is generated from specific priority ranking criteria and the proposed project is then placed on the Project Priority List. Only projects identified on the Project Priority List may be eligible for SRF loans. The process of being placed on the Project Priority List must be initiated by a written request from the potential SRF loan recipient or their engineering consultant. SRF loans are awarded to the highest priority projects that have met SRF technical, financial, and administrative requirements and are ready to proceed.

Since SRF loans include federal funds, each project requires development of a Facilities Plan, an environmental review, opportunities for minority and women business participation, a State-approved sewer use ordinance and Plan of Operation, and interim construction inspections.

For further information about Tennessee's Clean Water SRF Loan Program, call (615) 532-0445 or visit their Web site at http://www.tdec.net/srf.

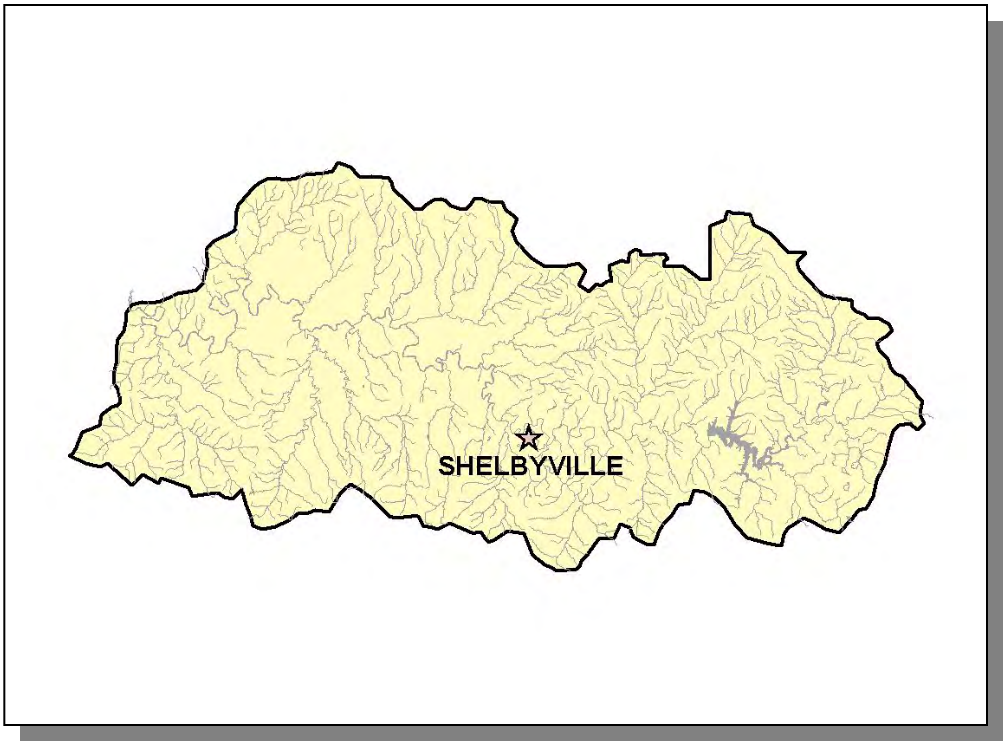


Figure 5-5. Location of Communities Receiving SRF Loans or Grants in the Upper Duck River Watershed. *More information is provided in Appendix V.*

5.3.C. Tennessee Department of Agriculture. The Tennessee Department of Agriculture's Water Resources Section consists of the federal Section 319 Nonpoint Source Program and the Agricultural Resources Conservation Fund Program. Both of these are grant programs which award funds to various agencies, non-profit organizations, and universities that undertake projects to improve the quality of Tennessee's waters and/or educate citizens about the many problems and solutions to water pollution. Both programs fund projects associated with what is commonly known as "nonpoint source pollution."

The Tennessee Department of Agriculture's Nonpoint Source Program (TDA-NPS) has the responsibility for management of the federal Nonpoint Source Program, funded by the US Environmental Protection Agency through the authority of Section 319 of the Clean Water Act. This program was created in 1987 as part of the reauthorization of the Clean Water Act, and it established funding for states, territories and Indian tribes to address NPS pollution. Nonpoint source funding is used for installing Best Management Practices (BMPs) to stop known sources of NPS pollution, training, education, demonstrations and water quality monitoring. The TDA-NPS Program is a non-regulatory program, promoting voluntary, incentive-based solutions to NPS problems. The TDA-NPS Program basically funds three types of programs:

- BMP Implementation Projects. These projects aid in the improvement of an impaired waterbody, or prevent a non-impaired water from becoming listed on the 303(d) List.

- Monitoring Projects. Up to 20% of the available grant funds are used to assist the water quality monitoring efforts in Tennessee streams, both in the state's 5-year watershed monitoring program, and also in performing before-and-after BMP installation, so that water quality improvements can be verified. Some monitoring in the Upper Duck River Watershed was funded under an agreement with the Tennessee Department of Agriculture, Nonpoint Source Program (U.S. Environmental Protection Agency Assistance Agreements C9994674-00-0, C9994674-01-0, and C9994674-02-0).

- Educational Projects. The intent of educational projects funded through TDA-NPS is to raise the awareness of landowners and other citizens about practical actions that can be taken to eliminate nonpoint sources of pollution to the waters of Tennessee.

The Tennessee Department of Agriculture Agricultural Resources Conservation Fund Program (TDA-ARCF) provides cost-share assistance to landowners across Tennessee 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. Additionally, a portion of the TDA-ARCF is used to implement information and education projects statewide, with the focus on landowners, producers, and managers of Tennessee farms and forests.

Participating contractors in the program are encouraged to develop a watershed emphasis for their individual areas of responsibility, focusing on waters listed on the Tennessee 303(d) List as being impaired by agriculture. Current guidelines for the TDA-ARCF are available. Landowners can receive up to 75% of the cost of the BMP as a reimbursement.

Since January of 1999, the Department of Agriculture and the Department of Environment and Conservation have had a Memorandum of Agreement whereby complaints received by TDEC concerning agriculture or silviculture projects would be forwarded to TDA for investigation and possible correction. Should TDA be unable to obtain correction, they would assist TDEC in the enforcement against the violator. More information forestry BMPs is available at:
http://tennessee.gov/agriculture/forestry/BMPs.pdf, and the complaint form is available at: http://tennessee.gov/environment/wpc/logform.php.

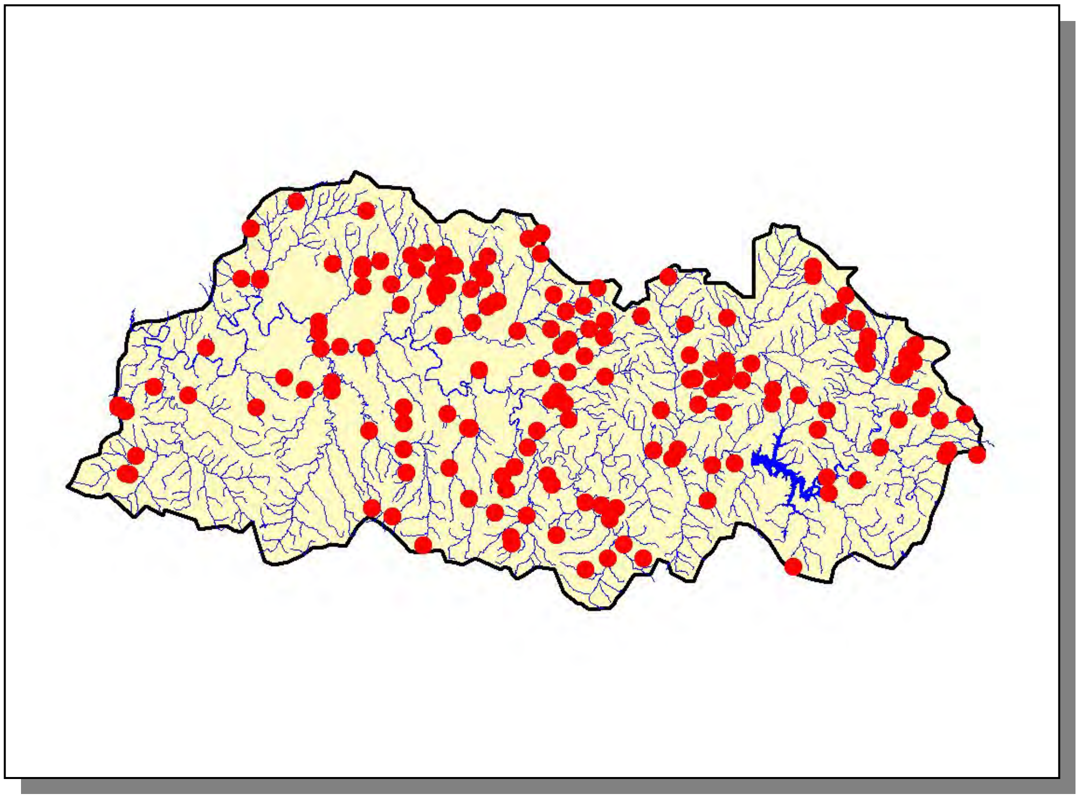


Figure 5-6. Location of BMPs installed from 1999 through 2003 in the Upper Duck River Watershed with Financial Assistance from the Tennessee Department of Agriculture's Nonpoint Source and Agricultural Resources Conservation Fund Grant Programs. *More information is provided in Appendix V.*

5.4. LOCAL INITIATIVES.

5.4.A. Tennessee Duck River Development Agency. The Tennessee Duck River Development Agency (Duck River Agency, or DRA) was created by the Tennessee General Assembly in 1965 as a comprehensive regional development agency. Its broad powers include the "control and development of the water resources" of the Duck River watershed. In 1998 the agency adopted the following mission statement:

"To develop, protect, and sustain a clean and dependable Water Resource for all citizens of the Duck River region".

In recent years the Agency has established two organizations that are providing critical guidance and cooperation in support of that mission. The Duck River Agency Technical Advisory Committee (DRATAC), comprised of the regions public water systems managers, provides direct program development advice and guidance to the Agency. At the same time the Duck River Watershed Water Resources Council (WRC), a voluntary association of virtually every public and private organizations working on water issues in the watershed, has accepted the challenge to develop and maintain a comprehensive water resources plan for the region.

The comprehensive water resources plan has three parts, water supply, water quality and emergency actions. The DRA and DRATAC took the lead developing a twenty-five year action plan as Part I Water Supply. It was approved by the DRA Board of Directors, July 2003 and accepted by the WRC in August 2003. Part I Water Supply plan action items are now being implemented by DRA/DRATAC and their WRC partners, TVA and USGS. Copies of the water supply plan and action item project reports are available from the DRA office.

The WRC is now focused on developing the first edition of Part II of the comprehensive plan, Water Quality Protection and Restoration. The TDEC Duck River Watershed Water Quality Management Plan provides critical elements for the DRA / WRC water quality plan that can be supplemented by WRC members to provide the best guidance and support for future cooperative actions.

For additional information:
Duck River Agency
210 E. Depot Street
Shelbyville, TN 37160
Tel 931-684-7820
duckrvr@bellsouth.net
http://www.duckriveragency.com

5.4.B. The Tennessee Scenic River Association's Duck River Opportunities Project. The Tennessee Scenic Rivers Association's Duck River Opportunities Project (DROP) started in 1999 with funding from the Tennessee Environmental Endowment. The basis of the project was to build partnerships to protect and enhance the ecological health of the Duck River and its tributaries. The DROP is pursuing a two-fold approach to addressing local water quality problems. The first approach is the formation of a citizen group whose focus is on the protection and enhancement of the ecological health of the

Duck River and its tributaries. The second approach is working with local communities to develop sub watershed restoration plans and to include activities that can be utilized as demonstration projects as well as enhancement of water quality.

More information about DROP, including the importance of Smart Growth in the Lower Duck River Watershed, and a schedule of events for DROP, can be found at:

http://www.paddletsra.org/duckriver.html

or by contacting John McFadden, Director of Science and Restoration at:

(615)-374-3744
jfm@hughes.net

5.4.C. The Nature Conservancy Duck River Project. Winding 269 miles through the heart of Tennessee, the Duck River is noted in The Nature Conservancy's "Rivers of Life" as the number two aquatic hot spot in the country with 33 at-risk fish and mussel species. Few rivers can equal these biological riches and few opportunities exist to preserve such a wide and wonderful array of southeastern fauna. In 2000 the Tennessee Chapter of The Nature Conservancy opened an office in the upper section of the Duck River watershed in order to engage state and federal partners and local communities in conserving this remarkable resource.

Challenges. Mussels are excellent indicators of water quality and recent surveys show that the mussel fauna in the Duck River is thriving, even though 450 miles of streams in the upper watershed are listed as impaired by the state. Today's improved agricultural practices notwithstanding, farming continues to contribute tons of sediment, chemicals and animal waste to the Duck River and its tributaries each year. Home and road construction, urban stormwater, municipal water treatment systems and other human activities contribute as well. Fecal coliform readings spike after rain events throughout the Upper Duck watershed. This is particularly alarming considering that the Duck River is the sole water supply for four large counties in its upper section.

Strategies.

Water Supply. Surface withdrawals from the Duck River supply water to a rapidly growing population in the next large watershed south of Williamson, Davidson and Rutherford counties. Meeting the needs of both the human and aquatic communities requires a sound and sustainable long-term strategy. The Nature Conservancy works closely with the Duck River Agency (DRA) and other partners on a collaborative watershed planning effort which will serve as a regional water supply and source water protection model for the state of Tennessee. As members of the DRA's Duck River Council, partners such as the US Geological Survey and the Duck River Utilities Commission are installing additional gauges and sampling water quality throughout the upper watershed. Plans are underway to facilitate a number of community meetings in the watershed with the goal of raising awareness and educating local citizens about ways to improve water quality.

Cross-Cutting Approaches. The Nature Conservancy received a four-year EPA 319 grant from Tennessee Department of Agriculture Nonpoint Source Pollution Program to develop and implement a watershed management plan for Big Rock Creek in Marshall County. Big Rock Creek is on the state's 303(d) list as impaired by urban and agricultural run-off. This sub-watershed is impacted by many of the same threats that exist throughout TNC's larger project area and provides an opportunity to address these issues on a specific and manageable scale. The Nature Conservancy is doing a variety of work on Big Rock Creek including assisting the city of Lewisburg with the Phase II stormwater ordinances, developing water quality curriculum for the elementary schools, and working with the agricultural community to implement BMPs. The Nature Conservancy will use the community outreach, stream assessment & restoration, and stormwater management practices being developed in the Big Rock Creek watershed as models for other Upper Duck River communities.

The rapid growth that is occurring in Middle Tennessee may ultimately pose the greatest threat to water quality in the Duck River. The Nature Conservancy and key partners at the state and local levels will review land use & infrastructure planning and development practices in Upper Duck watershed communities in order to prevent incompatible economic development that impacts water quality and damages the ecological integrity of the watershed.

Community Involvement. The Nature Conservancy is partnering with the Tennessee Wildlife Resources Agency to implement the Landowner Incentives Program in the upper Duck River watershed. This voluntary program is focused on biologically significant stream reaches that are on the 303(d) list. Staff will provide technical and financial assistance to farmers who are interested in implementing conservation practices on their land. This program is in addition to the work being done through TNC's partnership with NRCS District Conservationists in the four counties. Agricultural best management practices, coupled with outreach and education targeted at the farming community are crucial to improving water quality in this watershed.

