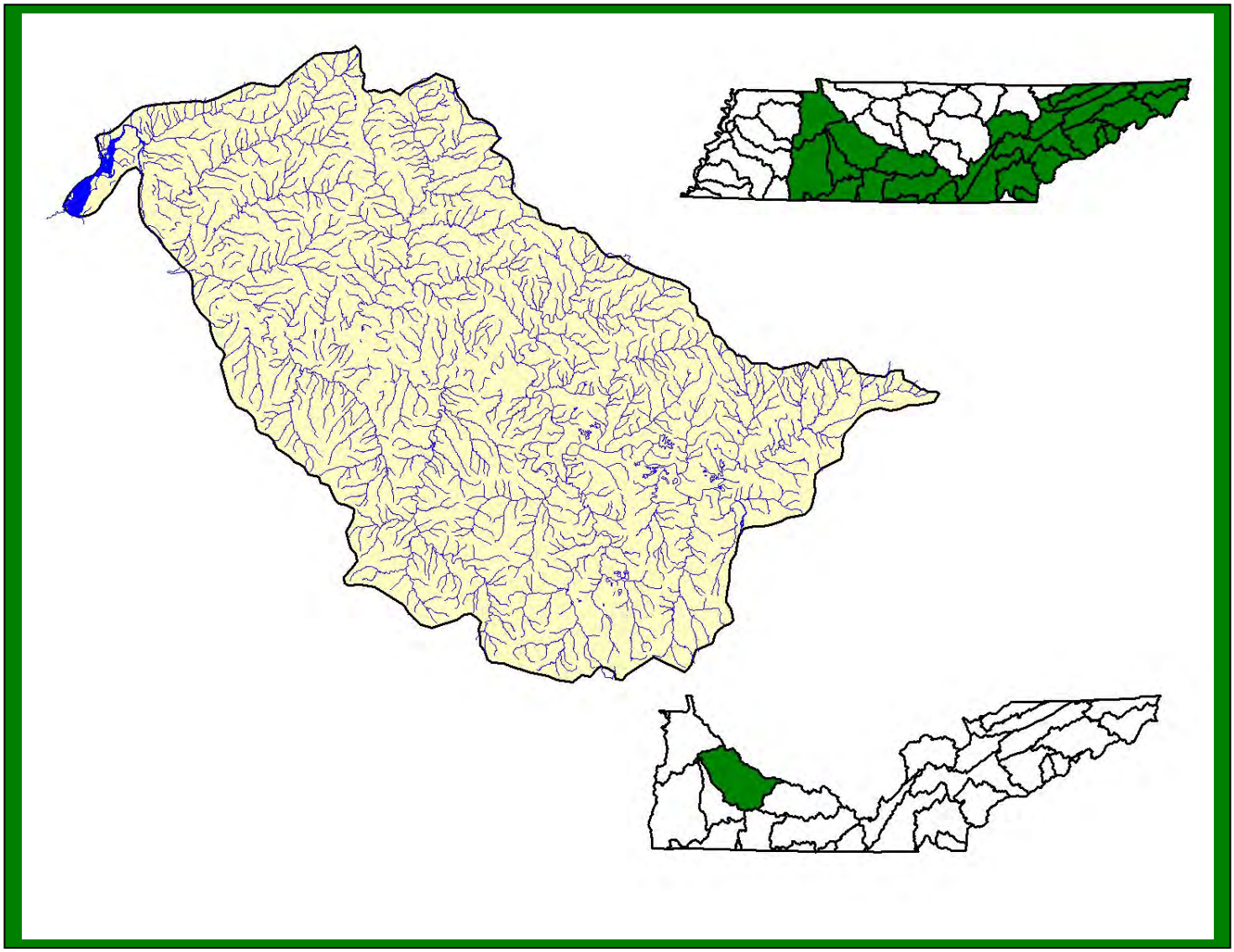
LOWER DUCK RIVER WATERSHED (06040003) OF THE TENNESSEE RIVER BASIN

WATERSHED WATER QUALITY MANAGEMENT PLAN



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

LOWER 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

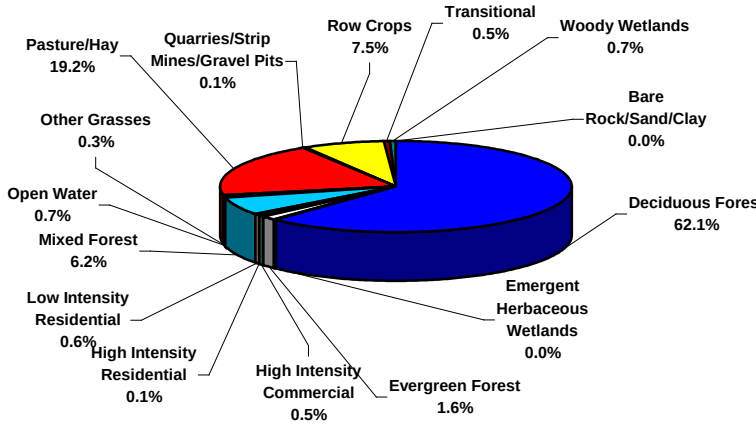
Summary – Lower Duck River

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 Lower 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.

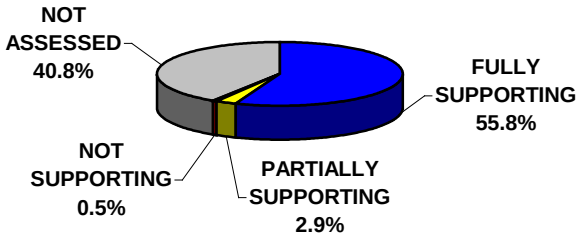
A detailed description of the watershed can be found in Chapter 2. The Lower Duck River Watershed is approximately 1,548 square miles and includes parts of nine Middle Tennessee counties. A part of the Tennessee River drainage basin, the watershed has 2,462 stream miles and 13 lake acres.



Land Use Distribution in the Lower Duck River Watershed.

Three interpretive areas and three wildlife management areas are located in the watershed. Eighty-one rare plant and animal species have been documented in the watershed, to include thirteen rare fish species, twelve rare mussel species, three rare snail species, and three rare reptile species. A portion of the Lower 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, 362 sampling events occurred in the Lower Duck River Watershed in 1999-2000. These were conducted at ambient, ecoregion or watershed monitoring sites. Monitoring results support the conclusion that 55.8% of total stream miles fully support designated uses.



Water Quality Assessment of Streams and Rivers in the Lower Duck River Watershed. Assessment data are based on the 2002 Water Quality Assessment of 2,461.8 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 Siltation, Organic Enrichment/ Low Dissolved Oxygen, Habitat Alteration and Unionized Ammonia.

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 Lower Duck River Watershed is Composed of Nine USGS-Delineated Subwatersheds (10-Digit Subwatersheds).

Point source contributions to the Lower Duck River Watershed consist of 13 individual NPDES-permitted facilities, three 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 (28), Tennessee Multi-Sector Permits (42), Mining Permits (1), Ready Mix Concrete Plant Permits (8), Water Treatment Plant Permits (3), and Concentrated Animal Feeding Operations (1). 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 Lower 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, and 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, Five Rivers RC&D Council and the Swan Conservation Trust) are also described.

Point and Nonpoint source approaches to water quality problems in the Lower 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 Lower 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. Components of the Watershed Approach. 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.

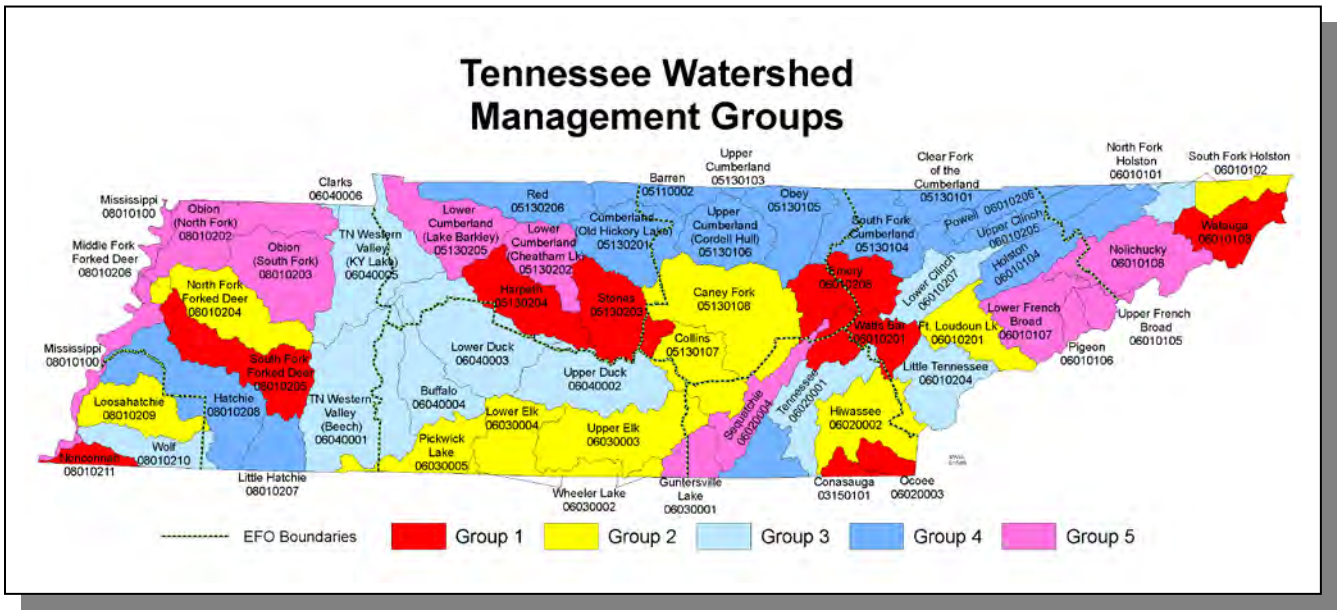


Figure 1-1. Watershed Groups in Tennessee's Watershed Approach to Water Quality.