While riverwalks and greenways are not typical projects for The Nature Conservancy, there is no question that increased connection to the natural world benefits us all. This connection increases the awareness of the values of our rivers and streams and of the impacts of our daily activities on these resources. The Nature Conservancy is working with communities throughout the upper watershed to create greenways and riverwalks that enhance their quality of life, provide meaningful information to local residents, and demonstrate the beauty and importance of healthy streams and riparian areas.

To contact The Nature Conservancy's Duck River Office in Columbia call (931)840-8881
Email: lcolley@tnc.org or spalmer@tnc.org

To read about The Nature Conservancy's Duck River Project, please visit us at:
http://nature.org/wherewework/northamerica/states/tennessee/preserves/art10169.html

CHAPTER 6

RESTORATION PRIORITIES IN THE UPPER DUCK RIVER WATERSHED

6.1. BACKGROUND.

The Watershed Water Quality Management Plan serves as a comprehensive inventory of resources and stressors in the watershed, a recommendation for control measures, and a guide for planning activities in the next five-year watershed cycle and beyond. Water quality improvement will be a result of implementing both regulatory and nonregulatory programs.

In addition to the NPDES program, some state and federal regulations, such as the TMDL and ARAP programs, address point and nonpoint issues. Construction and MS4 storm water rules (implemented under the NPDES program) have transitioned from Phase 1 to Phase 2. More information on storm water rules may be found at: http://www.state.tn.us/environment/wpc/stormh2o/MS4.htm.

This Chapter addresses point and nonpoint source approaches to water quality problems in the Upper Duck River Watershed.

6.2. COMMENTS FROM PUBLIC MEETINGS. Watershed meetings are open to the public, and most meetings were represented by citizens who live in the watershed, NPDES permitees, business people, farmers, and local river conservation interests. Locations for meetings were chosen after consulting with people who live and work in the watershed. Everyone with an interest in clean water is encouraged to be a part of the public meeting process. The times and locations of watershed meetings are posted at: The times and locations of watershed meetings are posted at: http://www.state.tn.us/environment/wpc/watershed/public.php.

6.2.A. Year 1 Public Meeting. The first Upper Duck River Watershed public meeting was held October 6, 1998 at Columbia State Community College. The goals of the meeting were to: (1) present, and review the objectives of, the Watershed Approach, (2) introduce local, state, and federal agency and nongovernment organization partners, (3) review water quality monitoring strategies, and (4) solicit input from the public.

Major Concerns/Comments

- Preserving streams that are pristine or unimpaired
- Clear cutting effects
- Perception that Duck River is polluted from historic phosphate mines
- Increased population leading to more development and infrastructure
- Lack of public awareness of water quality standards the public should expect

6.2.B. Year 3 Public Meeting. The second Upper Duck River Watershed public meeting was held March 29, 2001 at the Shelbyville Courthouse. The goals of the meeting were to: (1) provide an overview of the watershed approach, (2) review the monitoring strategy, (3) summarize the most recent water quality assessment, (4) discuss the TMDL schedule and citizens' role in commenting on draft TMDLs, and (5) discuss BMPs and other nonpoint source tools available through the Tennessee Department of Agriculture 319 Program and NRCS conservation assistance programs.

6.2.C. Year 5 Public Meeting. The third scheduled Upper Duck River Watershed public meeting was held October 7, 2005 at the Fly Arts Center in Shelbyville. The meeting featured nine educational components:

- Overview of draft Watershed Water Quality Management Plan slide show
- Benthic macroinvertebrate samples and interpretation
- SmartBoard™ with interactive GIS maps
- "How We Monitor Streams" self-guided slide show
- "Why We Do Biological Sampling" self-guided slide show
- TWRA display
- TVA display
- Duck River Development Agency display
- Harpeth River Watershed Association display

In addition, citizens had the opportunity to make formal comments on the draft Watershed Water Quality Management Plan.

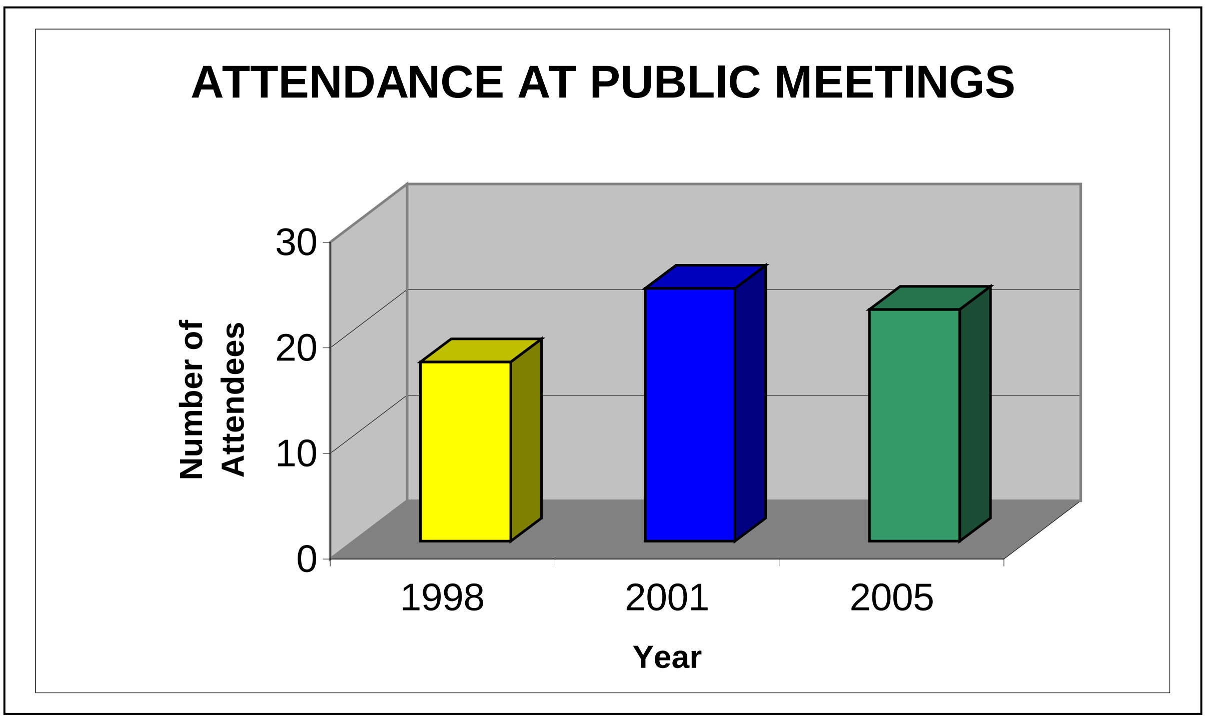


Figure 6-1. Attendance at Public Meetings in the Upper Duck River Watershed. *1998 meeting attendance number represents Buffalo River, Upper Duck River and Lower Duck River Watersheds joint meeting. Attendance numbers do not include TDEC personnel.*

Figure 6-2. David Sims (TWRA Region II) Explains the Fine Points of Native Duck River Mussels to the Duck River Agency Executive Director at the Upper Duck Watershed Public Meeting.

Figure 6-3. Informal Discussions Among Residents of the Watershed Are an Important Part of TDEC's Watershed Meetings.

6.3. APPROACHES USED.

6.3.A. Point Sources. Point source contributions to stream impairment are primarily addressed by NPDES and ARAP permit requirements and compliance with the terms of the permits. Notices of NPDES and ARAP draft permits available for public comment can be viewed at http://www.state.tn.us/environment/wpc/wpcppo/. Discharge monitoring data submitted by NPDES-permitted facilities may be viewed at http://www.epa.gov/enviro/html/pcs/pcs_query_java.html.

The purpose of the TMDL program is to identify remaining sources of pollution and allocate pollution control needs in places where water quality goals are still not being achieved. TMDL studies are tools that allow for a better understanding of load reductions necessary for impaired streams to return to compliance with water quality standards. More information about Tennessee's TMDL program may be found at:
http://www.state.tn.us/environment/wpc/tmdl/.

Approved TMDL:

Upper Duck River. TMDL for fecal coliform in the Upper Duck River and Upper Duck River Watershed. Approved May 17, 2004.
http://www.state.tn.us/environment/wpc/tmdl/approvedtmdl/UpDuck_Fecal05.pdf

Upper Duck River. TMDL for dissolved oxygen and nutrients in the Upper Duck River watershed. Approved August 11, 2005.
http://www.state.tn.us/environment/wpc/tmdl/approvedtmdl/UpDuck12_Nutr16.pdf

TMDLs are prioritized for development based on many factors.

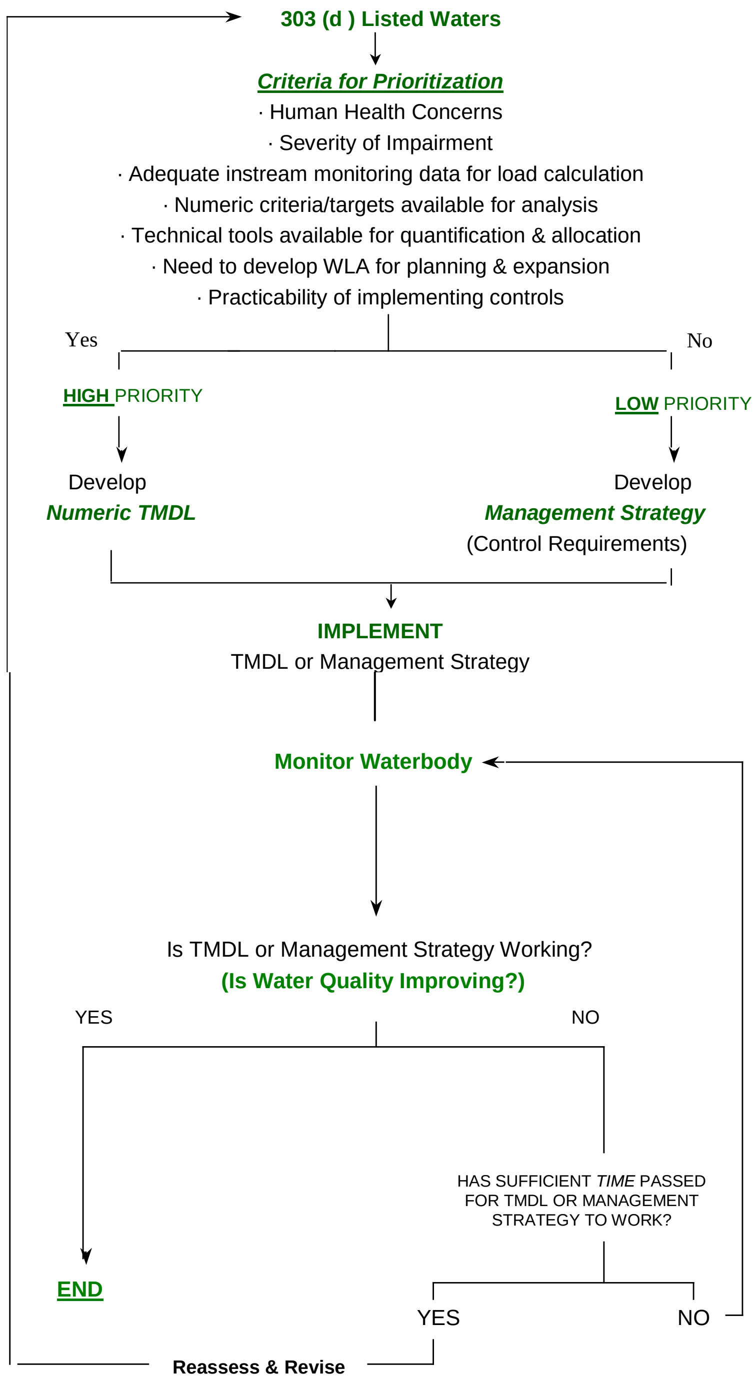


Figure 6.4. Prioritization scheme for TMDL Development.

6.3.B. Nonpoint Sources

Common nonpoint sources of pollution include urban runoff, riparian vegetation removal, and inappropriate land development, agricultural, and road construction practices. Since nonpoint pollution exists essentially everywhere rain falls, existing point source regulations can have only a limited effect. Other measures are, therefore, necessary.

There are several state and federal regulations that address some of the contaminants impacting waters in the Upper Duck River Watershed. Most of these are limited to only point sources: a pipe or ditch. Often, controls of point sources are not sufficient to protect waters, so other measures are necessary. Some measures include efforts by landowners and volunteer groups and the possible implementation of new regulations. Many agencies, such as the Tennessee Department of Agriculture (TDA) and the Natural Resources Conservation Service (NRCS), offer financial assistance to landowners for corrective actions (like Best Management Practices) that may be sufficient for recovery of impacted streams. Many nonpoint problems will require an active civic involvement at the local level geared towards establishment of improved zoning guidelines, building codes, streamside buffer zones and greenways, and general landowner education.

The following text describes types of impairments, possible causes, and suggested improvement measures. Restoration efforts should not be limited to only those streams and measures suggested below.

6.3.B.i. Sedimentation.

6.3.B.i.a. From Construction Sites. Construction activities have historically been considered “nonpoint sources.” In the late 1980’s, EPA designated them as being subject to NPDES regulation if more than 5 acres were being disturbed. In the spring of 2003, that threshold became 1 acre. The general permit issued for such construction sites establishes conditions for maintenance of the sites to minimize pollution from storm water runoff, including requirements for installation and inspection of erosion controls. Also, the general permit imposes more stringent inspection and self-monitoring requirements on sites in the watershed of streams that are already impaired due to sedimentation. Examples of streams impaired by sediment and land development in the Upper Duck River Watershed are Snell Branch and Big Rock Creek (Lewisburg area), Butler Creek (Shelbyville area), and the Duck River in Shelbyville and Manchester.

Construction sites within a sediment-impaired watershed may also have higher priority for inspections by WPC personnel, and are likely to have enforcement actions for failure to control erosion.

6.3.B.i.b. From Channel and/or Bank Erosion. Many streams within the Upper Duck River Watershed suffer from varying degrees of streambank erosion. When steam channels are altered, or large tracts of land are cleared, storm water runoff, will cause banks to become unstable and highly erodable. Heavy livestock traffic can also severely disturb banks. Destabilized banks contribute to sediment load and to the loss of beneficial riparian vegetation to the stream. Some inappropriate agricultural practices have impacted the hydrology and morphology of stream channels in this watershed.

Several agencies such as the NRCS and TDA, as well as watershed citizen groups, are working to stabilize portions of stream banks using bioengineering and other techniques. Many of the affected streams, like Big Rock Creek and streams in the North Fork system, could benefit from these types of projects. Other methods or controls that might be necessary to address common problems are:

Voluntary activities

- Re-establish bank vegetation (examples: Goose Creek and East Rock Creek).
- Establish off-channel watering areas for livestock by moving watering troughs and feeders back from stream banks (examples: Fountain Creek, Lick Creek, and Spring Creek).
- Limit cattle access to streams and bank vegetation (examples: Caney Creek, Alexander Creek, and Weakley Creek).

Additional strategies

- Increase efforts in the Master Logger program to recognize impaired streams and require more effective management practices.
- Better community planning for the impacts of development on small streams, especially development in growing areas (examples: Big Rock Creek in Lewisburg, Duck River in Shelbyville, and Duck River and Little Duck River in Manchester).
- Require post-construction run-off rates to be no greater than pre-construction rates in order to avoid in-channel erosion.
- Implement additional restrictions on logging in streamside management zones.
- Limit clearing of stream and ditch banks (examples: Snell Branch, Be4ll Buckle Creek, Wilson Creek). *Note: Permits may be required for any work along streams.*
- Limit road and utilities crossings of streams.
- Restrict the use of off-highway vehicles on stream banks and in stream channels.

6.3.B.i.c. From Agriculture and Silviculture. The Water Quality Control Act exempts normal agricultural and silvicultural practices that do not result in a point source discharge. Nevertheless, efforts are being made to address impacts due to these exempted practices.

The Master Logger Program has been in place for several years to train loggers how to install Best Management Practices that lessen the impact of logging activities on streams. Recently, laws and regulations were enacted which established that these BMPs must be used or the Commissioners of the Departments of Environment and Conservation and of Agriculture would be permitted to stop the logging operation that, upon failing to install these BMPs, was causing impacts to streams.
Since the Dust Bowl era, the agriculture community has strived to protect the soil from wind and soil erosion. Agencies such as the Natural Resources Conservation Service (NRCS), the University of Tennessee Agricultural Extension Service, and the Tennessee Department of Agriculture have worked to identify better ways of farming, to educate the farmers, and to install the methods that address the sources of some of the impacts due to agriculture. Cost sharing is available for many of these measures.

Many sediment problems traceable to agricultural practices also involve riparian loss due to close row cropping or pasture clearing for grazing. Lack of nay type of vegetated buffer along stream corridors is a major problem throughout the Upper Duck River Watershed. Impacted streams that could benefit from the establishment of riparian buffer zones include Thick Creek, Wilson Creek, Fall Creek, Hurricane Creek, and Little Sinking Creek.

6.3.B.ii. Pathogen Contamination.

Possible sources of pathogens are inadequate or failing septic tank systems, overflows or breaks in public sewer collection systems, poorly disinfected discharges from sewage treatment plants, and fecal matter from pets, livestock and wildlife washed into streams and storm drains. Permits issued by the Division of Water Pollution Control regulate discharges from point sources and require adequate control for these sources. Individual homes are required to have subsurface, on-site treatment (i.e., septic tank and field lines) if public sewers are not available. The Division of Ground Water Protection within the Columbia Field Office and delegated county health departments regulate septic tanks and field lines. In addition to discharges to surface waters, businesses may employ either subsurface or surface disposal of wastewater. The Division of Water Pollution Control regulates surface water disposal.

Currently, 18 stream systems in the Upper Duck River Watershed are known to have excessive pathogen contamination. The Duck River and Little Duck River (Manchester), Duck River (Shelbyville), and Bell Buckle Creek are impacted by urban areas, with contributions of bacterial contamination coming from storm water runoff, sewage collection system leaks, and treatment plant operation failures. Many streams in agricultural watersheds show elevated bacterial levels, including Fountain Creek, Clear Branch, Hurricane Creek, Fall Creek, Clem Creek, Weakley Creek, Alexander Creek, North Fork, Wilson Creek, Lick Creek, Spring Creek, Thick Creek, and Wallace Branch. Cascade Creek, in Bedford County, has been contaminated by a single Concentrated Animal Feeding Operation (CAFO).

Other measures that may be necessary to control pathogens are:

Voluntary activities

- Off-channel watering of livestock
- Limit livestock access to streams.
- Improve and educate on the proper management of animal waste from feeding operations.

Enforcement strategies

- Strengthen enforcement of regulations governing on-site wastewater treatment.
- Determine timely and appropriate enforcement for non-complying sewage treatment plants, large and small, and their collection systems.
- Identify Concentrated Animal Feeding Operations not currently permitted.

Additional strategies

- Develop intensive planning in areas where sewer is not available and treatment by subsurface disposal is not an option due to poor soils, floodplains, or high water tables.
- Develop and enforce leash laws and controls on pet fecal material.
- Greater efforts by sewer utilities to identify leaking lines or overflowing manholes.

6.3.B.iii. Excessive Nutrients and/or Dissolved Oxygen Depletion.

These two impacts are usually listed together because high nutrients often contribute to low dissolved oxygen within a stream. Since nutrients often have the same source as pathogens, the measures previously listed can also address many of these problems. Elevated nutrient loadings are also often associated with urban runoff from impervious surfaces, from fertilized lawns and croplands, and faulty sewage disposal processes. Nutrients are often transported with sediment, so many of the measures designed to reduce sediment runoff will also aid in preventing organic enrichment of streams and lakes.

Other sources of nutrients can be addressed by:

Voluntary activities

- Educate homeowners and lawn care companies in the proper application of fertilizers.
- Encourage landowners, developers, and builders to leave stream buffer zones. Streamside vegetation can filter out many nutrients and other pollutants before they reach the stream. These riparian buffers are also vital along livestock pastures. Examples of streams that could benefit are Hurricane Creek, Fall Creek, Wilson Creek, and Caney Creek.
- Use grassed drainage ways that can remove fertilizer before it enters streams.
- Use native plants for landscaping since they don't require as much fertilizer and water.

Physical changes to streams can prevent them from providing enough oxygen to biodegrade the materials that are naturally present. A few additional actions can address this problem:

- Maintain shade over a stream. Cooler water can hold more oxygen and retard the growth of algae. As a general rule, all stream channels suffer from some canopy removal. An intact riparian zone also acts as a buffer to filter out nutrient loads before they enter the water.
- Discourage impoundments. Ponds and lakes do not aerate water. *Note: Permits may be required for any work on a stream, including impoundments.*

Regulatory strategies.

- Strengthen enforcement of regulations governing on-site wastewater treatment.
- Impose more stringent permit limits for nutrients discharged from sewage treatment plants (including Duck River, Big Rock Creek, and Bell Buckle Creek).

- Timely and appropriate enforcement for noncomplying sewage treatment plants, large and small, and their collection system (examples: Duck River, Little Duck River, Bomar Creek).
- Identify Concentrated Animal Feeding Operations not currently permitted.
- Support and train local MS4 programs within municipalities to deal with storm water pollution issues.

6.3.B.iv. Toxins and Other Materials.

Although some toxic substances are discharged directly into waters of the state from a point source, much of these materials are washed in during rainfalls from an upland location, or via improper waste disposal that contaminates groundwater. In the Upper Duck River Watershed, a relatively small number of streams are damaged by storm water runoff from industrial facilities or urban areas. One notable example is east Fork Globe Creek, which is contaminated by runoff and leachate from a landfill. More stringent inspection and regulation of permitted industrial facilities, and local storm water quality initiatives and regulations, could help reduce the amount of contaminated runoff reaching state waters. Examples of streams that could benefit from these measures include the many small, urbanized tributaries feeding Big Rock Creek in Lewisburg and the Duck River in Shelbyville and Manchester.

Many materials enter our streams due to apathy, or lack of civility or knowledge by the public. Litter in roadside ditches, garbage bags tossed over bridge railings, paint brushes washed off over storm drains, and oil drained into ditches are all blatant examples of pollution in streams.

Some of these problems can be addressed by:

Voluntary activities

- Provide public education.
- Paint warnings on storm drains that connect to a stream.
- Sponsor community clean-up days.
- Landscape public areas.
- Encourage public surveillance of their streams and reporting of dumping activities to their local authorities.

Enforcement strategies

- Prohibit illicit discharges to storm drains.
- Strengthen litter law enforcement at the local level.

6.3.B.v. Habitat Alteration.

The alteration of the habitat within a stream can have severe consequences. Whether it is the removal of the vegetation providing a root system network for holding soil particles together, the release of sediment, which increases the bed load and covers benthic life and fish eggs, the removal of gravel bars, “cleaning out” creeks with heavy equipment, or the impounding of the water in ponds and lakes, many alterations impair the use of the stream for designated uses. Habitat alteration also includes the draining or filling of wetlands.

One large-scale stream habitat alteration that has created serious, long-term impacts is TVA's Normandy Dam, which impounds the Duck River. The dam causes unnatural temperature and flow fluctuations downstream, as well as deposition of manganese.

Nevertheless, individual landowners and developers are responsible for the vast majority of stream alterations. Some measures that can help address these problems are:

Voluntary activities

- Sponsor litter pickup days to remove litter that might enter streams.
- Organize stream cleanups removing trash, limbs and debris before they cause blockage.
- Avoid use of heavy equipment to "clean out" streams.
- Plant native vegetation along streams to stabilize banks and provide habitat.
- Encourage developers to avoid extensive use of culverts in streams.

Current regulations

- Restrict modification of streams by such means as culverting, lining, or impounding.
- Require mitigation for impacts to streams and wetlands when modifications are allowed.

Additional Enforcement

- Increased enforcement may be needed when violations of current regulations occur.

APPENDIX II

ID	NAME	HAZARD
027001	Bomar #2	S
027002	Lake Elaine	H
027003	Harvey Lake	S
027004	Bedford Lake	3
027006	Davis Lake	3
027007	Cortner	3
027008	Morgan Lake	3
167002	Toliver Lake	S
167003	Lake Tullahoma	2
167004	George Dickel	1
167005	Lake Womack	3
597003	Lewisburg Reservoir	1
597004	Pique Brothers	S
597006	Paradise Lake	3
167007	Old Stone Fort	2
167008	Lakewood Park #1	2
167009	Lakewood Park #2	2
027010	Coggins Lake	L

Table A2-1. Inventoried Dams in the Upper Duck River Watershed. *Hazard Codes: (H, 1), High; (S, 2), Significant; (L, 3), Low. TDEC only regulates dams indicated by a numeric hazard score.*

LAND COVER/LAND USE	ACRES	% OF WATERSHED
Open Water	4,777	0.63
Other Grasses	3,205	0.42
Pasture/Hay	208,807	27.62
Row Crops	106,937	14.15
Woody Wetlands	9,428	1.25
Emergent Herbaceous Wetlands	420	0.06
Deciduous Forest	296,264	39.19
Mixed Forest	85,377	11.30
Evergreen Forest	27,511	3.64
High Intensity: Commercial/Industrial	5,076	0.67
High Intensity: Residential	1,190	0.16
Low Intensity: Residential	5,806	0.77
Quarries/Strip Mines/Gravel Pits	419	0.06
Bare Rock/Sand/Clay	3	0.00
Transitional	652	0.09
Total	**755,872**	**100.00**

Table A2-2. Land Use Distribution in the Upper Duck River Watershed. *Data are from Multi-Resolution Land Characterization (MRLC) derived by applying a generalized Anderson level II system to mosaics of Landsat thematic mapper images collected every five years.*

ECOREGION	REFERENCE STREAM	WATERSHED (HUC)	
Plateau Escarpment (68c)	Mud Creek (68C13)	Upper Elk River	06030003
Cumberland Mountains (69d)	No Business Branch (69D01)	Clear Fork Cumberland	05130101
Western Highland Rim (71f)	South Harpeth Creek (71F12)	Harpeth River	05130204
	Wolf Creek (71F16)	Lower Duck River	06040003
	Brush Creek (71F19)	Buffalo River	06040004
	Swanegan Branch (71F27)	Pickwick Lake	06030005
	Little Swan Creek (71F28)	Lower Duck River	06040003
	Hurricane Creek (71F29)	Lower Duck River	06040003
Eastern Highland Rim (71g)	Flat Creek (71G03)	Cordell Hull Lake	05130106
	Spring Creek (71G04)	Cordell Hull Lake	05130106
	Hurricane Creek (71G10)	Upper Elk River	06030003
Outer Nashville Basin (71h)	Flynn Creek (71H03)	Cordell Hull Lake	05130106
	Clear Fork (71H06)	Caney Fork River	05130108
	Carson Fork (71H09)	Stones River	05130203
Inner Nashville Basin (71i)	Stewart Creek (71I03)	Stones River	05130203
	Flat Creek (71I10)	Upper Duck River	06040002
	Cedar Creek (71I12)	Old Hickory Lake	05130201
	Little Flat Creek (71I14)	Upper Duck River	06040002
	Harpeth River (71I15)	Harpeth River	05130204
	West Fork Stones River (71I16)	Stones River	05130203
Loess Plains (74b)	Terrapin Creek (74B01)	Obion River	08010202

Table A2-3. Ecoregion Monitoring Sites in Ecoregions 68c, 69d, 71f, 71g, 71h, 71i, and 74b.

CODE	NAME	AGENCY	AGENCY ID
7	TDEC/Grassy Pond Site	TDEC/DNH	S.USTNHP 753
10	TDEC/DNH Southern Twayblade Population Site	TDEC/DNH	S.USTNHP 164
19	TDEC/DNH Mount Tema Glade Site	TDEC/DNH	S.USTNHP 209
22	TDEC/DNH AEDC Highway 55 Wet Oak Barrens Site	TDEC/DNH	S.USTNHP 317
38	TDEC/DNH Sinking Pond State Natural Area Site	TDEC/DNH	M.USTNHP 81
83	TDEC/DNH Burnt Hill Road Glade Site	TDEC/DNH	S.USTNHP 128
87	TDEC/DNH Huckleberry Creek Forest Site	TDEC/DNH	S.USTNHP 565
88	TDEC/DNH Hunt Creek Road Woods and Swamp Site	TDEC/DNH	S.USTNHP 593
89	TDEC/DNH AEDC Hunt Creek Swamp Site	TDEC/DNH	S.USTNHP 560
90	TDEC/DNH AEDC Double Ponds Site	TDEC/DNH	S.USTNHP 323
91	AEDC Loop Road Barren and Swamp Site	TDEC/DNH	S.USTNHP 313
92	TDEC/DNH May Prairie State Natural Area Site	TDEC/DNH	S.USTNHP 391
123	TDEC/DNH Forrest Mill Pond State Natural Area Site	TDEC/DNH	S.USTNHP 141
128	TDEC/DNH Hickory Flat Woods Site	TDEC/DNH	S.USSER01 2421
153	TDEC/DNH Parks Creek Swamp Site	TDEC/DNH	S.USTNHP 107
171	TDEC/DNH Wayside Swamp Site	TDEC/DNH	S.USTNHP 324
185	TDEC/DNH Parks Creek Swamp Complex-North Site	TDEC/DNH	
186	TDEC/DNH Parks Creek Swamp Complex-South Site	TDEC/DNH	
220	USACOE-Nashville Client Site	USACOE-Nashville	
237	USACOE-Nashville Client Site	USACOE-Nashville	
241	USACOE-Nashville Client Site	USACOE-Nashville	
329	TDOT I-24 Mitigation/Permit Site	TDOT	
465	TDEC/WPC Snake Creek WPC Permit/Mitigation Site	TDEC/WPC	
533	USFWS AEDC #1	USFWS	AEDC.1
534	USFWS AEDC #2	USFWS	AEDC.2
535	USFWS AEDC #3	USFWS	AEDC.3
536	USFWS AEDC #4	USFWS	AEDC.4
537	USFWS AEDC #5	USFWS	AEDC.5
538	USFWS AEDC #6	USFWS	AEDC.6
539	USFWS AEDC #7	USFWS	AEDC.7
540	USFWS AEDC #8	USFWS	AEDC.8
541	USFWS AEDC #9	USFWS	AEDC.9
542	USFWS AEDC #10	USFWS	AEDC.10
543	USFWS AEDC #11	USFWS	AEDC.11
544	USFWS AEDC #12	USFWS	AEDC.12
545	USFWS AEDC #13	USFWS	AEDC.13
546	USFWS AEDC #14	USFWS	AEDC.14
547	USFWS AEDC #15	USFWS	AEDC.15
548	USFWS AEDC #16	USFWS	AEDC.16
549	USFWS AEDC #17	USFWS	AEDC.17
550	USFWS AEDC #18	USFWS	AEDC.18
551	USFWS AEDC #19	USFWS	AEDC.19
552	USFWS AEDC #20	USFWS	AEDC.20
553	USFWS AEDC #21	USFWS	AEDC.21
554	USFWS AEDC #22	USFWS	AEDC.22
555	USFWS AEDC #23	USFWS	AEDC.23
556	USFWS AEDC #24	USFWS	AEDC.24
557	USFWS AEDC #25	USFWS	AEDC.25
558	USFWS AEDC #26	USFWS	AEDC.26
560	USFWS AEDC #28	USFWS	AEDC.28