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.

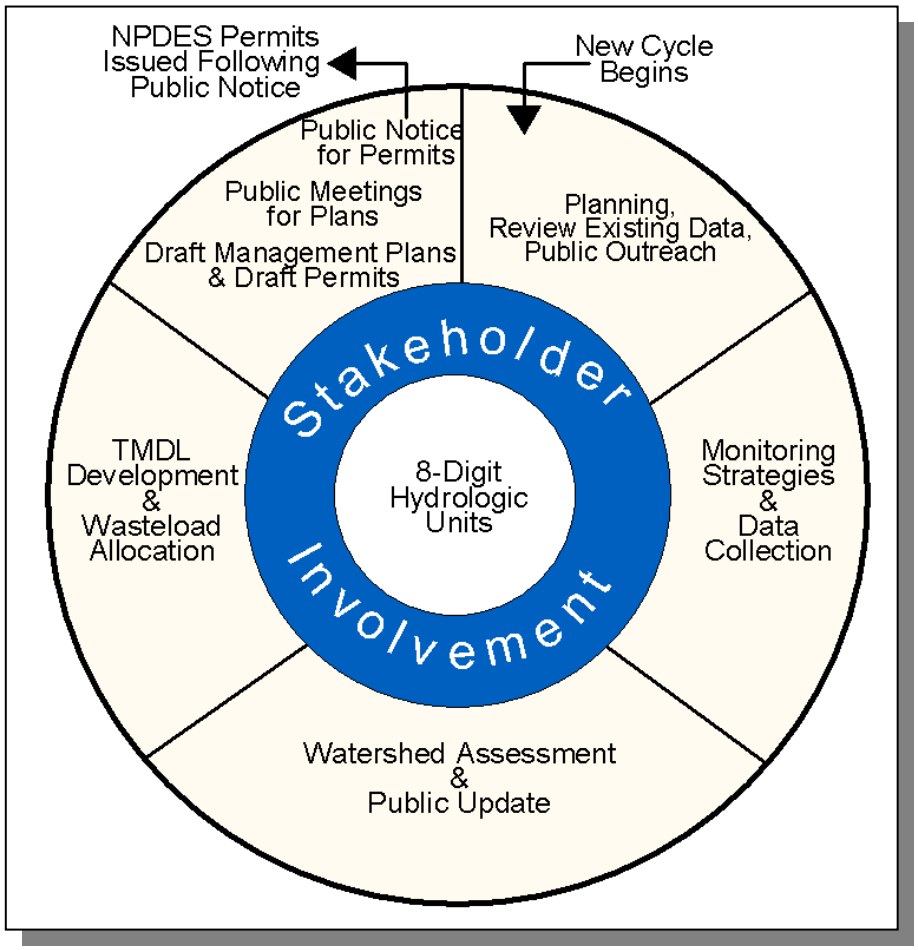


Figure 1-2. The Watershed Approach Cycle.

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 LOWER 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 Lower Duck River Watershed.

2.2. DESCRIPTION OF THE WATERSHED.

2.2.A. General Location. The Lower Duck River Watershed is located in Middle Tennessee and includes parts of Dickson, Giles, Hickman, Humphreys, Lawrence, Lewis, Maury, Perry, and Williamson Counties.

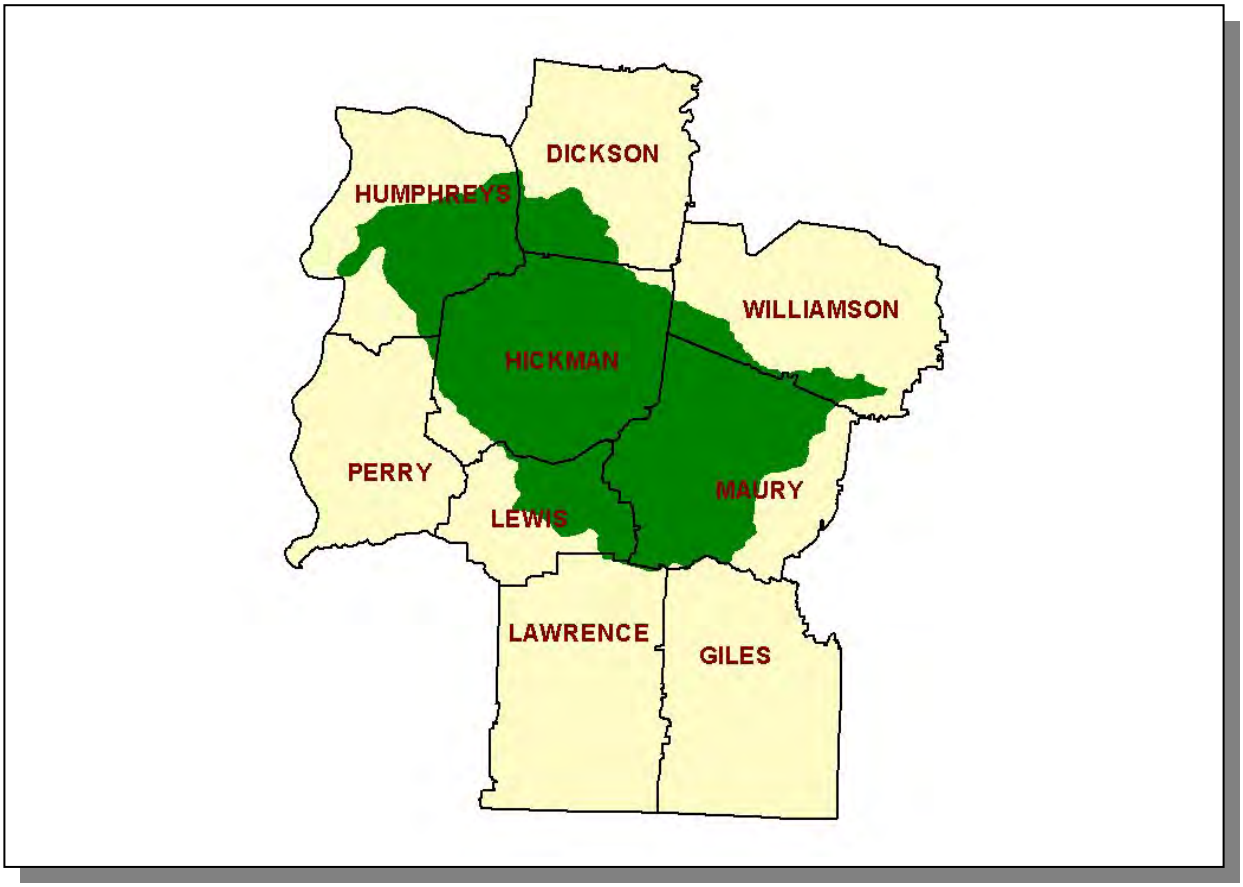


Figure 2-1. General Location of the Lower Duck River Watershed.

COUNTY	% OF WATERSHED IN EACH COUNTY
Hickman	36.3
Maury	29.8
Humphreys	15.1
Lewis	8.6
Dickson	5.1
Williamson	4.1
Lawrence	0.5
Giles	0.3
Perry	0.2

Table 2-1. The Lower Duck River Watershed Includes Parts of Nine Middle Tennessee Counties.

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

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

MUNICIPALITY	POPULATION	COUNTY
Columbia*	32,308	Maury
Mount Pleasant	12,058	Maury
Spring Hill	5,968	Murray/Williamson
Centerville*	5,045	Hickman

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 Lower Duck River Watershed, designated 06040003 by the USGS, drains approximately 1,548 square miles and empties to the Tennessee Western Valley (KY Lake) Watershed (06040005).