CODE	NAME	AGENCY	AGENCY ID
561	USFWS AEDC #29	USFWS	AEDC.29
562	USFWS AEDC #30	USFWS	AEDC.30
563	USFWS AEDC #31	USFWS	AEDC.31
564	USFWS AEDC #32	USFWS	AEDC.32
565	USFWS AEDC #33	USFWS	AEDC.33
566	USFWS AEDC #34	USFWS	AEDC.34
567	USFWS AEDC #35	USFWS	AEDC.35
568	USFWS AEDC #36	USFWS	AEDC.36
569	USFWS AEDC #37	USFWS	AEDC.37
570	USFWS AEDC #38	USFWS	AEDC.38
571	USFWS AEDC #39	USFWS	AEDC.39
572	USFWS AEDC #40	USFWS	AEDC.40
573	USFWS AEDC #41	USFWS	AEDC.41
574	USFWS AEDC #42	USFWS	AEDC.42
575	USFWS AEDC #43	USFWS	AEDC.43
576	USFWS AEDC #44	USFWS	AEDC.44
577	USFWS AEDC #45	USFWS	AEDC.45
578	USFWS AEDC #46	USFWS	AEDC.46
585	USFWS AEDC #53	USFWS	AEDC.53
590	USFWS AEDC #58	USFWS	AEDC.58
599	USFWS AEDC #67	USFWS	AEDC.67
621	USFWS AEDC #89	USFWS	AEDC.89
622	USFWS AEDC #89A	USFWS	AEDC.89A
623	USFWS AEDC #90	USFWS	AEDC.90
624	USFWS AEDC #91	USFWS	AEDC.91
625	USFWS AEDC #92	USFWS	AEDC.92
626	USFWS AEDC #93	USFWS	AEDC.93
627	USFWS AEDC #94	USFWS	AEDC.94
628	USFWS AEDC #95	USFWS	AEDC.95
629	USFWS AEDC #96	USFWS	AEDC.96
630	USFWS AEDC #97	USFWS	AEDC.97
631	USFWS AEDC #98	USFWS	AEDC.98
632	USFWS AEDC #99	USFWS	AEDC.99
633	USFWS AEDC #100	USFWS	AEDC.100
634	USFWS AEDC #101	USFWS	AEDC.101
635	USFWS AEDC #102	USFWS	AEDC.102
636	USFWS AEDC #103	USFWS	AEDC.103
637	USFWS AEDC #104	USFWS	AEDC.104
638	USFWS AEDC #105	USFWS	AEDC.105
639	USFWS AEDC #106	USFWS	AEDC.106
640	USFWS AEDC #107	USFWS	AEDC.107
641	USFWS AEDC #108	USFWS	AEDC.108
642	USFWS AEDC #109	USFWS	AEDC.109
643	USFWS AEDC #110	USFWS	AEDC.110
644	USFWS AEDC #111	USFWS	AEDC.111
645	USFWS AEDC #112	USFWS	AEDC.112
646	USFWS AEDC #113	USFWS	AEDC.113
647	USFWS AEDC #114	USFWS	AEDC.114
648	USFWS AEDC #115	USFWS	AEDC.115
649	USFWS AEDC #116	USFWS	AEDC.116
650	USFWS AEDC #117	USFWS	AEDC.117

CODE	NAME	AGENCY	AGENCY ID
651	USFWS AEDC #118	USFWS	AEDC.118
652	USFWS AEDC #119	USFWS	AEDC.119
653	USFWS AEDC #120	USFWS	AEDC.120
654	USFWS AEDC #121	USFWS	AEDC.121
655	USFWS AEDC #122	USFWS	AEDC.122
656	USFWS AEDC #123	USFWS	AEDC.123
657	USFWS AEDC #124	USFWS	AEDC.124
658	USFWS AEDC #125	USFWS	AEDC.125
659	USFWS AEDC #126	USFWS	AEDC.126
660	USFWS AEDC #127	USFWS	AEDC.127
661	USFWS AEDC #128	USFWS	AEDC.128
662	USFWS AEDC #129	USFWS	AEDC.129
663	USFWS AEDC #130	USFWS	AEDC.130
664	USFWS AEDC #131	USFWS	AEDC.131
665	USFWS AEDC #132	USFWS	AEDC.132
666	USFWS AEDC #133	USFWS	AEDC.133
667	USFWS AEDC #134	USFWS	AEDC.134
668	USFWS AEDC #135	USFWS	AEDC.135
669	USFWS AEDC #136	USFWS	AEDC.136
672	USFWS AEDC #139	USFWS	AEDC.139
673	USFWS AEDC #140	USFWS	AEDC.140
674	USFWS AEDC #141	USFWS	AEDC.141
675	USFWS AEDC #142	USFWS	AEDC.142
676	USFWS AEDC #143	USFWS	AEDC.143
677	USFWS AEDC #144	USFWS	AEDC.144
678	USFWS AEDC #145	USFWS	AEDC.145
679	USFWS AEDC #146	USFWS	AEDC.146
680	USFWS AEDC #147	USFWS	AEDC.147
681	USFWS AEDC #148	USFWS	AEDC.148
682	USFWS AEDC #149	USFWS	AEDC.149
685	USFWS AEDC #152	USFWS	AEDC.152
686	USFWS AEDC #153	USFWS	AEDC.153
690	USFWS AEDC #157	USFWS	AEDC.157
691	USFWS AEDC #158	USFWS	AEDC.158
740	USFWS AEDC #207	USFWS	AEDC.207
743	USFWS AEDC #210	USFWS	AEDC.210
744	USFWS AEDC #211	USFWS	AEDC.211
766	USFWS AEDC #233	USFWS	AEDC.233
767	USFWS AEDC #234	USFWS	AEDC.234
768	USFWS AEDC #235	USFWS	AEDC.235
769	USFWS AEDC #236	USFWS	AEDC.236
771	USFWS AEDC #238	USFWS	AEDC.238
772	USFWS AEDC #239	USFWS	AEDC.239
773	USFWS AEDC #240	USFWS	AEDC.240
774	USFWS AEDC #241	USFWS	AEDC.241
775	USFWS AEDC #242	USFWS	AEDC.242
776	USFWS AEDC #243	USFWS	AEDC.243
777	USFWS AEDC #244	USFWS	AEDC.244
778	USFWS AEDC #245	USFWS	AEDC.245
779	USFWS AEDC #246	USFWS	AEDC.246
780	USFWS AEDC #247	USFWS	AEDC.247

CODE	NAME	AGENCY	AGENCY ID
781	USFWS AEDC #248	USFWS	AEDC.248
782	USFWS AEDC #249	USFWS	AEDC.249
783	USFWS AEDC #250	USFWS	AEDC.250
784	USFWS AEDC #251	USFWS	AEDC.251
785	USFWS AEDC #252	USFWS	AEDC.252
794	USFWS AEDC #261	USFWS	AEDC.261
1003	Brad Bingham Thesis: Site 1 Fredonia Quad	USFWS	Bingham-Fridonia.1
1004	Brad Bingham Thesis: Site 2 Fredonia Quad	USFWS	Bingham-Fridonia.2
1005	Brad Bingham Thesis: Site 3 Fredonia Quad	USFWS	Bingham-Fridonia.3
1007	Brad Bingham Thesis: Site 5 Fredonia Quad	USFWS	Bingham-Fridonia.5
1008	Brad Bingham Thesis: Site 6 Fredonia Quad	USFWS	Bingham-Fridonia.6
1009	Brad Bingham Thesis: Site 7 Fredonia Quad	USFWS	Bingham-Fridonia.7
1010	Brad Bingham Thesis: Site 8 Fredonia Quad	USFWS	Bingham-Fridonia.8
1011	Brad Bingham Thesis: Site 9 Fredonia Quad	USFWS	Bingham-Fridonia.9
1012	Brad Bingham Thesis: Site 10 Fredonia Quad	USFWS	Bingham-Fridonia.10
1013	Brad Bingham Thesis: Site 11 Fredonia Quad	USFWS	Bingham-Fridonia.11
1019	Brad Bingham Thesis: Site 17 Fredonia Quad	USFWS	Bingham-Fridonia.17
1020	Brad Bingham Thesis: Site 18 Fredonia Quad	USFWS	Bingham-Fridonia.18
1021	Brad Bingham Thesis: Site 19 Fredonia Quad	USFWS	Bingham-Fridonia.19
1022	Brad Bingham Thesis: Site 20 Fredonia Quad	USFWS	Bingham-Fridonia.20
1023	Brad Bingham Thesis: Site 21 Fredonia Quad	USFWS	Bingham-Fridonia.21
1024	Brad Bingham Thesis: Site 22 Fredonia Quad	USFWS	Bingham-Fridonia.22
1025	Brad Bingham Thesis: Site 23 Fredonia Quad	USFWS	Bingham-Fridonia.23
1026	Brad Bingham Thesis: Site 24 Fredonia Quad	USFWS	Bingham-Fridonia.24
1027	Brad Bingham Thesis: Site 25 Fredonia Quad	USFWS	Bingham-Fridonia.25
1029	Brad Bingham Thesis: Site 27 Fredonia Quad	USFWS	Bingham-Fridonia.27
1030	Brad Bingham Thesis: Site 28 Fredonia Quad	USFWS	Bingham-Fridonia.28
1032	Brad Bingham Thesis: Site 30 Fredonia Quad	USFWS	Bingham-Fridonia.30
1033	Brad Bingham Thesis: Site 31 Fredonia Quad	USFWS	Bingham-Fridonia.31
1034	Brad Bingham Thesis: Site 32 Fredonia Quad	USFWS	Bingham-Fridonia.32
1035	Brad Bingham Thesis: Site 33 Fredonia Quad	USFWS	Bingham-Fridonia.33
1036	Brad Bingham Thesis: Site 34 Fredonia Quad	USFWS	Bingham-Fridonia.34
1037	Brad Bingham Thesis: Site 35 Fredonia Quad	USFWS	Bingham-Fridonia.35
1038	Brad Bingham Thesis: Site 36 Fredonia Quad	USFWS	Bingham-Fridonia.36
1039	Brad Bingham Thesis: Site 37 Fredonia Quad	USFWS	Bingham-Fridonia.37
1040	Brad Bingham Thesis: Site 38 Fredonia Quad	USFWS	Bingham-Fridonia.38
1041	Brad Bingham Thesis: Site 39 Fredonia Quad	USFWS	Bingham-Fridonia.39
1042	Brad Bingham Thesis: Site 40 Fredonia Quad	USFWS	Bingham-Fridonia.40
1043	Brad Bingham Thesis: Site 42 Fredonia Quad	USFWS	Bingham-Fridonia.42
1044	Brad Bingham Thesis: Site 43 Fredonia Quad	USFWS	Bingham-Fridonia.43
1249	TWRA A-Frame Pond Site	TWRA	
1251	TWRA Parks Creek Swamp Site	TWRA	
1505	USACOE James C. Hailey and Company Site	USFWS	
1810	TDEC/DNH Pin Oak/Overcup Oak Swamp Site	TDEC/DNH	
1923	TWRA Hickory Flats Site	TWRA	
2053	TWRA Bark Camp Barrens Site	TWRA	
2054	TWRA Bark Camp Barrens Site	TWRA	
2204	TWRA Bark Camp Barrens Site	TWRA	
2206	TWRA Bark Camp Barrens Site	TWRA	
2209	TWRA Bark Camp Barrens Site	TWRA	
2210	TWRA Bark Camp Barrens Site	TWRA	

CODE	NAME	AGENCY	AGENCY ID
2211	TWRA Bark Camp Barrens Site	TWRA	
2212	TWRA Bark Camp Barrens Site	TWRA	
2213	TWRA Bark Camp Barrens Site	TWRA	
2216	TWRA Bark Camp Barrens Site	TWRA	
2598	TWRA Hickory Flats Woods Site	TWRA	
2705	USGS AEDC Tupelo Swamp Site	USGS	03596073 R.96-4277
2706	USGS Willow Oak Swamp Site	USGS	325090860410 R.96-4277
2707	USGS Westall Swamp Site	USGS	035960815 R.96-4277

Table A2-4. Wetland Sites in Upper Duck River Watershed in TDEC Database. *TDEC, Tennessee Department of Environment and Conservation; USACOE-Nashville, United States Army Corps of Engineers-Nashville District; WPC, Water Pollution Control; TDOT, Tennessee Department of Transportation; USGS, United States Geological Survey; USFWS, United States Fish and Wildlife Service; TWRA, Tennessee Wildlife Resources Agency; DNH, Division of Natural Heritage.* ***This table represents an incomplete inventory and should not be considered a dependable indicator of the presence of wetlands in the watershed.***

APPENDIX III

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Anderton Branch	TN06040002028_0200	2.9
Anthony Branch	TN06040002028_0100	2.5
Bennett Branch	TN06040002028_0300	3.8
Big Rock Creek	TN06040002012_1000	11.0
Bobo Creek	TN06040002026_0100	5.9
Bobo Creek	TN06040002582_1000	11.8
Boiling Spring Branch	TN06040002032_0400	3.9
Brush Creek	TN06040002002_0200	4.3
Carroll Creek	TN06040002064_1000	4.6
Cedar Creek	TN06040002008_1000	13.6
Crumption Creek	TN06040002571_1000	24.5
Doddy Creek	TN06040002030_0200	5.9
Duck River	TN06040002001_1000	32.7
Duck River	TN06040002010_1000	24.9
Duck River	TN06040002020_1000	29.8
Duck River	TN06040002027_2000	19.3
Duck River	TN06040002032_1000	4.0
Duck River	TN06040002032_3000	20.8
East Fork	TN06040002047_0200	3.1
East Rock Creek	TN06040002012_0150	37.5
Flat Creek	TN06040002026_1000	11.6
Flat Creek	TN06040002049_1000	3.3
Flat Creek	TN06040002049_2000	10.6
Fountain Creek	TN06040002002_1000	8.7
Fountain Creek	TN06040002002_2000	5.7
Garrison Fork Creek	TN06040002034_1000	8.6
Garrison Fork Creek	TN06040002034_2000	13.7
Globe Creek	TN06040002002_0300	44.1
Hale Branch	TN060400020306.7T_0100	4.9
Hurricane Creek	TN06040002002_0500	12.7
Little Flat Creek	TN06040002027_0400	12.7
Little Flat Creek	TN06040002049_0200	18.3
Muddy Branch	TN06040002032_0310	5.1
Negro Creek	TN06040002001_0100	8.7
New Herman Fork	TN06040002026_0300	19.7
Noah Fork	TN06040002034_0700	44.1
Norman Creek	TN06040002030_0300	9.2
Parks Creek	TN06040002032_0600	18.0
Perry Creek	TN06040002032_0500	5.8
Rich Creek	TN06040002010_0100	22.3
Shipman Creek	TN06040002030_0400	9.9
Silver Creek	TN06040002002_0100	19.3

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
South Fork Fountain Creek	TN06040002002_0400	12.9
Thompson Creek	TN06040002028_1000	10.4
UT to Thompson Creek	TN06040002028_0400	1.1
UT to Thompson Creek	TN06040002028_0500	1.3
Wartrace Creek	TN06040002033_1000	32.4
Wolf Creek	TN06040002502_0200	26.5

Table A3-1a. Streams Fully Supporting Designated Uses in the Upper Duck River Watershed.