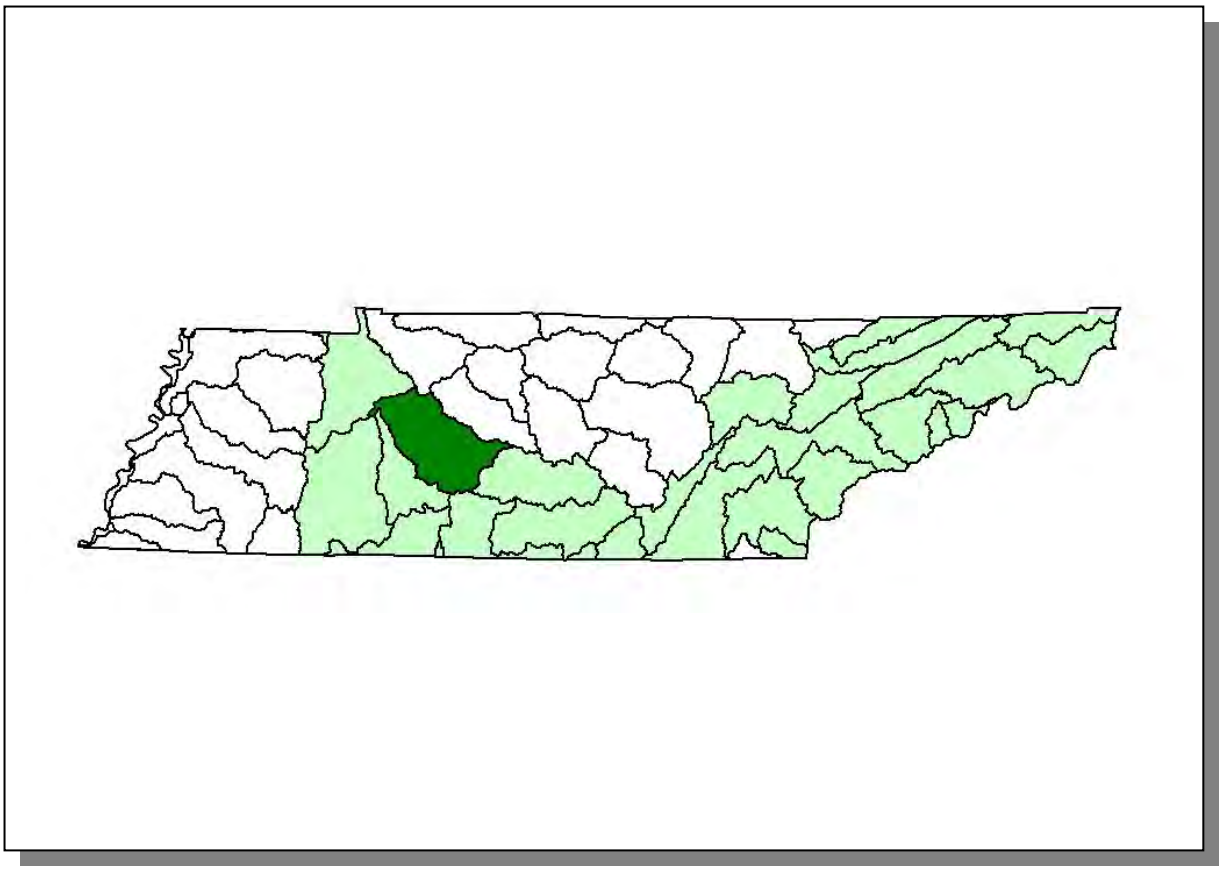


Figure 2-3. The Lower Duck River Watershed is Part of the Tennessee River Basin.

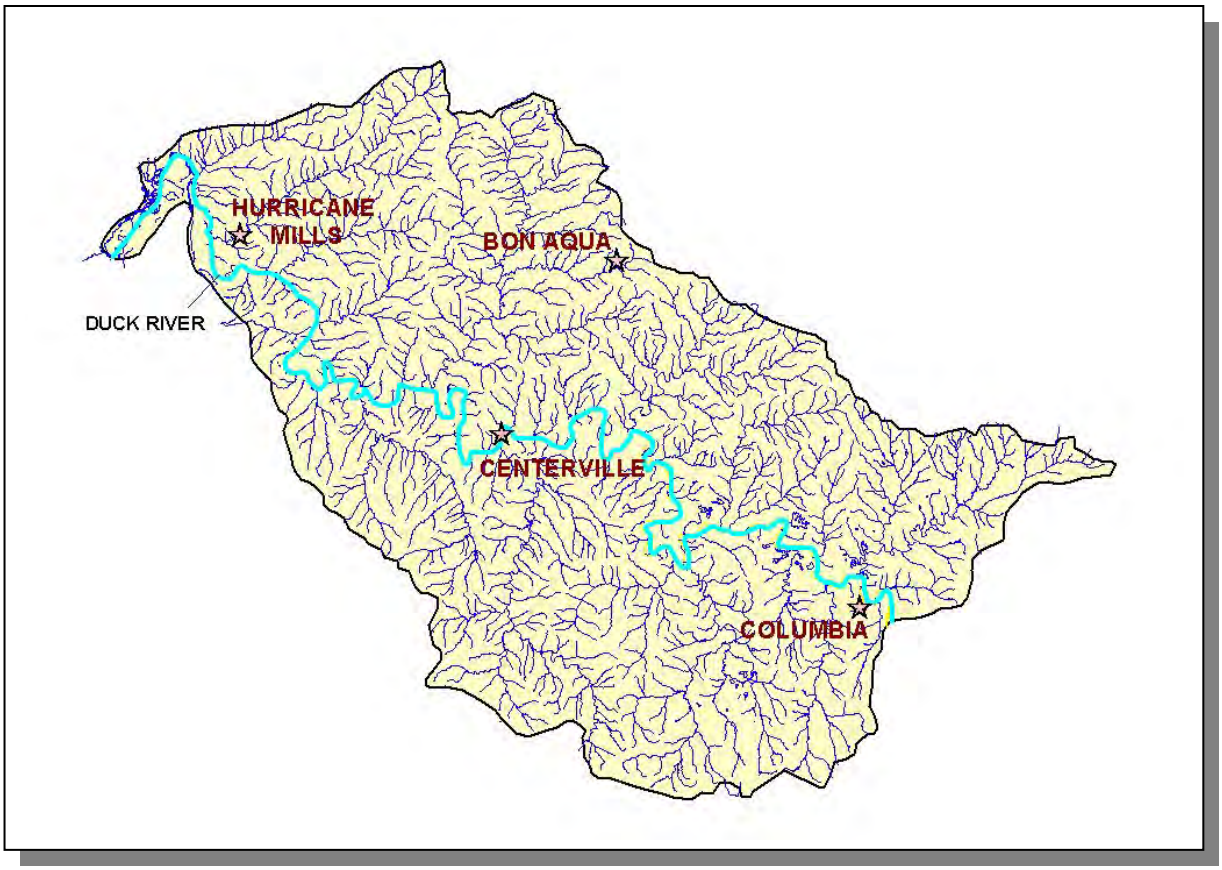


Figure 2-4. Hydrology in the Lower Duck River Watershed. *There are 2,462 stream miles and 13 lake acres in the Lower Duck River Watershed as catalogued in the assessment database. Location of the Duck River and the cities of Bon Aqua, Centerville, Columbia, and Hurricane Mills are shown for reference.*

2.3.B. Dams. There are 53 dams inventoried by TDEC Division of Water Supply in the Lower Duck River Watershed. These dams either retain 30 acre-feet of water or have structures at least 20 feet high.

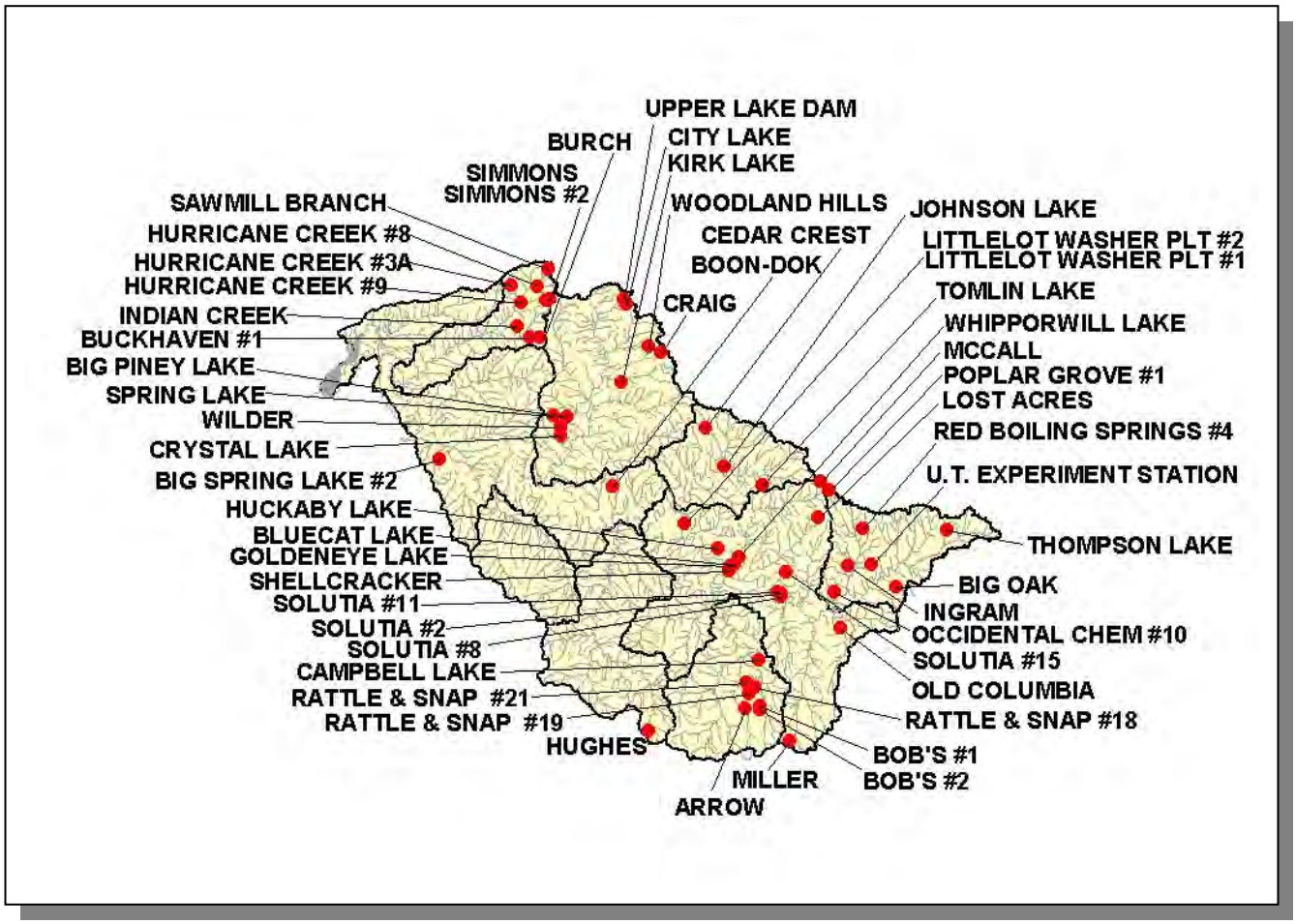


Figure 2-5. Location of Inventoried Dams in the Lower Duck River Watershed. *More information is provided in Appendix II and on the TDEC homepage at http://gwidc.memphis.edu/website/dws/.*

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.