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Alexander Creek	TN06040002039_0300	21.1
Bashaw Creek	TN06040002032_0100	16.4
Big Rock Creek	TN06040002012_2000	9.0
Big Rock Creek	TN06040002012_3000	6.0
Butler Creek	TN06040002027_0300	14.2
Caney Creek	TN06040002048_1000	13.1
Clem Creek	TN06040002039_0100	14.2
Davis Branch	TN06040002024_0100	2.2
Duck River	TN06040002027_1000	1.6
Duck River	TN06040002030_1000	12.1
East Rock Creek	TN06040002012_0100	16.9
Fall Creek	TN06040002038_1000	11.4
Fountain Creek	TN06040002002_3000	7.9
Goose Creek	TN06040002001_0300	7.3
Hurricane Creek	TN06040002038_0300	29.4
Lick Creek	TN06040002047_0300	8.8
Little Sinking Creek	TN06040002021_0100	7.6
North Fork Creek	TN06040002039_1000	3.7
North Fork Creek	TN06040002039_2000	4.0
North Fork Creek	TN06040002039_3000	9.2
Sinking Creek	TN06040002021_1000	12.0
Sinking Creek	TN06040002021_2000	14.4
Spring Creek	TN06040002047_1000	13.2
Thick Creek	TN06040002048_0100	13.4
Wallace Branch	TN06040002049_0400	3.8
Weakley Creek	TN06040002039_0250	13.1
Weakly Creek	TN06040002039_0200	6.2
Wilson Creek	TN06040002046_1000	19.5

Table A3-1b. Streams Partially Supporting Designated Uses in the Upper Duck River Watershed.

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Bell Buckle Creek	TN06040002033_0300	11.1
Bomar Creek	TN06040002027_0200	4.1
Cascade Creek	TN06040002030_0310	2.7
Clear Branch	TN06040002032_0300	7.3
Duck River	TN06040002032_2000	2.0
East Fork of Globe Creek	TN06040002002_0310	8.8
Little Duck River	TN06040002502_1000	10.6
Snell Branch	TN06040002012_0700	4.5
Sugar Creek	TN06040002024_1000	21.7

Table A3-1c. Streams Not Supporting Designated Uses in the Upper Duck River Watershed.

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Anthony Branch	TN06040002033_0200	5.3
Ashland Branch	TN06040002024_0300	6.1
Belfast Creek	TN06040002012_0120	14.5
Benford Creek	TN06040002038_0200	11.4
Bluestocking Branch	TN06040002024_0200	7.5
Boone Creek	TN06040002049_0500	4.4
Buchanon Branch	TN06040002024_0400	5.7
Coleman Fork	TN06040002026_0200	6.0
Collins Creek	TN06040002012_0400	5.3
Comstock Creek	TN06040002049_0300	5.8
Cortner Branch	TN06040002021_0200	3.9
Crooked Run	TN06040002026_0500	4.1
Derryberry Branch	TN06040002001_0200	4.3
Doddy Creek	TN06040002030_0210	5.9
Dry Branch	TN06040002012_0200	7.8
Eaton Branch	TN06040002032_0200	9.7
Goodman Springs Branch	TN06040002502_0100	6.2
Goose Creek	TN06040002026_0400	4.6
Hickory Flat Creek	TN06040002502_0300	2.6
Holland Creek	TN06040002027_0100	5.1
Hoover Creek	TN06040002033_0400	2.4
Huckleberry Creek	TN06040002502_0500	4.3
Hunt Creek	TN06040002502_0400	10.9
Hutton Creek	TN06040002038_0100	8.6
Jake Branch	TN06040002034_0300	3.3
Kelly Creek	TN06040002033_0500	7.2
Knob Creek	TN06040002034_0900	5.4
Lawrence Branch	TN06040002034_0400	2.0
Little Hurricane Creek	TN06040002020_0100	16.8
McBride Branch	TN06040002034_0600	7.3
Misc. Tribs to Duck River	TN06040002032_0999	17.6

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Mud Creek	TN06040002012_0110	12.2
Mud Creek	TN06040002026_0600	10.0
Muse Creek	TN06040002033_0600	3.0
New Lake Branch	TN06040002012_0600	3.5
Norton Branch	TN06040002034_0500	5.6
Osteen Branch	TN06040002046_0100	3.0
Plum Branch	TN06040002047_0400	2.5
Powell Creek	TN06040002020_0200	10.4
Pumpkin Creek	TN06040002049_0100	9.5
Puncheon Camp Creek	TN06040002034_0200	8.4
Riley Creek	TN06040002053_1000	9.5
Russell Branch	TN06040002030_0100	2.8
Sallie Branch	TN06040002034_0100	6.5
Sanders Creek	TN06040002012_0500	4.5
Snake Creek	TN06040002012_0300	9.4
Snake Creek	TN06040002024_0500	5.6
Stokes Branch	TN06040002033_0100	5.6
Straight Creek	TN06040002034_0800	5.4
Tribs to Big Rock Creek	TN06040002012_0999	18.1
Tribs to Duck River	TN06040002001_0999	13.5
Tribs to Duck River	TN06040002010_0999	6.5
Tribs to Duck River	TN06040002020_0999	10.8
Tribs to Duck River	TN06040002027_0999	14.7
Tribs to Duck River	TN06040002030_0999	5.7
Tribs to Flat Creek	TN06040002026_0999	11.1
Tribs to Flat Creek	TN06040002049_0999	15.1
Tribs to Fountain Creek	TN06040002002_0999	24.1
Tribs to Garrison Fork Creek	TN06040002034_0999	33.8
Tribs to Normandy Reservoir	TN060400020306.7T_1000	17.3
Tribs to North Fork Creek	TN06040002039_0999	22.5
Tribs to Thompson Creek	TN06040002028_0999	9.5
UT to Crumption Creek	TN06040002571_0100	3.8
West Fork	TN06040002047_0100	3.5
Wright Branch	TN06040002012_0800	14.6

Table A3-1d. Streams Not Assessed in the Upper Duck River Watershed.

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (ACRES)
Normandy Reservoir	TN060400020306.7_1000	3,260

Table A3-1e. Lakes Fully Supporting Designated Uses in the Upper Duck River Watershed.

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)	SUPPORT DESCRIPTION
Alexander Creek	TN06040002039_0300	21.1	Partial
Bell Buckle Creek	TN06040002033_0300	11.1	Not supporting
Cascade Creek	TN06040002030_0310	2.7	Not supporting
Clear Branch	TN06040002032_0300	7.3	Not supporting
Clem Creek	TN06040002039_0100	14.2	Partial
Duck River	TN06040002027_1000	1.6	Partial
Duck River	TN06040002032_2000	2.0	Not supporting
Fall Creek	TN06040002038_1000	11.4	Partial
Fountain Creek	TN06040002002_3000	7.9	Partial
Hurricane Creek	TN06040002038_0300	29.4	Partial
Lick Creek	TN06040002047_0300	8.8	Partial
Little Duck River	TN06040002502_1000	10.6	Not supporting
North Fork Creek	TN06040002039_1000	3.7	Partial
North Fork Creek	TN06040002039_2000	4.0	Partial
North Fork Creek	TN06040002039_3000	9.2	Partial
Spring Creek	TN06040002047_1000	13.2	Partial
Thick Creek	TN06040002048_0100	13.4	Partial
Wallace Branch	TN06040002049_0400	3.8	Partial
Weakley Creek	TN06040002039_0250	13.1	Partial
Weakly Creek	TN06040002039_0200	6.2	Partial
Wilson Creek	TN06040002046_1000	19.5	Partial

Table A3-2a. Stream Impairment Due to Pathogens in the Upper Duck River Watershed.

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)	SUPPORT DESCRIPTION
Alexander Creek	TN06040002039_0300	21.1	Partial
Bell Buckle Creek	TN06040002033_0300	11.1	Not supporting
Big Rock Creek	TN06040002012_2000	9.0	Partial
Big Rock Creek	TN06040002012_3000	6.0	Partial
Caney Creek	TN06040002048_1000	13.1	Partial
Davis Branch	TN06040002024_0100	2.2	Partial
Duck River	TN06040002027_1000	1.6	Partial
East Rock Creek	TN06040002012_0100	16.9	Partial
Fall Creek	TN06040002038_1000	11.4	Partial
Hurricane Creek	TN06040002038_0300	29.4	Partial
Little Sinking Creek	TN06040002021_0100	7.6	Partial
North Fork Creek	TN06040002039_3000	9.2	Partial
Sinking Creek	TN06040002021_1000	12.0	Partial
Sinking Creek	TN06040002021_2000	14.4	Partial
Snell Branch	TN06040002012_0700	4.5	Not supporting
Thick Creek	TN06040002048_0100	13.4	Partial
Weakley Creek	TN06040002039_0250	13.1	Partial

Table A3-2b. Stream Impairment Due to Siltation in the Upper Duck River Watershed.

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)	SUPPORT DESCRIPTION
Bell Buckle Creek	TN06040002033_0300	11.1	Not supporting
Big Rock Creek	TN06040002012_3000	6.0	Partial
Butler Creek	TN06040002027_0300	14.2	Partial
East Rock Creek	TN06040002012_0100	16.9	Partial
Fall Creek	TN06040002038_1000	11.4	Partial
Goose Creek	TN06040002001_0300	7.3	Partial
Hurricane Creek	TN06040002038_0300	29.4	Partial
Lick Creek	TN06040002047_0300	8.8	Partial
Little Sinking Creek	TN06040002021_0100	7.6	Partial
Sinking Creek	TN06040002021_1000	12.0	Partial
Sinking Creek	TN06040002021_2000	14.4	Partial
Snell Branch	TN06040002012_0700	4.5	Not supporting
Thick Creek	TN06040002048_0100	13.4	Partial
Wilson Creek	TN06040002046_1000	19.5	Partial

Table A3-2c. Stream Impairment Due to Other Habitat Alterations in the Upper Duck River Watershed.

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)	SUPPORT DESCRIPTION
Big Rock Creek	TN06040002012_2000	9.0	Partial
Caney Creek	TN06040002048_1000	13.1	Partial
Clem Creek	TN06040002039_0100	14.2	Partial
Fall Creek	TN06040002038_1000	11.4	Partial
Hurricane Creek	TN06040002038_0300	29.4	Partial
Wilson Creek	TN06040002046_1000	19.5	Partial

Table A3-2d. Stream Impairment Due to Nutrients in the Upper Duck River Watershed.

APPENDIX IV

LAND USE/LAND COVER	AREAS IN HUC-10 SUBWATERSHEDS (ACRES)			
	01	02	03	04
Bare Rock/Sand/Clay	2	40,098		
Deciduous Forest	76,525	40,098	64,238	12,421
Emergent Herbaceous Wetlands	195	13	72	138
Evergreen Forest	3,068	2,224	5,365	1,927
High Intensity: Commercial/Industrial/Transportation	1,734	302	1,336	252
High Intensity: Residential	392	20	539	8
Low Intensity: Residential	1,723	197	1,835	150
Mixed Forest	6,711	7,849	17,653	4,785
Open Water	3,104	23	485	189
Other Grasses: Urban/Recreational	1,190	86	1,003	24
Pasture/Hay	31,398	25,197	49,756	18,058
Row Crops	18,786	6,045	29,056	12,101
Transitional	465		12	
Woody Wetlands	4,891	675	1,275	1,385
Quarries/Strip Mines/Gravel Pits			119	
Total	**150,183**	**82,727**	**172,744**	**51,439**

LAND USE/LAND COVER	AREAS IN HUC-10 SUBWATERSHEDS (ACRES)		
	05	06	07
Deciduous Forest	56,512	22,905	23,566
Emergent Herbaceous Wetlands	1	1	
Evergreen Forest	7,887	4,412	2,628
High Intensity: Commercial/Industrial/Transportation	581	638	233
High Intensity: Residential	25	199	7
Low Intensity: Residential	402	1,356	143
Mixed Forest	24,152	12,832	11,395
Open Water	908	53	14
Other Grasses: Urban/Recreational	83	808	11
Pasture/Hay	39,535	22,359	22,505
Row Crops	23,925	11,847	5,177
Transitional	137	11	28
Woody Wetlands	936	231	36
Quarries/Strip Mines/Gravel Pits	179	121	
Total	**155,262**	**77,772**	**65,744**

Table A4-1. Land Use Distribution in Upper Duck River Watershed by HUC-10. *Data are from 1992 Multi-Resolution Land Characterization (MRLC) derived by applying a generalized Anderson Level II system to mosaics of Landsat thematic mapper images collected every five years.*

HYDROLOGIC SOIL GROUPS
GROUP A SOILS have low runoff potential and high infiltration rates even when wet. They consist chiefly of sand and gravel and are well to excessively drained.
GROUP B SOILS have moderate infiltration rates when wet and consist chiefly of soils that are moderately deep to deep, moderately to well drained, and moderately coarse to coarse textures.
GROUP C SOILS have low infiltration rates when wet and consist chiefly of soils having a layer that impedes downward movement of water with moderately fine to fine texture.
GROUP D SOILS have high runoff potential, very low infiltration rates, and consist chiefly of clay soils.

Table A4-2. Hydrologic Soil Groups in Tennessee as Described in WCS.

STATION	HUC-10	AGENCY	STREAM NAME	AREA (SQ MILES)	LOW FLOW (CFS)		
					1Q10	7Q10	3Q20
03595000	0604000201	USGS	Duck River	55.2	4.5	5.2	4.2
03595100	0604000201	USGS	Little Duck River	13.0	0.87	0.95	0.81
03595300	0604000201	USGS	Little Duck River	35.3	2.51	2.82	2.31
03595500	0604000201	USGS	Little Duck River	40.4	5.0	5.3	4.7
03595520	0604000201	USGS	Grindstone Hollow Creek				
03596000	0604000201	USGS	Duck River	107	11.7	13.0	10.9
03596100	0604000201	USGS	Crumpton Creek	28.1	3.1	3.4	2.7
03596110	0604000201	USGS	Big Spring				
03596200	0604000201	USGS	Carroll Creek	3.32	0.08	0.10	0.07
03596500	0604000201	TVA	Duck River	208	48	48	45
352803086135801	0604000201	USGS	Duck River				
03596700	0604000202	USGS	Garrison Fork	16.8	0.31	0.38	0.27
03596900	0604000202	USGS	Noah Fork	12.1	-	-	0
03597000	0604000202	USGS	Garrison Fork	66.3	0.7	1.6	1.0
03597210	0604000202	USGS	Garrison Fork	85.5			
03597300	0604000202	USGS	Wartrace Creek				
03597400	0604000202	USGS	Wartrace Creek				
03597450	0604000202	USGS	Kelly Creek				
03597500	0604000202	USGS	Wartrace Creek	16.3	0	0	0
03597550	0604000202	USGS	Muse Branch				
03597590	0604000202	USGS	Wartrace Creek	35.7			
03597600	0604000202	USGS	Wartrace Creek	36.4	-	-	0
03597700	0604000202	USGS	Garrison Fork	130	2.5	3.0	2.2
03597800	0604000203	USGS	Thompson Creek	18.3	0.98	1.10	0.92
03597898	0604000203	USGS	Flat Creek	49.0			
03597900	0604000203	USGS	Flat Creek	49.6	0.21	0.27	0.16
03598000	0604000203	USGS	Duck River	481	78.6	96.6	73.5
03598188	0604000203	USGS	Sinking Creek	18.1	-	-	0
035977607	0604000203	USGS	Anderton Branch				
03598200	0604000204	USGS	Weakly Creek				
03598250	0604000204	USGS	North Fork Creek	71.9	-	-	0
03599240	0604000205	USGS	Duck River				
03599250	0604000205	USGS	Duck River	916	-	-	23.5
03599400	0604000205	USGS	Little Flat Creek				
03599408	0604000205	USGS	Duck River	1,016			
03599000	0604000206	USGS	Big Rock Creek	24.9	0	0	0
03599102	0604000206	USGS	Wilson Spring				
03599200	0604000206	USGS	East Rock Creek				
03599430	0604000207	USGS	Fountain Creek	26.9	0.49	0.62	0.37
03599450	0604000207	USGS	Fountain Creek	74.0	1.35	1.70	1.02

Table A4-3. Historical Streamflow Data Summary Based on Mean Daily Flows in Upper Duck River Watershed. *USGS, United States Geological Survey; TVA, Tennessee Valley Authority. Additional information may be found at:*
http://nwis.waterdata.usgs.gov/tn/nwis/discharge

AGENCY	STATION	ALIAS	LOCATION	HUC-10
TDEC	BASHA000.1CE		Bashaw Creek @ RM 0.1	0604000201
TDEC	BOBO001.6CE	000390	Bobo Creek at RM 1.6	0604000201
TDEC	BSPRI000.4CE	DUCKRIS13	Boiling Springs Branch @ RM 0.4	0604000201
TDEC	CARRO003.2CE	000460	Carroll Creek @ RM 3.2	0604000201
TDEC	CASCA000.7BE		Cascade Branch @ RM 0.7	0604000201
TDEC	CLEAR001.0CE		Clear Branch @ RM 1.0	0604000201
TDEC	CLEAR001.1CE	DUCKRIS12	Clear Branch @ RM 1.1	0604000201
TDEC	CRUMP002.9CE	000715	Crumpton Creek @ RM 2.9	0604000201
TDEC	DODDY000.7BE		Doddy Creek @ RM 0.7	0604000201
TDEC	DUCK248.0BE	1025	Duck River @ RM 248.4	0604000201
TDEC	DUCK253.0CE	NORMANDY03	Duck River @ RM 253.0	0604000201
TDEC	1020	001020	Duck River @ RM 265.3	0604000201
TDEC	DUCK265.4CE	001019	Duck River @ RM 265.4	0604000201
TDEC		DICKRIS06	Duck River @ RM 269.1	0604000201
TDEC	DUCK269.6CE		Duck River @ RM 269.6	0604000201
TDEC		DUCKRIS07	Duck River @ RM 270.1	0604000201
TDEC		DUCKRIS08	Duck River @ RM 270.8	0604000201
TDEC		DUCKRIS09	Duck River @ RM 272.1	0604000201
TDEC		DUCKRIS10	Duck River @ RM 274.3	0604000201
TDEC	DUCK275.8CE		Duck River @ RM 275.8	0604000201
TDEC		DUCKRIS14	Duck River @ RM 277.69	0604000201
TDEC	DUCK275.8CE		Duck River @ RM 275.8	0604000201
TDEC	DUCK265.5CE		Duck River @ RM 265.5	0604000201
TDEC	DUCK328.4BE		Duck River @ RM 328.4	0604000201
TDEC	LDUCK002.3CE	1710	Little Duck River @ RM 2.3	0604000201
TDEC	LDUCK001.3CE	LDUCKIS07	Little Duck River @ RM 1.3	0604000201
TDEC	LDUCK002.0CE	LDUCKIS06	Little Duck River @ RM 2.0	0604000201
TDEC	LDUCK002.2CE	LDUCKIS05	Little Duck River @ RM 2.2	0604000201
TDEC	LDUCK002.5CE	LDUCKIS04	Little Duck River @ RM 2.5	0604000201
TDEC	LDUCK004.2CE	LDUCKIS03	Little Duck River @ RM 4.2	0604000201
TDEC	LDUCK005.8CE	LDUCKIS02	Little Duck River @ RM 5.8	0604000201
TDEC	LDUCK006.4CE	LDUCKIS01	Little Duck River @ RM 6.4	0604000201
TDEC	1026	001026	Duck River @ RM 247.0 (Normandy Dam Tailwater)	0604000201
TDEC	DUCK252.0CE		Duck River @ RM 252.0 (Normandy Reservoir)	0604000201
TDEC	DUCK259.6CE	NORMANDY08	Duck River @ RM 259.6 (Normandy Reservoir)	0604000201
TDEC	CARRO000.8CE	NORMANDY07	Normandy Reservoir at Carroll Creek Embayment	0604000201
TDEC	CRUMP000.4CE	NORMANDY05	Normandy Reservoir at Crumpton Ck Embayment	0604000201
TDEC	NORMANDY01		Normandy Reservoir At Dam	0604000201
TDEC	DUCK252.0CE		Duck River @ RM 252.0 (Normandy Reservoir)	0604000201
TDEC	DUCK255.1CE	NORMANDY04	DUCK River @ RM 255.1 (Normandy Reservoir)	0604000201
TDEC	RILEY000.6CE	NORMANDY06	Normandy Reservoir at Riley Creek Embayment	0604000201
TDEC	DUCKRIS11		Parks Creek @ RM 1.0	0604000201
TVA	476821		Boiling Springs Branch @ RM 0.4	0604000201
TVA	477419		Boyd Branch @ RM 0.7	0604000201

AGENCY	STATION	ALIAS	LOCATION	HUC-10
TVA	477494		Carroll Creek @ RM 0.4	0604000201
TVA	476098		Carroll Creek @ RM 0.5	0604000201
TVA	476430		Carroll Creek @ RM 1.0	0604000201
TVA	476426		Crumpton Creek @ RM 2.40	0604000201
TVA	476833		Duck River @ RM 239.44	0604000201
TVA	475788		Duck River @ RM 239.8	0604000201
TVA	475787		Duck River @ RM 243.1	0604000201
TVA	476330		Duck River @ RM 243.1 (Inflow)	0604000201
TVA	476331		Duck River @ RM 243.1 (Outflow)	0604000201
TVA	476332		Duck River @ RM 243.1 (Shoals)	0604000201
TVA	477490		Duck River @ RM 245.05	0604000201
TVA	477489		Duck River @ RM 245.1	0604000201
TVA	477488		Duck River @ RM 246.9	0604000201
TVA	475745		Duck River @ RM 246.95	0604000201
TVA	475435		Duck River @ RM 248.3	0604000201
TVA	476219		Duck River @ RM 248.6	0604000201
TVA	477652		Duck River @ RM 248.7	0604000201
TVA	477657		Duck River @ RM 248.9	0604000201
TVA	477656		Duck River @ RM 249.2	0604000201
TVA	477655		Duck River @ RM 249.5	0604000201
TVA	477453		Duck River @ RM 249.50	0604000201
TVA	477661		Duck River @ RM 249.6	0604000201
TVA	477497		Duck River @ RM 250.0	0604000201
TVA	475786		Duck River @ RM 250.05	0604000201
TVA	477660		Duck River @ RM 250.1	0604000201
TVA	477654		Duck River @ RM 250.3	0604000201
TVA	476662		Duck River @ RM 250.5	0604000201
TVA	477658		Duck River @ RM 250.5	0604000201
TVA	477659		Duck River @ RM 250.7	0604000201
TVA	477653		Duck River @ RM 250.9	0604000201
TVA	477683		Duck River @ RM 251.1	0604000201
TVA	475044		Duck River @ RM 251.2	0604000201
TVA	477100		Duck River @ RM 251.5	0604000201
TVA	476244		Duck River @ RM 252.0	0604000201
TVA	476663		Duck River @ RM 252.0	0604000201
TVA	477498		Duck River @ RM 252.1	0604000201
TVA	477493		Duck River @ RM 253.5	0604000201
TVA	476220		Duck River @ RM 253.8	0604000201
TVA	476097		Duck River @ RM 255.0	0604000201
TVA	477499		Duck River @ RM 255.1	0604000201
TVA	477420		Duck River @ RM 255.25	0604000201
TVA	477454		Duck River @ RM 257.0	0604000201
TVA	477522		Duck River @ RM 258.0	0604000201
TVA	475785		Duck River @ RM 258.4	0604000201

AGENCY	STATION	ALIAS	LOCATION	HUC-10
TVA	477500		Duck River @ RM 259.0	0604000201
TVA	476172		Duck River @ RM 259.4	0604000201
TVA	477421		Duck River @ RM 259.5	0604000201
TVA	477523		Duck River @ RM 260.0	0604000201
TVA	477501		Duck River @ RM 260.6	0604000201
TVA	477502		Duck River @ RM 261.9	0604000201
TVA	476429		Duck River @ RM 262.0	0604000201
TVA	476428		Duck River @ RM 264.0	0604000201
TVA	475436		Duck River @ RM 265.4	0604000201
TVA	476427		Duck River @ RM 265.5	0604000201
TVA	476247		Duck River @ RM 268.50	0604000201
TVA	475437		Duck River @ RM 270.1	0604000201
TVA	475866		Duck River @ RM 270.2	0604000201
TVA	476819		Duck River @ RM 275.9	0604000201
TVA	476822		Duck River @ RM 280.1	0604000201
TVA	476808		Duck River @ RM 285.84	0604000201
TVA	476333		Garrison Fork @ RM 0.01	0604000201
TVA	475873		Little Duck River @ RM 2.2	0604000201
TVA	475438		Little Duck River @ RM 5.7	0604000201
TVA			Normandy Drawdown	0604000201
TVA	476820		Parks Creek @ RM 0.9	0604000201
TVA	476099		Riley Creek @ RM 0.5	0604000201
TDEC	BBUCK001.0BE	BELLB001.BE	Bell Buckle Creek @ RM 1.0	0604000202
TDEC	GARRI004.3BE		Garrison Fork @ RM 4.3	0604000202
TDEC	GARRI000.6BE	GFCIS23	Garrison Fork Creek @ RM 0.6	0604000202
TDEC	GARRI001.15BE	GFCIS22	Garrison Fork Creek @ RM 1.15	0604000202
TDEC	GARRI001.3BE	GFCIS21	Garrison Fork Creek @ RM 1.30	0604000202
TDEC	GARRI001.5BE	GFCIS20	Garrison Fork Creek @ RM 1.50	0604000202
TDEC	GARRI001.7BE	GFCIS19	Garrison Fork Creek @ RM 1.70	0604000202
TDEC	GARRI001.8BE	GFCIS18	Garrison Fork Creek @ RM 1.80	0604000202
TDEC	GARRI001.9BE	GFCIS17	Garrison Fork Creek @ RM 1.90	0604000202
TDEC	GARRI001.93BE	GFCIS16	Garrison Fork Creek @ RM 1.93	0604000202
TDEC	GARRI002.02BE	GFCIS15	Garrison Fork Creek @ RM 2.02	0604000202
TDEC	GARRI002.1BE	GFCIS14	Garrison Fork Creek @ RM 2.10	0604000202
TDEC	GARRI002.2BE	GFCIS13	Garrison Fork Creek @ RM 2.20	0604000202
TDEC	GARRI002.3BE	GFCIS12	Garrison Fork Creek @ RM 2.30	0604000202
TDEC	GARRI002.39BE	GFCIS10	Garrison Fork Creek @ RM 2.39	0604000202
TDEC	GARRI002.52BE	GFCIS11	Garrison Fork Creek @ RM 2.52	0604000202
TDEC	GARRI002.53BE	GFCIS09	Garrison Fork Creek @ RM 2.53	0604000202
TDEC	GARRI002.68BE	GFCIS08	Garrison Fork Creek @ RM 2.68	0604000202
TDEC	GARRI002.87BE	GFCIS07	Garrison Fork Creek @ RM 2.87	0604000202
TDEC	GARRI002.98BE	GFCIS06	Garrison Fork Creek @ RM 2.98	0604000202
TDEC	GARRI003.05BE	GFCIS05	Garrison Fork Creek @ RM 3.05	0604000202
TDEC	GARRI003.14BE	GFCIS04	Garrison Fork Creek @ RM 3.14	0604000202

AGENCY	STATION	ALIAS	LOCATION	HUC-10
TDEC	GARRI003.29BE	GFCIS03	Garrison Fork Creek @ RM 3.29	0604000202
TDEC	GARRI003.31BE	GFCIS01	Garrison Fork Creek @ RM 3.31	0604000202
TDEC	WARTR001.2BE		Wartrace Creek @ RM 1.2	0604000202
TVA	476845		Bates Branch @ RM 0.86	0604000202
TVA	476846		Bates Branch @ RM 0.96	0604000202
TVA	476847		Bates Branch @ RM 1.17	0604000202
TVA	476867		Bell Buckle Creek @ RM 0.1	0604000202
TVA	476850		Drainage Ditch @ Mile 0.03	0604000202
TVA	476851		Drainage Ditch @ Mile 0.03	0604000202
TVA	476861		Drainage Ditch @ RM 0.02	0604000202
TVA	476844		Drainage Ditch @ RM 0.03	0604000202
TVA	476849		Drainage Ditch @ RM 0.05	0604000202
TVA	476869		Drainage Ditch 0.1 Mile From Fox Dairy	0604000202
TVA	476870		Drainage Ditch 0.2 Mile From Winnet Farm	0604000202
TVA	475747		Garrison Fork @ RM 0.6	0604000202
TVA	476834		Garrison Fork @ RM 1.5	0604000202
TVA	476835		Garrison Fork @ RM 1.85	0604000202
TVA	476853		Garrison Fork @ RM 12.60	0604000202
TVA	476854		Garrison Fork @ RM 12.70	0604000202
TVA	476836		Garrison Fork @ RM 3.2	0604000202
TVA	476852		Garrison Fork @ RM 9.4	0604000202
TVA	476841		Hatchett Branch @ RM 1.06	0604000202
TVA	476842		Hatchett Branch @ RM 1.34	0604000202
TVA	476843		Hatchett Branch @ RM 1.56	0604000202
TVA	476840		Latimer Creek @ RM 0.04	0604000202
TVA	476856		Lee Branch @ RM 0.1	0604000202
TVA	476857		Lee Branch @ RM 0.62	0604000202
TVA	476855		Puncheon Camp Creek @ RM 0.08	0604000202
TVA	476858		Puncheon Camp Creek @ RM 2.71	0604000202
TVA	476859		Puncheon Camp Creek @ RM 2.82	0604000202
TVA	476860		Unnamed Tributary @ RM 0.03	0604000202
TVA	476848		Unnamed Tributary @ RM 0.08	0604000202
TVA	476862		Unnamed Tributary @ RM 0.26	0604000202
TVA	476864		Unnamed Tributary @ RM 0.90	0604000202
TVA	476865		Unnamed Tributary @ RM 1.01	0604000202
TVA	476837		Wartrace Creek @ RM 1.25	0604000202
TVA	476838		Wartrace Creek @ RM 10.45	0604000202
TVA	476839		Wartrace Creek @ RM 10.58	0604000202
TVA	476863		Wartrace Creek @ RM 5.67	0604000202
TVA	476868		Wartrace Creek @ RM 6.63	0604000202
TVA	476866		Wartrace Creek @ RM 7.5	0604000202
TDEC	DUCK221.3BE	DUCK221.3	Duck River @ RM 221.3	0604000203
TDEC	ANDER000.2BE		Anderton Branch @ RM 0.2	0604000203
TDEC	BENNE000.1BE		Bennett Branch @ RM 0.1	0604000203