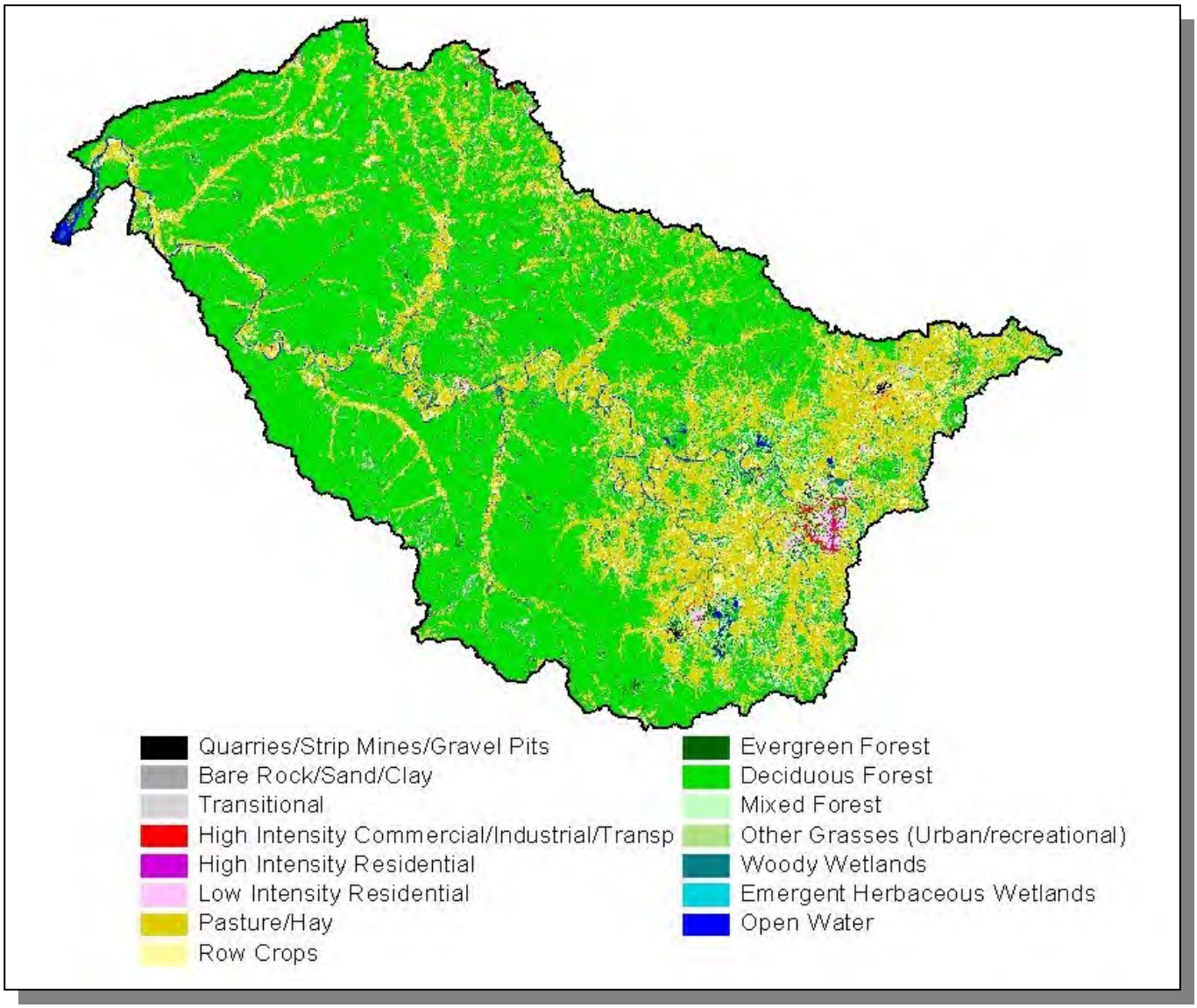


Figure 2-6. Illustration of Select Land Cover/Land Use Data from MRLC Satellite Imagery in the Lower Duck River Watershed.

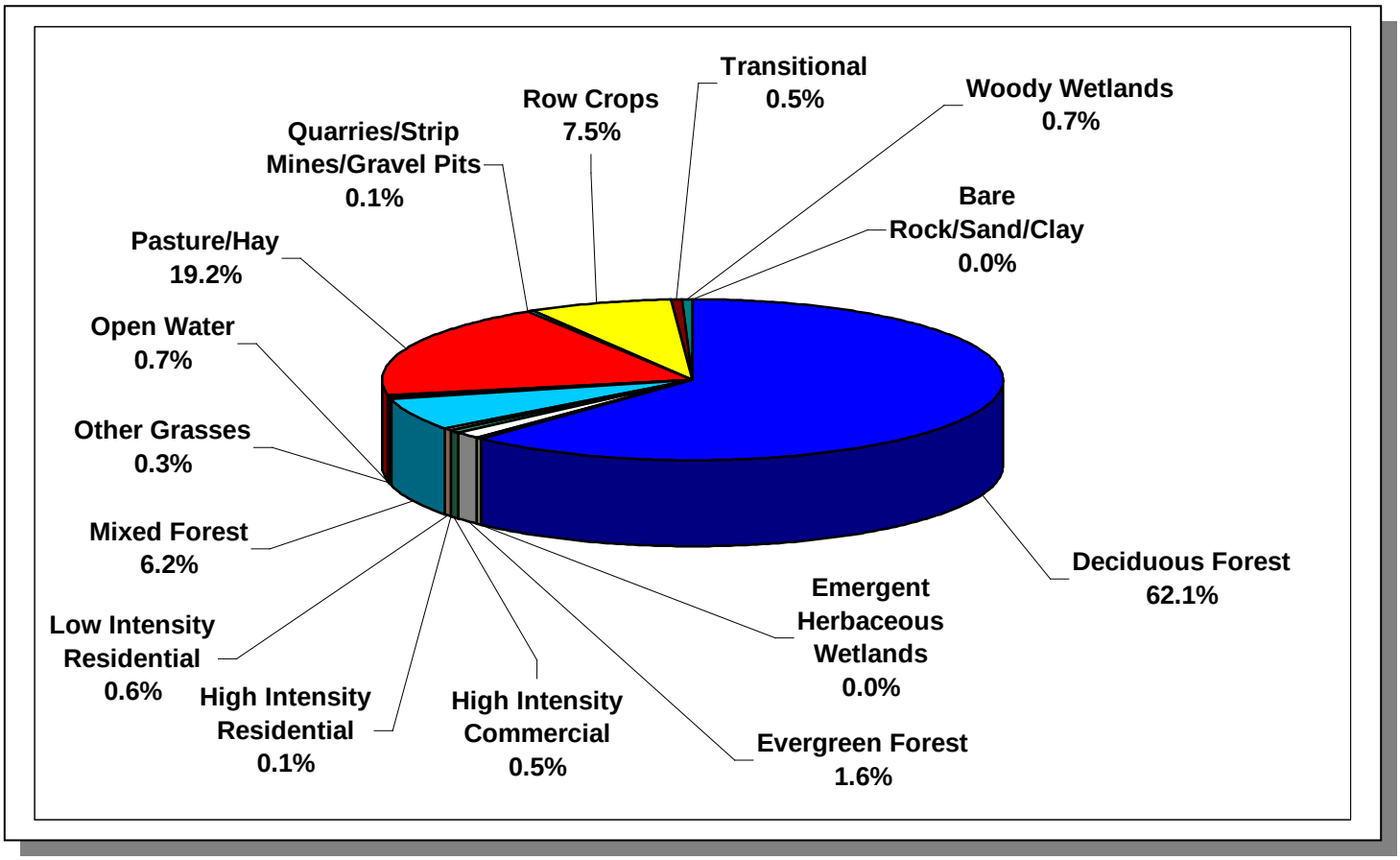


Figure 2-7. Land Use Distribution in the Lower Duck River Watershed. *More information is provided in Appendix II.*

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.