AGENCY	STATION	ALIAS	LOCATION	HUC-10
TDEC	BOMAR001.0BE		Bomar Creek @ RM 1.0	0604000203
TDEC	DAVIS000.2BE		Davis Branch @ RM 0.2	0604000203
TDEC	001030		Duck River @ Selbyville WTP Intake	0604000203
TDEC	001036		Duck River @ RM 192.1	0604000203
TDEC	DUCK216.2BE		Duck River @ RM 216.2	0604000203
TDEC	DUCK235.6BE		Duck River @ RM 235.6	0604000203
TDEC	FALL001.2BE		Fall Creek @ RM 1.2	0604000203
TDEC	FALL003.0BE		Fall Creek @ RM 3.0	0604000203
TDEC	FALL006.1BE		Fall Creek @ RM 6.1	0604000203
TDEC	FLAT002.7BE		Flat Creek @ RM 2.7	0604000203
TDEC	HURRI001.0BE		Hurricane Creek @ RM 1.0	0604000203
TDEC	HURRI004.2BE		Hurricane Creek @ RM 4.2	0604000203
TDEC	LSINK001.0BE		Little Sinking Creek @ RM 1.0	0604000203
TDEC	SINKI001.2BE	ECO71I07	Sinking Creek @ RM 1.2	0604000203
TDEC	SINKI003.3BE		Sinking Creek @ RM 3.3	0604000203
TDEC	SINKI008.9BE		Sinking Creek @ RM 8.9	0604000203
TDEC	SUGAR000.4BE		Sugar Creek @ RM 0.4	0604000203
TDEC	SUGAR002.7BE		Sugar Creek @ RM 2.7	0604000203
TDEC	THOMP001.4BE		Thompson Creek @ RM 1.4	0604000203
TDEC	THOMP006.5BE		Thompson Creek @ RM 6.5	0604000203
TVA	476372		Duck River @ RM 192.1	0604000203
TVA	476324		Duck River @ RM 202.2 (Inflow)	0604000203
TVA	476325		Duck River @ RM 202.2 (Outflow)	0604000203
TVA	476326		Duck River @ RM 202.2 (Shoals)	0604000203
TVA	475256		Duck River @ RM 202.3	0604000203
TVA	475215		Duck River @ RM 210.33	0604000203
TVA	475249		Duck River @ RM 212.4	0604000203
TVA	475214		Duck River @ RM 215.1	0604000203
TVA	475042		Duck River @ RM 216.18	0604000203
TVA	475213		Duck River @ RM 219.2	0604000203
TVA	475212		Duck River @ RM 219.83	0604000203
TVA	475248		Duck River @ RM 220.54	0604000203
TVA	475276		Duck River @ RM 220.85	0604000203
TVA	475211		Duck River @ RM 221.34	0604000203
TVA	476245		Duck River @ RM 221.4	0604000203
TVA	476826		Duck River @ RM 221.45	0604000203
TVA	475761		Duck River @ RM 222.0	0604000203
TVA	476823		Duck River @ RM 222.9	0604000203
TVA	476827		Duck River @ RM 224.15	0604000203
TVA	477492		Duck River @ RM 225.35	0604000203
TVA	477491		Duck River @ RM 229.3	0604000203
TVA	475043		Duck River @ RM 235.6	0604000203
TVA	476370		Fall Creek @ RM 1.3	0604000203
TVA	476369		Sinking Creek @ RM 0.9	0604000203

AGENCY	STATION	ALIAS	LOCATION	HUC-10
TVA	475252		Sugar Creek @ RM 0.45	0604000203
TDEC	ALEXA004.0BE		Alexander Creek @ RM 4.0	0604000204
TDEC	CLEM000.4BE		Clem Creek @ RM 0.4	0604000204
TDEC	NFORK016.4BE		North Fork Creek @ RM 16.4	0604000204
TDEC	NFORK003.5BE		North Fork Creek @ RM 3.5	0604000204
TDEC	NFORK004.7BE		North Fork Creek @ RM 4.7	0604000204
TDEC	NFORK007.7BE		North Fork Creek @ RM 7.7	0604000204
TDEC	WEAKL001.7BE		Weakley Creek @ RM 1.7	0604000204
TDEC	WEAKL005.2BE		Weakley Creek @ RM 5.2	0604000204
TVA	476365		North Fork Creek @ RM 3.4	0604000204
TVA	476368		North Fork Creek @ RM 7.7	0604000204
TVA	476367		Weakly Creek @ RM 0.2	0604000204
TDEC	CANEY002.6ML		Caney Creek @ RM 2.6	0604000205
TDEC	CEDAR002.2MY		Cedar Creek @ RM 2.2	0604000205
TDEC	001040		Duck River @ Lewisburg WTP Intake	0604000205
TDEC			Duck River at I-65	0604000205
TDEC	DUCK141.1MY		Duck River @ RM 141.1	0604000205
TDEC	DUCK180.0ML		Duck River @ RM 180.0	0604000205
TDEC	FLAT001.1MY		Flat Creek @ RM 1.1	0604000205
TDEC			Flat Creek @ RM 6.4	0604000205
TDEC	LICK001.8ML		Lick Creek @ RM 1.8	0604000205
TDEC	RICH000.5ML		Rich Creek @ RM 0.5	0604000205
TDEC	SPRIN003.2ML	ECO71I05	Spring Creek @ RM 3.2	0604000205
TDEC	THICK002.0ML		Thick Creek @ RM 2.0	0604000205
TDEC	WALLA000.8WI		Wallace Branch @ RM 0.8	0604000205
TDEC	WILSO000.7ML		Wilson Creek @ RM 0.7	0604000205
TDEC	WILSO002.9BE		Wilson Creek @ RM 2.9	0604000205
TDEC	WILSO005.2BE	ECO71I06	Wilson Creek @ RM 5.2	0604000205
TVA	476358		Caney Creek @ RM 1.0	0604000205
TVA	476356		Cedar Creek @ RM 1.80	0604000205
TVA	475989		Duck River @ RM 141.0	0604000205
TVA	476807		Duck River @ RM 145.85	0604000205
TVA	475987		Duck River @ RM 150.4	0604000205
TVA	475041		Duck River @ RM 156.5	0604000205
TVA	476318		Duck River @ RM 159.4 (Inflow)	0604000205
TVA	476319		Duck River @ RM 159.4 (Outflow)	0604000205
TVA	476320		Duck River @ RM 159.4 (Shoals)	0604000205
TVA	476301		Duck River @ RM 160.4	0604000205
TVA	476253		Duck River @ RM 164.4	0604000205
TVA	476252		Duck River @ RM 172.0	0604000205
TVA	476321		Duck River @ RM 179.1 (Inflow)	0604000205
TVA	476322		Duck River @ RM 179.1 (Outflow)	0604000205
TVA	476323		Duck River @ RM 179.1 (Shoals)	0604000205
TVA	476371		Duck River @ RM 179.2	0604000205

AGENCY	STATION	ALIAS	LOCATION	HUC-10
TVA	476828		Duck River @ RM 179.5	0604000205
TVA	476829		Duck River @ RM 179.8	0604000205
TVA	475474		Duck River @ RM 180.23	0604000205
TVA	476830		Duck River @ RM 180.5	0604000205
TVA	475986		Duck River @ RM 181.0	0604000205
TVA	476824		Duck River @ RM 181.05	0604000205
TVA	476825		Duck River @ RM 181.9	0604000205
TVA	476872		Duck River @ RM 182.5	0604000205
TVA	475048		Duck River @ RM 186.5	0604000205
TVA	476818		Duck River @ RM 186.58	0604000205
TVA	476817		Duck River @ RM 186.75	0604000205
TVA	476251		Duck River @ RM 191.8	0604000205
TVA	476357		Flat Creek @ RM 1.1	0604000205
TVA	476363		Spring Creek @ RM 3.0	0604000205
TVA	476816		Spring Creek @ RM 3.97	0604000205
TVA	476814		Spring Creek @ RM 5.75	0604000205
TVA	476815		Spring Creek @ RM 9.0	0604000205
TVA	476364		Wilson Creek @ RM 0.7	0604000205
TDEC	BROCK001.4ML		Big Rock Creek @ RM 1.4	0604000206
TDEC	BROCK015.8ML		Big Rock Creek @ RM 15.8	0604000206
TDEC	BROCK016.7ML		Big Rock Creek @ RM 16.7	0604000206
TDEC	BROCK019.5ML		Big Rock Creek @ RM 19.5	0604000206
TDEC	BROCK020.1ML		Big Rock Creek @ RM 20.1	0604000206
TDEC	BROCK005.2ML		Big Rock Creek @ RM 5.2	0604000206
TDEC	BROCK006.0ML		Big Rock Creek @ RM 6.0	0604000206
TDEC	BROCK009.4ML		Big Rock Creek @ RM 9.4	0604000206
TDEC	DRY001.2ML	DRYB001.2ML	Dry Branch @ RM 1.2	0604000206
TDEC	0001040		Duck River 50' Upstream Of Lewisburg STP	0604000206
TDEC	EROCK001.8ML		East Rock Creek @ RM 1.8	0604000206
TDEC	EROCK020.8BE		East Rock Creek @ RM 20.8	0604000206
TDEC	SNELL000.3ML	SNELB000.3ML	Snell Branch @ RM 0.3	0604000206
TDEC	WRIGH000.1ML	WRIGB00.1ML	Wright Branch @ RM 0.1	0604000206
TVA	475748		Big Rock Creek @ RM 1.4	0604000206
TVA	476359		Big Rock Creek @ RM 1.4	0604000206
TVA	475476		Big Rock Creek @ RM 15.90	0604000206
TVA	475543		Big Rock Creek @ RM 17.8	0604000206
TVA	476361		Big Rock Creek @ RM 5.9	0604000206
TVA	475475		Big Rock Creek @ RM 5.95	0604000206
TVA	475762		Duck River @ RM 181.0	0604000206
TVA	476362		East Rock Creek @ RM 1.9	0604000206
TVA	476360		Unnamed Tributary @ RM 0.1	0604000206
TDEC	EFGLO000.1ML		East Fork Globe Creek @ RM 0.1	0604000207
TDEC	FOUNT000.3MY		Fountain Creek @ RM 0.3	0604000207
TDEC	FOUNT013.2MY		Fountain Creek @ RM 13.2	0604000207

AGENCY	STATION	ALIAS	LOCATION	HUC-10
TDEC	FOUNT002.8MY		Fountain Creek @ RM 2.8	0604000207
TDEC	GLOBE001.6MY		Globe Creek @ RM 1.6	0604000207
TDEC	GLOBE001.7MY		Globe Creek @ RM 1.7	0604000207
TDEC	SILVE001.5MY		Silver Creek @ RM 1.5	0604000207
TVA	476806		Fountain Creek @ RM 0.03	0604000207
TVA	476254		Fountain Creek @ RM 0.5	0604000207
TVA	476802		Fountain Creek @ RM 13.3	0604000207
TVA	476801		Fountain Creek @ RM 14.5	0604000207
TVA	476800		Fountain Creek @ RM 19.40	0604000207
TVA	476805		Fountain Creek @ RM 6.98	0604000207
TVA	476804		Fountain Creek @ RM 8.95	0604000207
TVA	476803		Globe Creek @ RM 1.5	0604000207

Table A4-4. STORET Water Quality Monitoring Stations in the Upper Duck River Watershed*. RM, River Mile; TDEC, Tennessee Department of Environment and Conservation; TVA, Tennessee Valley Authority.*

FACILITY NUMBER	FACILITY NAME	SIC	SIC NAME	MADI	WATERBODY	HUC-10
TN0067938	TWRA-Normandy Fish Hatchery	0921	Fish Hatcheries	Minor	Duck River @ RM 248.0	0604000201
TN0025038	Manchester STP	4952	Sewerage System	Major	Duck River @ RM 268.5	0604000201
TN0002470	Tennessee Dickel Distilling Company	2085	Distilled and Blended Liquors	Minor	Cascade Creek @ RM 0.1 to Cascade Branch @ RM 1.4	0604000201
TN0002143	Coey Tanning	3111	Leather tanning and Finishing	Major	Garrison Fork Creek @ RM 3.5	0604000202
TN0020443	Wartrace STP	4952	Sewerage System	Minor	Wartrace Creek @ RM 2.0	0604000202
TN0020591	Bell Buckle STP	4952	Sewerage System	Minor	Bell Buckle Creek @ RM 0.8	0604000202
TN0024180	Shelbyville STP	4952	Sewerage System	Minor	Duck River @ RM 221.3	0604000203
TN0002135	Tyson Foods, Incorporated	2015	Poultry Slaughtering	Major	Duck River @ RM 220.5	0604000203
TN0064670	Chapel Hill Waste Water Treatment Plant	4952	Sewerage System	Minor	Duck River @ RM 185.5	0604000205
TN0062073	Chapel Woods STP	4952	Sewerage System	Minor	Duck River @ RM 177.5	0604000205
TN0022888	Lewisburg STP	4952	Sewerage System	Major	Big Rock Creek @ RM 16.8	0604000206
TN0002445	International Comfort Products Corporation	3585	Air Conditioning, Heating, and Refrigeration Equipment	Minor	Snell Branch @ RM 1.6 to Big Rock Creek @ RM 15.5	0604000206

Table A4-5. NPDES Permittees in the Upper Duck River Watershed. *RM, River Mile; SIC, Standard Industrial Classification; MADI, Major Discharge Indicator.*

FACILITY NUMBER	PERMITEE	COUNTY	LIVESTOCK	WATERBODY	HUC-10
TNA000105	Robeert A. Wiser	Coffee	Poultry	UT to Normandy Reservoir	0604000201
TNA000012	Soulat Kayasith	Marshall	Poultry	Rich Creek	0604000205

Table A4-6. CAFO Sites in the Upper Duck River Watershed. *UT, Unnamed Tributary.*

FACILITY NUMBER	PERMITEE	SIC	SIC NAME	WATERBODY	HUC-10
TN0022756	The Rogers Group (Shelbyville Quarry)	1422	Limestone-Crushed and Broken	Duck River	0604000203
TN0066508	Vulcan Construction Materials (Shelbyville Quarry)	1422	Limestone-Crushed and Broken	UT to Bomar Creek	0604000203
TN0071846	The Rogers Group (Deason Quarry)	1422	Limestone-Crushed and Broken	North Fork Creek	0604000204
TN0072524	Castle Rock Quarries (Castle Rock Quarry)	1411	Sandstone Mining	UT to Roaring Creek	0604000205
TN0061395	The Rogers Group (Columbia Quarry)	1422	Limestone-Crushed and Broken	Goose Creek	0604000205
TN0066630	The Rogers Group (Pottsville Quarry)	1422	Limestone-Crushed and Broken	UT to Duck River and Karst	0604000205
TN0066338	The Rogers Group (Anchor Rock Quarry)	1422	Limestone-Crushed and Broken	Duck River	0604000205
TN0079171	Warner/Brothers Custom Stone Quarry	1422	Limestone-Crushed and Broken	UT to Duck River	0604000205
TN0003654	The Rogers Group (Lewisburg Quarry)	1422	Limestone-Crushed and Broken	Big Rock Creek	0604000206
TN0071251	The Rogers Group (Belfast Quarry)	1422	Limestone-Crushed and Broken	UT to Dry Creek	0604000206