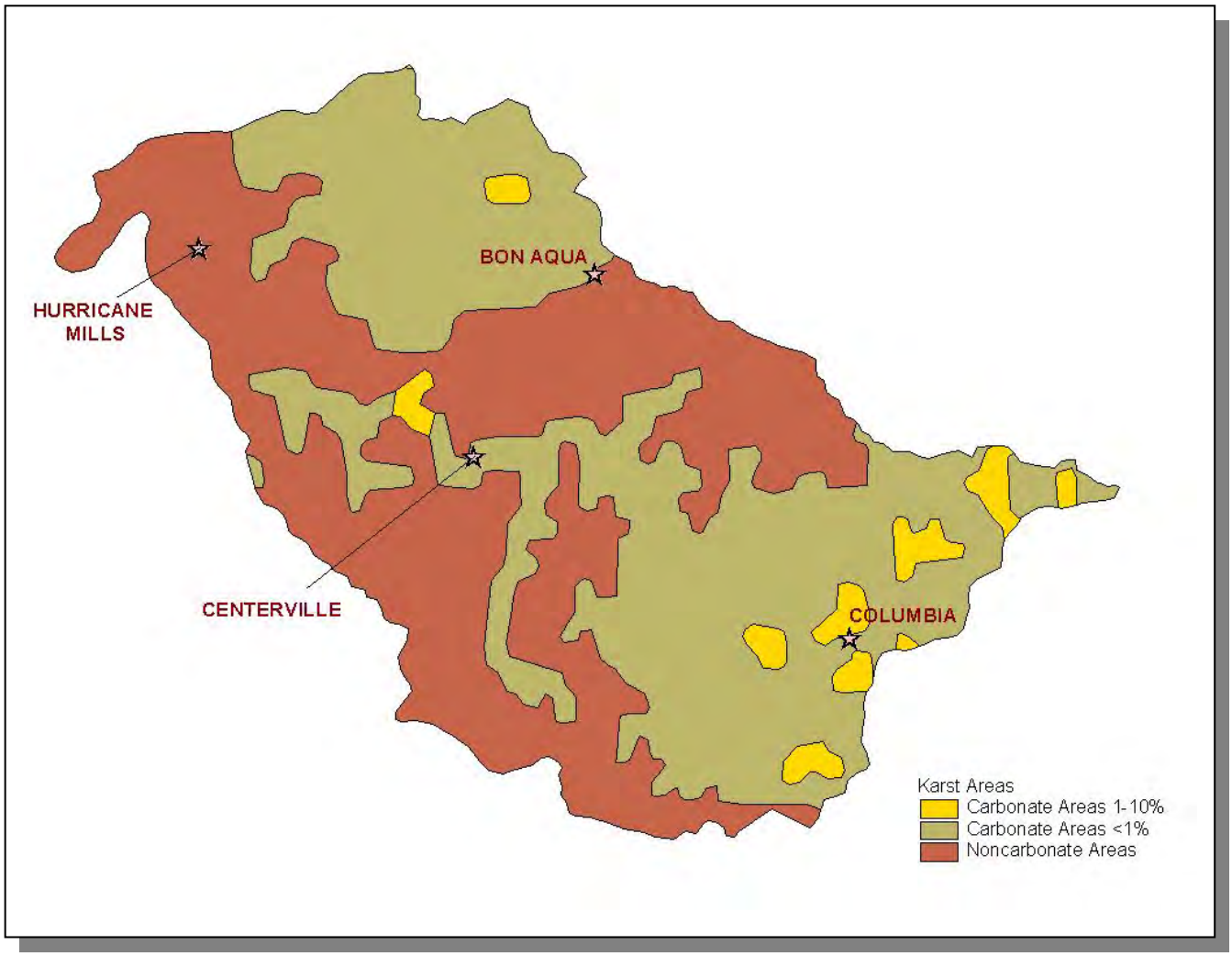


Figure 2-8. Illustration of Karst Areas in Lower Duck River Watershed. *Locations of Bon Aqua, Centerville, Columbia, and Hurricane Mille are shown for reference.*

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 Lower Duck River Watershed lies within a single Level III ecoregion (Interior Plateau) and contains 3 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.

- **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.

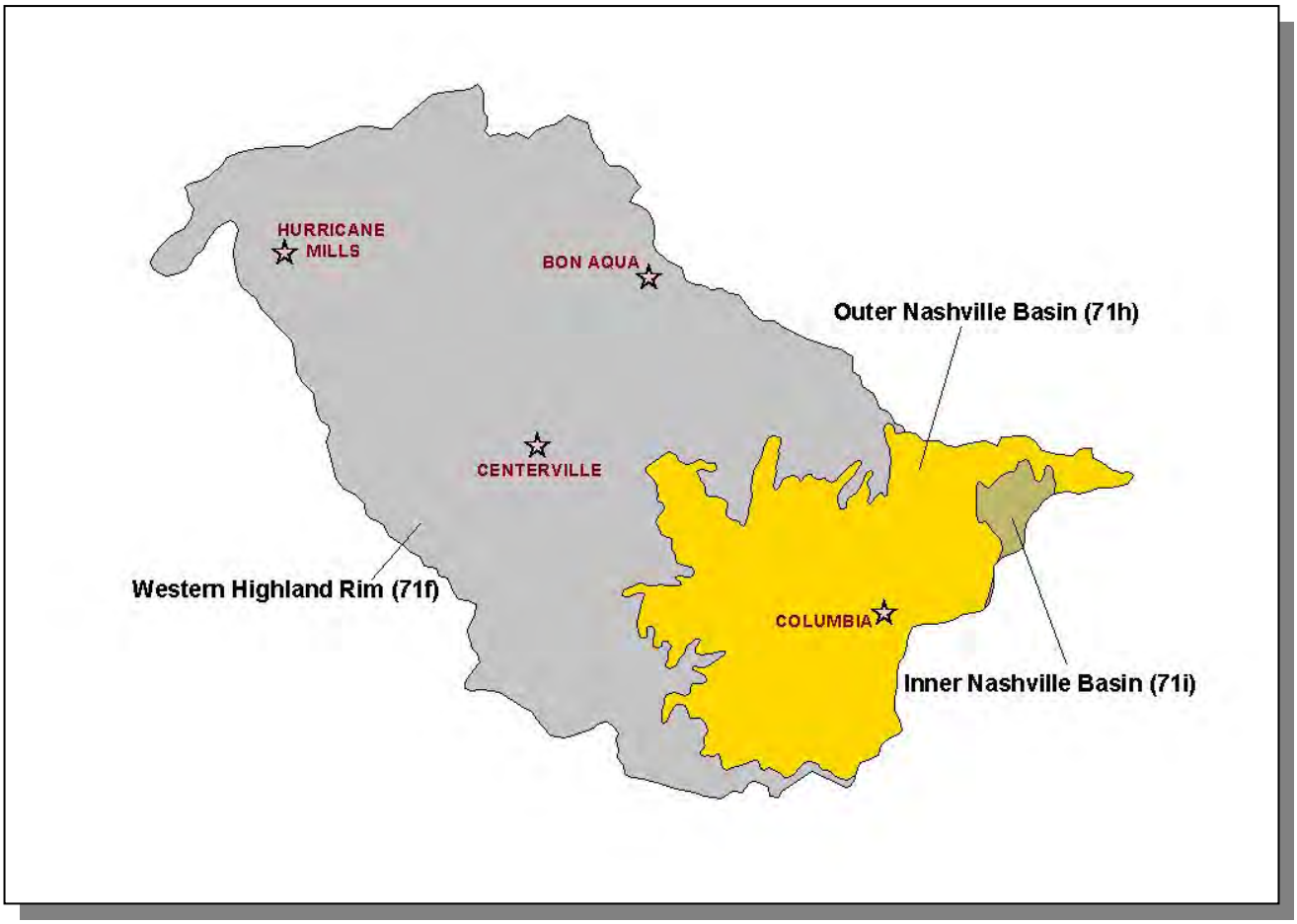


Figure 2-9. Level IV Ecoregions in the Lower Duck River Watershed. *Locations of Bon Aqua, Centerville, Columbia, and Hurricane Mille are shown for reference.*

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.

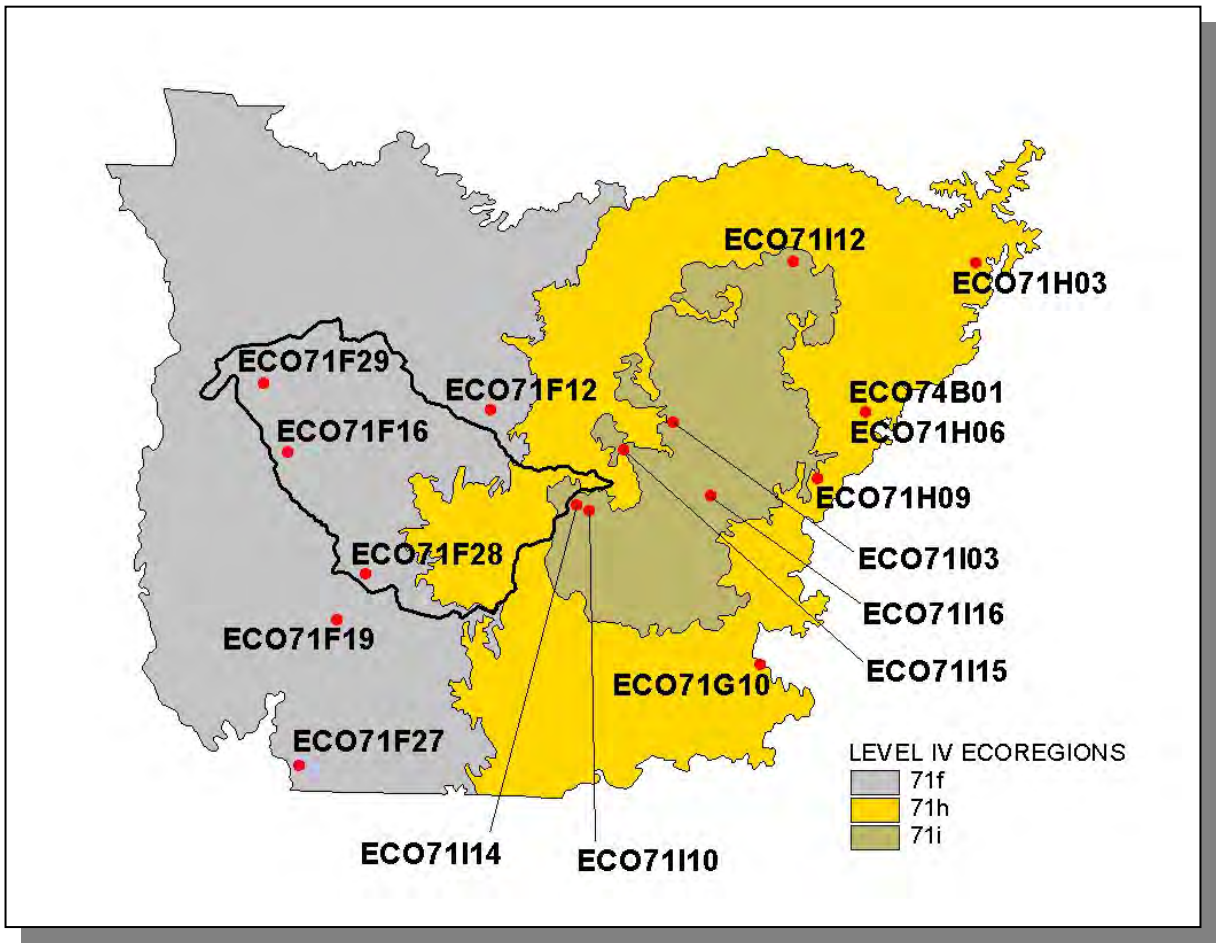


Figure 2-10. Ecoregion Monitoring Sites in Level IV Ecoregions 71f, 71h, and 71i in Tennessee. *The Lower Duck River Watershed boundary is shown for reference. More information is provided in Appendix II.*

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	4
Mussels	12
Snails	3
Amphibians	1
Birds	4
Fish	13
Mammals	5
Reptiles	3
Plants	36
Total	**81**

Table 2-3. There are 81 Known Rare Plant and Animal Species in the Lower Duck River Watershed.

In the Lower Duck River Watershed, there are 13 rare fish species, 11 rare mussel species, and 6 rare snail species.

SCIENTIFIC NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS
Carpiodes velifer	Highfin Carpsucker		D
Cycleptus elongatus	Blue Sucker	MC	T
Etheostoma denoncourti	Golden Darter		
Etheostoma luteovinctum	Redband Darter		D
Etheostoma pseudovulatum	Egg-Mimic Darter	MC	E
Etheostoma striatulum	Striated Darter	MC	T
Etheostoma aquali	Coppercheek Darter	MC	T
Hemitremia flammea	Flame Chub	MC	D
Icthyomyzon gagei	Southern Brook Lamprey		D
Noturus sp 3	Saddled Madtom		T
Noturus stanauli	Pygmy Madtom	LE	E
Percina burtoni	Blotchside Darter	MC	D
Percina phoxocephala	Slenderhead Darter		D
Conradilla caelata	Birdwing Pearly Mussel	LE	E
Cumberlandia monodonta	Spectaclecase		
Epioblasma brevidens	Cumberlandian Combshell	LE	E
Epioblasma florentina walkeri	Tan Riffleshell	LE	E
Hemistena lata	Cracking Pearly Mussel	LE	E
Lexingtonia dolabelloides	Slabside Pearly Mussel	C	
Obovaria retusa	Ring Pink	LE	E
Plethobasus cooperianus	Orange-Foot Pimpleback	LE	E
Pleurobema clava	Clubshell	LE	E
Quadrula cylindrica cylindrica	Rabbitsfoot		
Quadrula intermedia	Cumberland Monkeyface	LE	E
Toxolasma cylindrellus	Pale Lilliput	LE	E
Leptoxis praerosa	Onyx Rocksnail		
Lithasia duttoniana	Helmet Rocksnail		
Lithasia geniculata fulginosa	Geniculate Riversnail		
Lithasia salebrosa	Rustic Rocksnail		

Table 2-4. Rare Aquatic Species in the Lower 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/

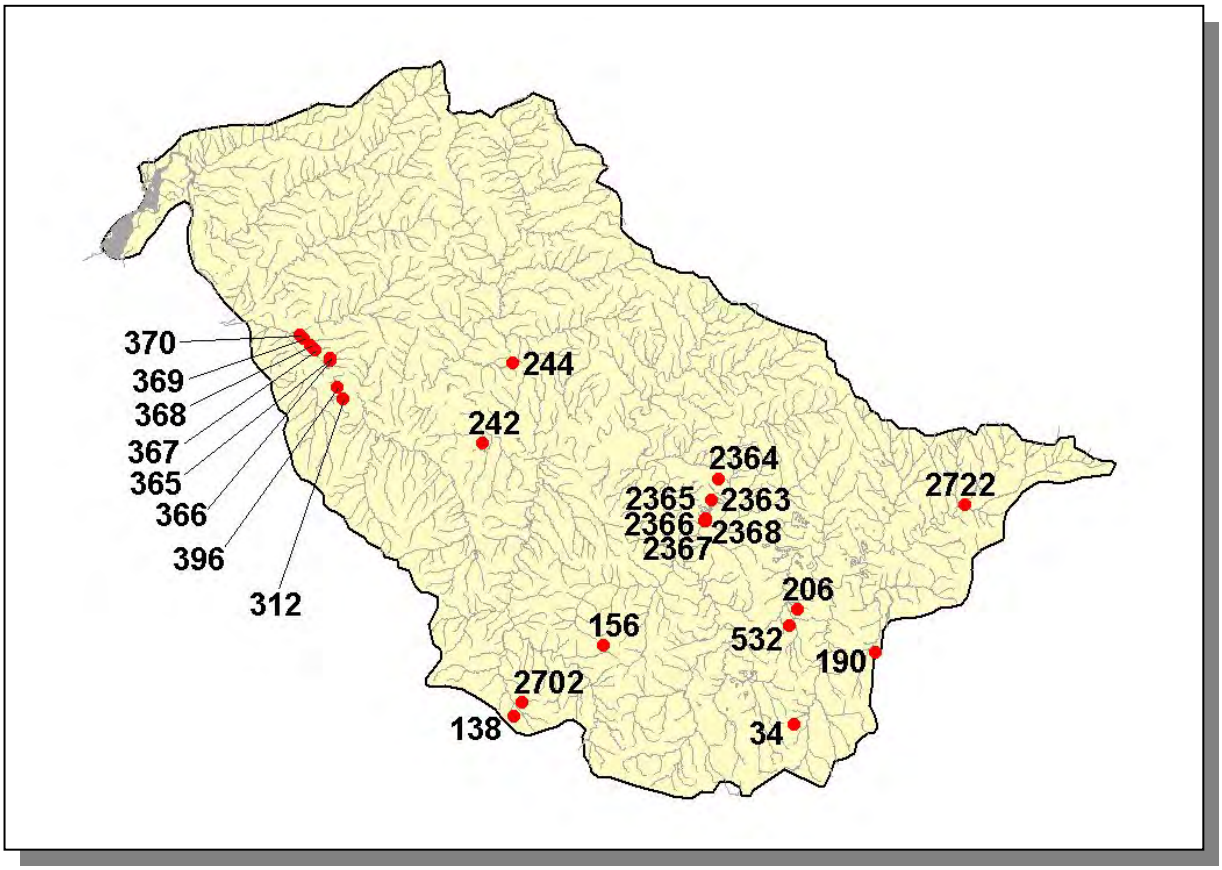


Figure 2-11. Location of Wetland Sites in TDEC Division of Natural Heritage Database in the Lower Duck River Watershed. This map represents an incomplete inventory and should not be considered a dependable indicator of the presence of wetlands*. More information is provided in Appendix II.*

2.7. CULTURAL RESOURCES.

2.7.A. State Scenic River. A portion of the Lower Duck River has been designated as a State Scenic River. The segment from Iron Bridge Road upstream to the Marshall County line (in the Upper Duck River Watershed) 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/