Table A4-7. Active Permitted Mining Sites in the Upper Duck River Watershed. *SIC, Standard Industrial Classification; UT, Unnamed Tributary.*

FACILITY NUMBER	PERMITEE	WATERBODY	HUC-10
TN0063860	Duck River Utility Commission	Reedy Creek @ RM 10.6	0604000201
TN0022802	Shelbyville WTP	Robinson Creek @ RM 221.9	0604000203
TN0073547	Maury County Board of Public Utilities	Duck River @ RM 164.4	0604000205

Table A4-8. Water Treatment Plants in the Upper Duck River Watershed. *RM, River Mile.*

FACILITY NUMBER	PERMITEE	WATERBODY	HUC-10
TNG110061	I.M.I. Tennessee	WWC to UT to Duck River	0604000201
TNG110117	Sequatchie Concrete Services	Holland Branch	0604000203
TNG11032	Childress Concrete Co.	WWC to Collins Creek to Big Rock Creek @ RM 18.0	0604000206

Table A4-9. Ready Mix Concrete Plants in the Upper Duck River Watershed. *RM, River Mile; UT, Unnamed Tributary; WWC, Wet Weather Conveyance.*

LOG NUMBER	COUNTY	DESCRIPTION	WATERBODY	HUC-10
NRS00.227	Coffee	Stream Relocation	UT Carroll Creek	0604000201
NRS02.252	Coffee	Sewer Line Crossing	Little Duck River and UT to Little Duck River	0604000201
NRS02.437	Coffee	Concrete Replacement	Duck River	0604000201
NRS02.352	Coffee	Bridge repair	Duck River	0604000201
NRS03.035C	Bedford	Bridge and Approach	UT to Knob Creek	0604000202
NRS03.035	Bedford	Bridge and Approach	Knob Creek	0604000202
NRS03.035B	Bedford	Bridge and Approach	Knob Creek	0604000202
NRS02.336	Bedford	Wetland Filling	Hurricane Creek	0604000203
NRS01.318	Bedford	Bridge and Approach	Duck River	0604000203
NRS03.343	Bedford	Gravel Dredging	Duck River	0604000203
NRS02.016	Bedford	Gravel Dredging	Big Springs Branch	0604000203
NRS01.379	Bedford	Water Withdrawal	Duck River	0604000203
NRS02.141	Bedford	Water Line Crossings (2)	Flat Creek	0604000203
NRS02.112	Bedford	Bridge replacement	Duck River	0604000203
NRS03.216	Marshall	Bridge Replacement	Duck River	0604000205
NRS02.168	Maury	Bridge Repair	Flat Creek and Carlton Branch	0604000205

Table A4-10. Individual ARAP Permits Issued January 2000 Through June 2004 in Upper Duck River Watershed. UT, *Unnamed Tributary.*

FACILITY NUMBER	FACILITY NAME	SECTOR	RECEIVING STREAM	AREA*	HUC-10
TNR054505	Volunteer Engineering	AB	Hunt Creek	1.5	0604000201
TNR051524	M-Tek, Incorporated	AB	Hunt Creek	84.42	0604000201
TNR054562	DESA Specialty	AB, AA	Hunt Creek	7.13	0604000201
TNR051142	Gaylen Fann's Auto Parts	M	WWC to UT to Hunt Creek	40	0604000201
TNR054339	ACME Mechanical Contractors	AA	Duck River	11.88	0604000201
TNR051158	Batesville Casket Co.	Y, P	Goodman Spring Branch	169	0604000201
TNR054275	K&S Steel Fabricators	AA	Greenbriar Creek	9.91	0604000201
TNR056250	Pro Auto Sales and Salvage	M	Ditch to Walker Branch	0.8	0604000201
TNR054403	Tempco Fireplace Products	E, AA	Metropolitan Storm Sewer	12.55	0604000201
TNR050874	PCA Apparel Industries	V	Grindstone Hollow Creek	4	0604000201
TNR050963	Driver's Truck Salvage	M	UT to Duck River	4	0604000201
TNR053036	AEDC Landfill	L	WWC to Crumpton Creek	26.52	0604000201
TNR053948	MCA Fabrication	Y	Little Duck River	4.7	0604000201
TNR056414	Manchester Waste Water Treatment Plant	T, P	Grindstone Hollow Creek	11	0604000201
TNR050973	CFC Recycling	N	Hickerson Spring Branch	23.75	0604000201
TNR050063	Oak Tennessee, Inc.	Y		4.6	0604000201
TNR050977	Bumble Bee Boats	R	Bobo Creek	8	0604000201
TNR050811	Goodrich Landing Gear	AB	Bobo Creek	30	0604000201
TNR053555	United Parcel Service	P	UT to Rock Creek	1.6	0604000201
TNR050073	Tennessee Dickel Distilling Company	U, A, P	Cascade Branch	7.6	0604000201
TNR054380	Trico Products Corp.	AA	Stewart's Creek	3	0604000202
TNR050777	Haskins Auto Salvage	M	WWC to UT to Kelly Crouch Branch	388	0604000202
TNR051562	Quail Hollow Landfill	L	Anderson Creek and Powell Creek	3	0604000203
TNR056349	Bedford County Asphalt	D	Bomar Creek @ RM 2.3	8.4	0604000203
TNR054317	Quintec Films Corp.	Y	Retention Pond	92	0604000203
TNR056440	Wright Paving Company	D, J	Bomar Creek	0.5	0604000203
TNR051723	Shelbyville Recycled Fiber	N	Bomar Creek	2	0604000203
TNR055952	PSC Metals, Inc.	N	Bomar Creek	15	0604000203
TNR051056	Eaton Corp.-Plant #2	AB	Bomar Creek	9.4	0604000203
TNR054504	Cooper Steel Fabricating	AA, P	Holland Creek	47.92	0604000203
TNR051059	Eaton Corp.-Plant #1	AB	Bomar Creek	31	0604000203
TNR053010	Pechiney Plastic Packaging	Y	Holland Branch	0.3	0604000203
TNR054415	Wego Precision Machine	AB	Holland Creek	5.4	0604000203
TNR056380	Bluegrass Cooperage Co.	A	WWC to Holland Creek	17.4	0604000203
TNR053664	Shelbyville Municipal Airport	S	UT to Hurricane Creek	29	0604000203
TNR051624	Calsonic North America	AB	Little Hurricane Creek	12.8	0604000203
TNR050309	Alchem Aluminum	F, P	Bomar Creek	4.7	0604000203
TNR056408	Shelbyville Waste Water Treatment Plant	T	Duck River @ RM 221.3, 221.35, and 221.4	4.7	0604000203

FACILITY NUMBER	FACILITY NAME	SECTOR	RECEIVING STREAM	AREA*	HUC-10
TNR056428	Shelbyville Waste Water Treatment Plant	T	Duck River @ RM 221.3, 221.35, and 221.4	4.7	0604000203
TNR050439	Sanford Corporation	Y	Duck River	35	0604000203
TNR050175	Tyson Foods	U	Duck River	57.04	0604000203
TNR050125	Nowlin Auto Sales and Salvage	M	WWC to UT to Dryland Creek	17	0604000203
TNR051123	James Auto Salvage	M	WWC to UT to Duck River	7	0604000203
TNR054249	Trott Lumber Company	A	Sinking Creek	4.99	0604000203
TNR050609	Sanders Auto Salvage	M	WWC to UT to Alexander Creek	10	0604000205
TNR050005	Kantus Corporation	Y, AB	Snake Creek	32.6	0604000206
TNR053403	Pliant Corporation	Y	Collins Creek	10.12	0604000206
TNR054166	Matrix Drilling Products	AB	Capps Branch	3.11	0604000206
TNR053236	Mead Containerboard	B	Capps Branch	4	0604000206
TNR050742	Ken-Koat Corporation	AA	WWC to Capps Branch	4.5	0604000206
TNR050011	Cosmolab, Incorporated	Y, C	Big Rock Creek	17.9	0604000206
TNR053776	Abeco Die Casting	F	Capps Branch	3	0604000206
TNR050037	Tennessee Tech Coatings Corporation	C	Capps Branch @ RM 2.3	0.8	0604000206
TNR053136	Walker Die Casting	F	Capps Branch	101	0604000206
TNR056387	FedEx Freight East	P	Collins Creek	1	0604000206
TNR050573	Sanford	Y	Rock Creek	25.35	0604000206
TNR054499	Tennessee Pencil Co.	Y	Rock Creek	1.4	0604000206
TNR051246	Moon Products, Inc.	Y	Rock Creek	6.32	0604000206
TNR054223	T&H Concrete Products	E	Loyd Creek	0.62	0604000206
TNR053212	Ellington Airport	S	Wright Branch	0.7	0604000206
TNR051879	International Comfort Products	P	Snell Branch	160	0604000206
TNR051563	Cedar Ridge	P	East Fork Globe Creek	207	0604000207

Table A4-11. Active Permitted TMSP Facilities in the Upper Duck River Watershed. *Area, acres of property associated with industrial activity; UT, Unnamed Tributary; WWC, Wet Weather Conveyance. Sector details may be found in Table A4-12.*

SECTOR	TMSP SECTOR NAME
A	Timber Products Facilities
AA	Facilities That Manufacture Metal Products including Jewelry, Silverware and Plated Ware
AB	Facilities That Manufacture Transportation Equipment, Industrial or Commercial Machinery
AC	Facilities That Manufacture Electronic and Electrical Equipment and Components, Photographic and Optical Goods
AD	Facilities That Are Not Covered Under Sectors A Thru AC (Monitoring Required)
AE	Facilities That Are Not Covered Under Sectors A Thru AC (Monitoring Not Required)
B	Paper and Allied Products Manufacturing Facilities
C	Chemical and Allied Products Manufacturing Facilities
D	Asphalt Paving, Roofing Materials, and Lubricant Manufacturing Facilities
E	Glass, Clay, Cement, Concrete, and Gypsum Product Manufacturing Facilities
F	Primary Metals Facilities
G	Metal Mines (Ore Mining and Dressing) (RESERVED)
H	Inactive Coal Mines and Inactive Coal Mining-Related Facilities
I	Oil or Gas Extraction Facilities
J	Construction Sand and Gravel Mining and Processing and Dimension Stone Mining and Quarrying Facilities
K	Hazardous Waste Treatment Storage or Disposal Facilities
L	Landfills and Land Application Sites
M	Automobile Salvage Yards
N	Scrap Recycling and Waste and Recycling Facilities
O	Steam Electric Power Generating Facilities
P	Vehicle Maintenance or Equipment Cleaning areas at Motor Freight Transportation Facilities, Passenger Transportation Facilities, Petroleum Bulk Oil Stations and Terminals, the United States Postal Service, or Railroad Transportation Facilities
Q	Vehicle Maintenance Areas and Equipment Cleaning Areas of Water Transportation Facilities
R	Ship or Boat Building and Repair Yards
S	Vehicle Maintenance Areas, Equipment Cleaning Areas or From Airport Deicing Operations located at Air Transportation Facilities
T	Wastewater Treatment Works
U	Food and Kindred Products Facilities
V	Textile Mills, Apparel and other Fabric Product Manufacturing Facilities
W	Furniture and Fixture Manufacturing Facilities
X	Printing and Platemaking Facilities
Y	Rubber and Miscellaneous Plastic Product Manufacturing Facilities
Z	Leather Tanning and Finishing Facilities

Table A4-12. TMSP Sectors and Descriptions.

APPENDIX V

CONSERVATION PRACTICE	AMOUNT	
	FEET	ACRES
Alley Cropping		
Contour Buffer Strips		
Crosswind Trap Strips		
Field Borders	25,540	
Filter Strips		11
Grassed Waterways		14
Hedgerow Plantings		
Herbaceous Wind Barriers		
Riparian Forest Buffers		
Streambank and Shoreline Protection	7	
Windbreaks and Shelterbelts		
Total Conservation Buffers	**25,547**	**25**

Table A5-1a. Conservation Buffers Conservation Practices in Partnership with NRCS in the Upper Duck River Watershed. *Data are from Performance & Results Measurement System (PRMS) for October 1, 2003 through September 30, 2004 reporting period.*

NUTRIENT MANAGEMENT PLANS APPLIED	ACRES
Feed Management	0
Irrigation Management	0
Water Management	0
Nutrient Management	3,404
Waste Utilization	0

Table A5-1b. Nutrient Management Conservation Practices in Partnership with NRCS in the Upper Duck River Watershed. *Data are from PRMS for October 1, 2003 through September 30, 2004 reporting period.*

PARAMETER	FEET	NUMBER
Pipeline	2,500	
Pond		2
Spring Development		3
Watering Facility		1
Total	**2,500**	**6**

Table A5-1c. Water Supply Conservation Practices in Partnership with NRCS in the Upper Duck River Watershed. *Data are from PRMS for October 1, 2003 through September 30, 2004 reporting period.*

CONSERVATION PRACTICE	NUMBER
Sediment Basin	2

Table A5-1d. Water Detention/Retention Conservation Practices in Partnership with NRCS in the Upper Duck River Watershed. *Data are from PRMS for October 1, 2003 through September 30, 2004 reporting period.*

CONSERVATION PRACTICE	FEET	ACRES
Grassed Waterway		14

Table A5-1e. Land Treatment: Surface Water Management Conservation Practices in Partnership with NRCS in the Upper Duck River Watershed. *Data are from PRMS for October 1, 2003 through September 30, 2004 reporting period.*

PARAMETER	ACRES
Acres of Pest Management Systems Applied	3,206

Table A5-1f. Pest Management Conservation Practices in Partnership with NRCS in the Upper Duck River Watershed. *Data are from PRMS for October 1, 2003 through September 30, 2004 reporting period.*

CONSERVATION PRACTICE	AMOUNT	
	Feet	**Acres**
Fence	37,841	
Firebreak	850	
Forest Harvest Management		240
Heavy Use Area Protection		
Pasture and Hay Planting		80
Prescribed Grazing		1,695
Range Planting		
Use Exclusion		2
Pipeline		2,500
Prescribed Burning		
Total	**38,691**	**4,517**

Table A5-1g. Grazing/Forages Conservation Practices in Partnership with NRCS in the Upper Duck River Watershed. *Data are from PRMS for October 1, 2003 through September 30, 2004 reporting period.*

COMMUNITY	PROJECT DESCRIPTION	AWARD DATE	AWARD AMOUNT
Shelbyville	Wastewater Collection System Upgrades	02/03/03	$3,395,000

Table A5-2. Communities in the Upper Duck River Watershed Receiving SRF Grants or Loans.

PRACTICE	NRCS CODE	NUMBER OF BMPs
Composting Facility	317	9
Contour Buffer Strips	332	1
Critical Area Planting	342	3
Crop to Pasture	512	1
Diversion	362	4
Fence	382	10
Filter Strip	393	1
Grassed Waterway	412	7
Heavy Use Area	561	13
Irrigation Water Conveyance	430	1
Pasture/Hay Planting	512	4
Pasture/Hay Planting	512	110
Pipeline	516	1
Pond	378	3
Prescribed Grazing	528	1
Riparian Forest Buffer	391	1
Spring Development	574	3
Streambank Protection	580	1
Waste Management System	312	5
Waste Storage Facility	313	2
Watering Facility	614	13
Well Decommissioning	351	1

Table A5-3. Best Management Practices Installed by Tennessee Department of Agriculture and Partners in the Upper Duck River Watershed.