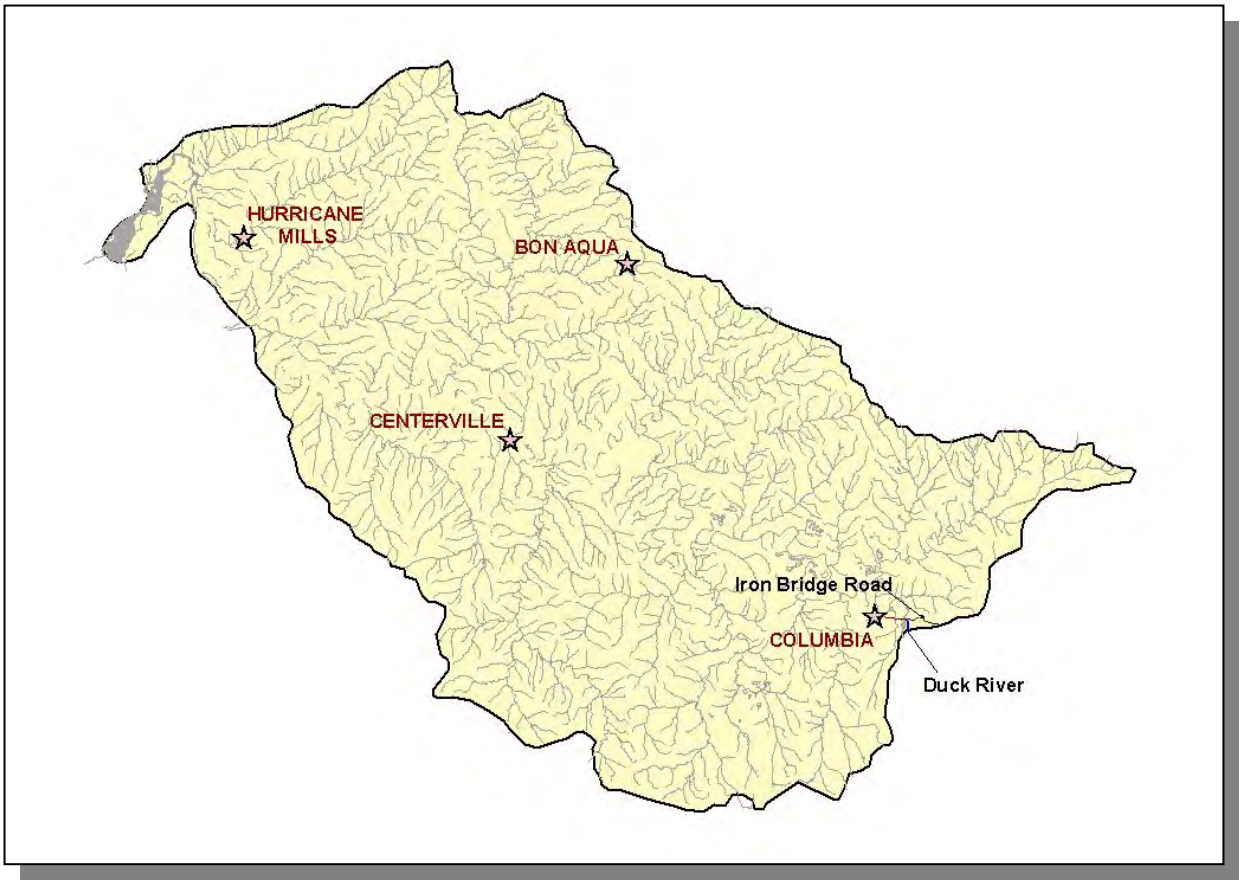


Figure 2-12. A Portion of the Lower Duck River is Designated as a State Scenic River. *Locations of Bon Aqua, Centerville, Columbia, and Hurricane Mills are shown for reference.*

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

- Tennessee NWR-Duck River Unit, established in 1945, is managed by the U.S. Fish and Wildlife Service as an important resting and feeding area for wintering waterfowl as well as migratory birds and resident wildlife. The site is managed by the U.S. Fish and Wildlife Service.
- Link Farm State Archaeological Site in Humphreys County features a prehistoric Mississippian era mound. The site is managed by the state of Tennessee.
- Natchez Trace Parkway National Park commemorates an ancient trail that connected southern portions of the Mississippi River to salt licks in modern-day Tennessee. Between 1785 and 1820, boatmen floated down the Ohio and Mississippi Rivers to Natchez, MS and New Orleans, LA, and walked back to Nashville on the 444-mile Trace. The Park is managed by the National Park Service.

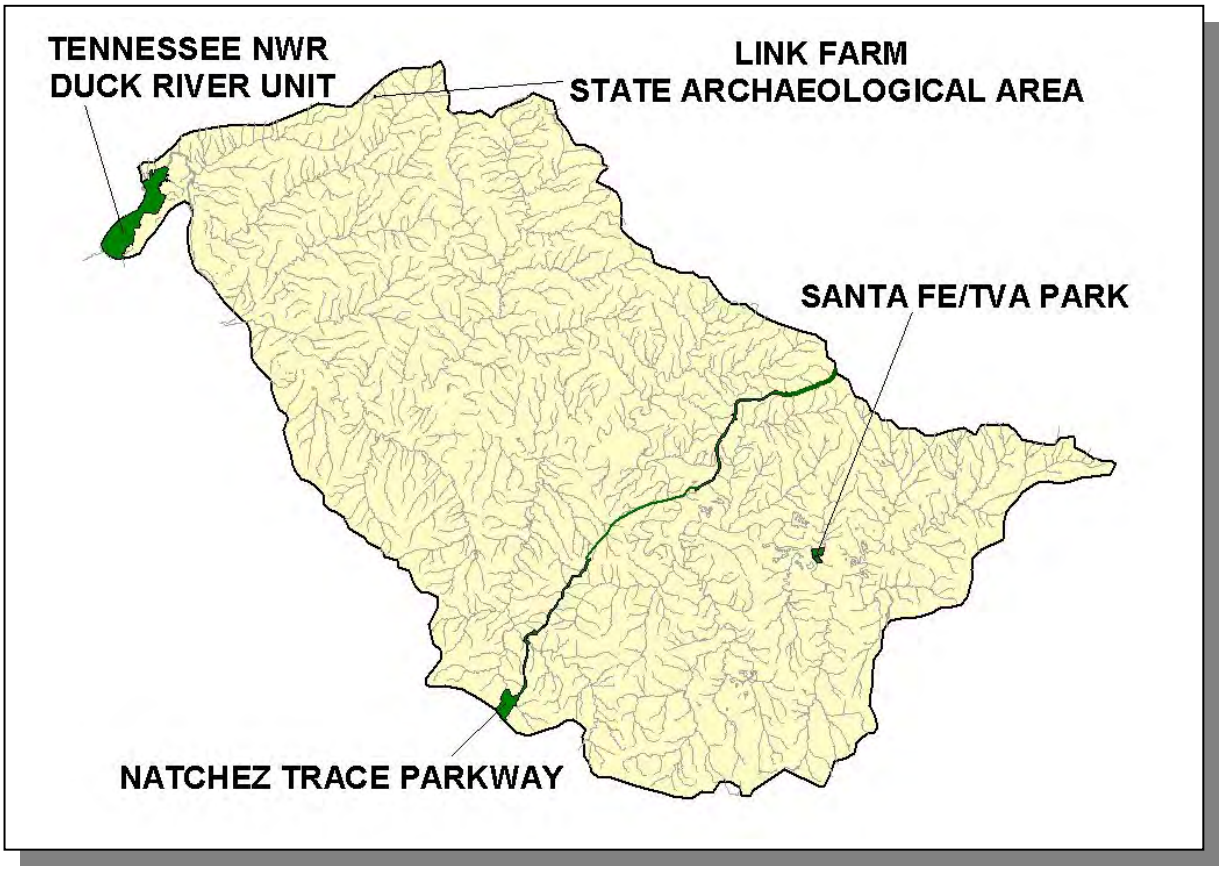


Figure 2-13. Locations of State- and Federally-Managed Lands in the Lower Duck River Watershed.

2.7.C. Wildlife Management Area. The Tennessee Wildlife Resources Agency manages three wildlife management areas in the Lower Duck River Watershed.

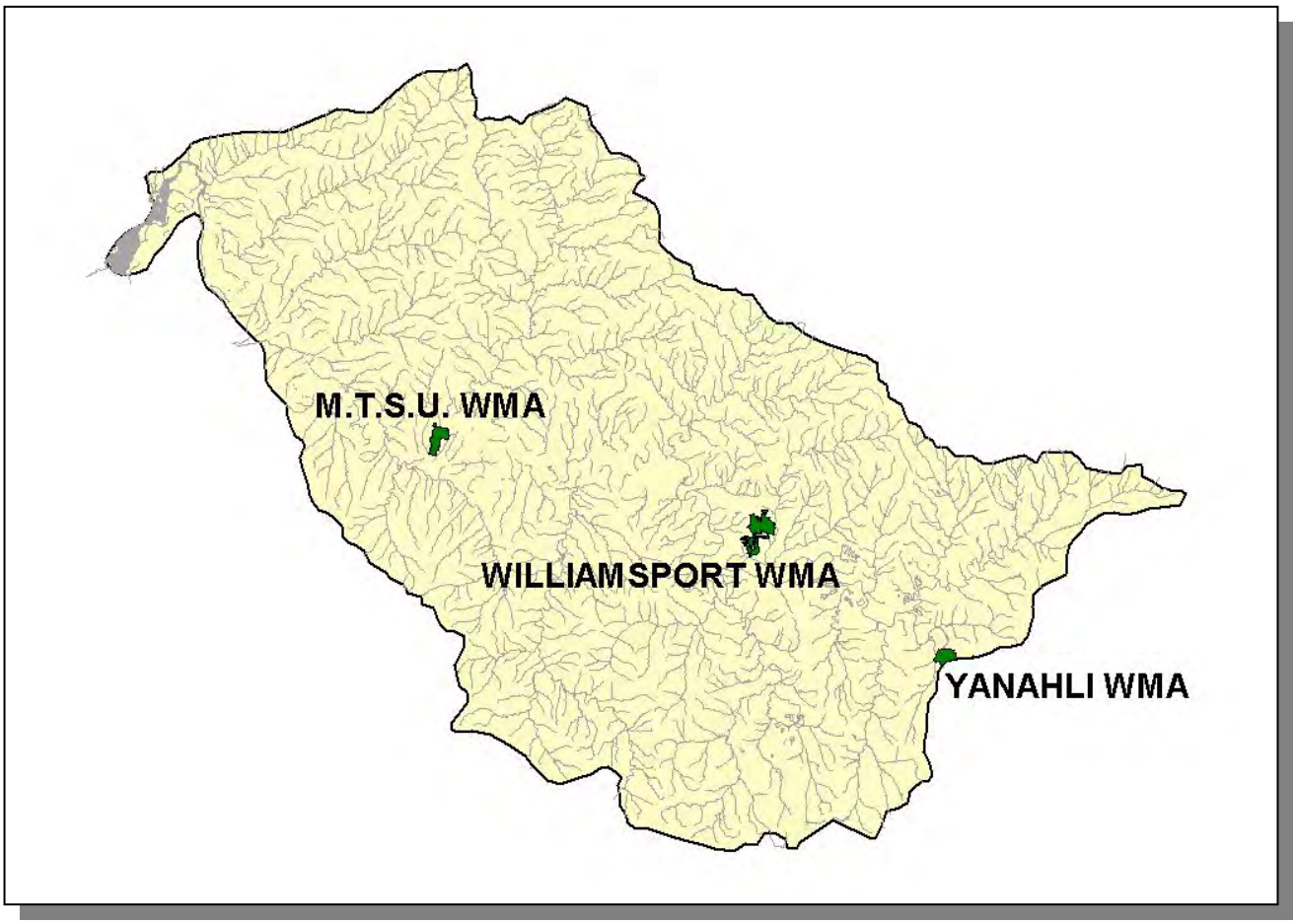


Figure 2-14. TWRA Manages Wildlife Management Areas in the Lower Duck River Watershed.

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
Aenon Creek	3				Hampshire Creek		3	
Bear Creek	2,3				Hurricane Creek	3	3	1
Beaver Creek	2				Indian Creek	3		
Beaverdam Creek	2	2	2,3		Isbell Creek	3		
Big Bigby Creek	2	2	3		Knob Creek	3		
Big Spring Creek	2				Leipers Creek	2	3	
Big Swan Creek	2	1,2	2		Lick Creek	2		2
Blue Buck Creek	3				Little Bigby Creek	3		2
Blue Creek	3	2			Little Swan Creek	3		1
Bluewater Branch Beaver Dam Creek	2				Mill Creek	2		1
Brushy Fork Creek	4				Piney Branch Little Swan Creek	3		
Carters Creek	3				Piney River	1,2,3	2	2,3
Catheys Creek	3				Quality Creek	3		
Coon Creek	3				Rutherford Creek	3	3	2
Dry Creek			2		Scotts Creek	2		
Duck River	2,3	2	2,3		Snow Creek	2		
East Fork Greenlick Creek	3				Sugar Creek	2,3	3	
East Piney River	2				Sulphur Fork Tumbling Creek	2	2	1
Garner Creek	2				Turkey Creek	2		
Gin Branch Greenlick Creek	3				Wades Branch Beaverdam Creek	3		
Greenlick Creek	3				West Fork Bigby Creek	3		

Table 2-5. Stream Scoring from the Tennessee Rivers Assessment Project in the Lower 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 LOWER 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 Lower Duck River Watershed, summarizes data collection and assessment results, and describes impaired waters.

3.2. DATA COLLECTION. Comprehensive water quality monitoring in the Lower 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.

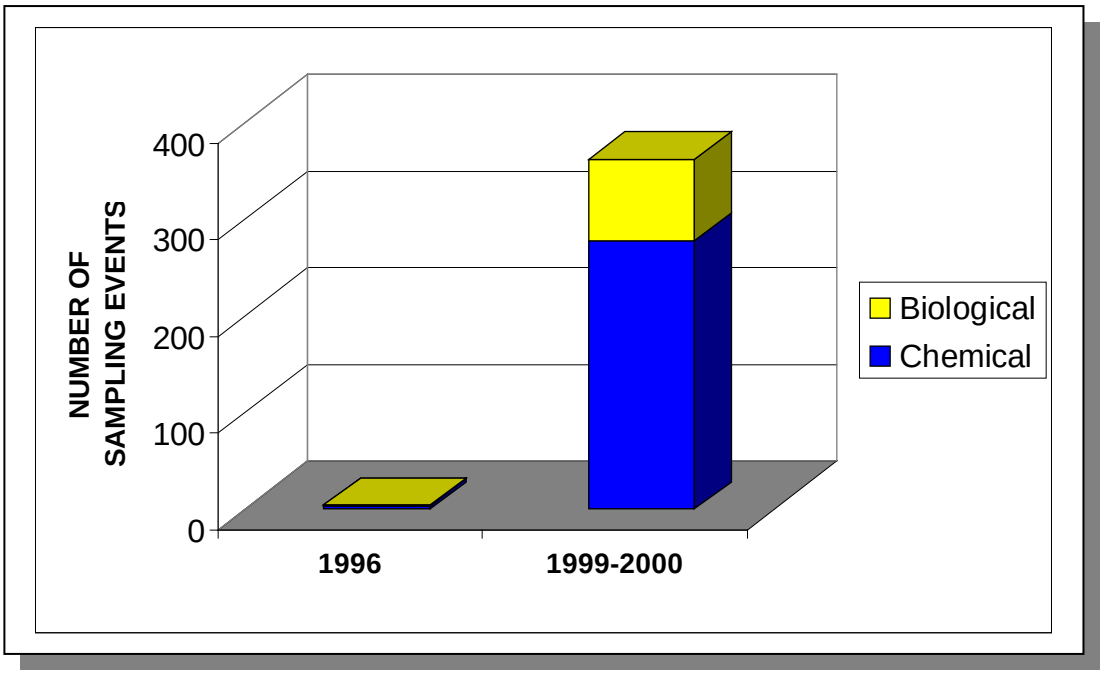


Figure 3-1. Number of Sampling Events Using the Traditional Approach (1996) and Watershed Approach (1999-2000) in the Lower Duck River Watershed.

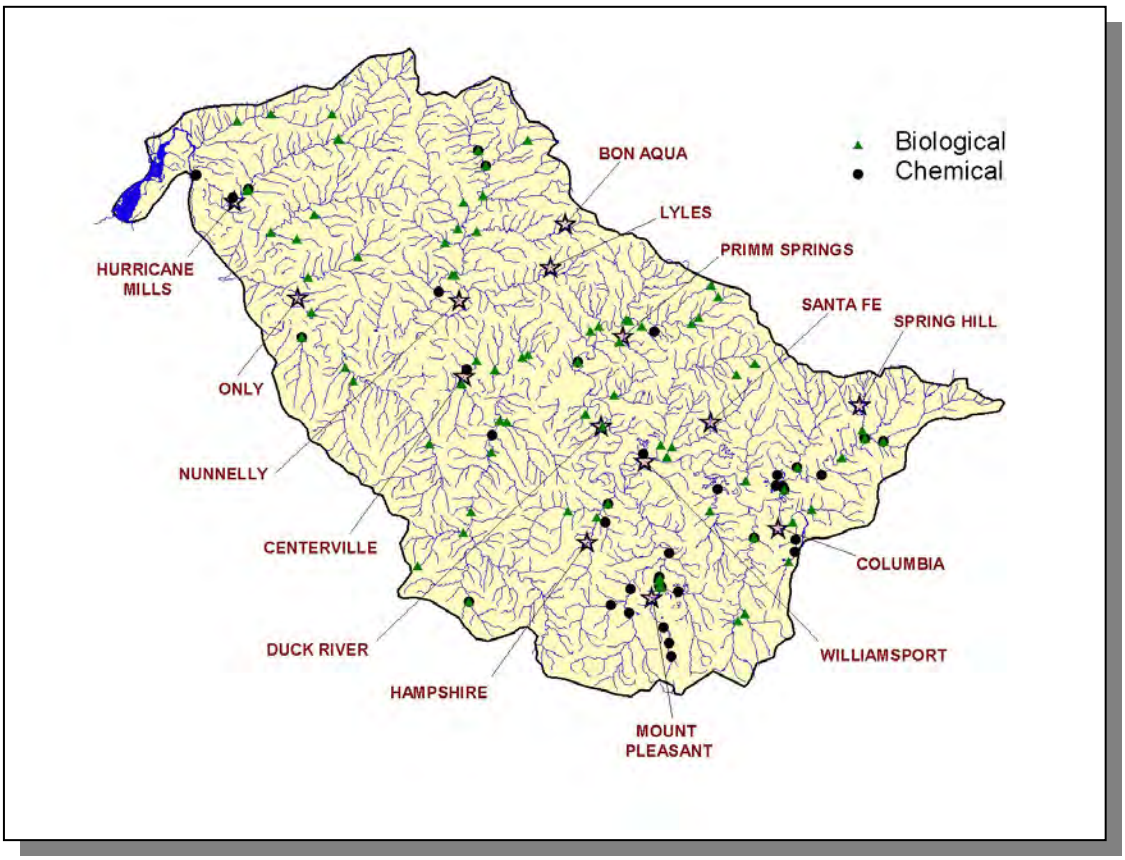


Figure 3-2. Location of Monitoring Sites in the Lower Duck River Watershed. *Locations of Bon Aqua, Centerville, Columbia, Duck River, Hampshire, Hurricane Mills, Lyles, Mount Pleasant, Nunnelly, Only, Primm Springs, Santa Fe, Spring Hill, and Williamsport are shown for reference.*

	1996	1999-2000
Biological	1	84
Chemical	3	278
Total	**4**	**362**

Table 3-1. Number of Sampling Events in the Lower 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 staff (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 Lower 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 Lower Duck River Watershed lies within a single Level III ecoregion (Interior Plateau) and contains 3 subecoregions (Level IV):

- Western Highland Rim (71f)
- 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.

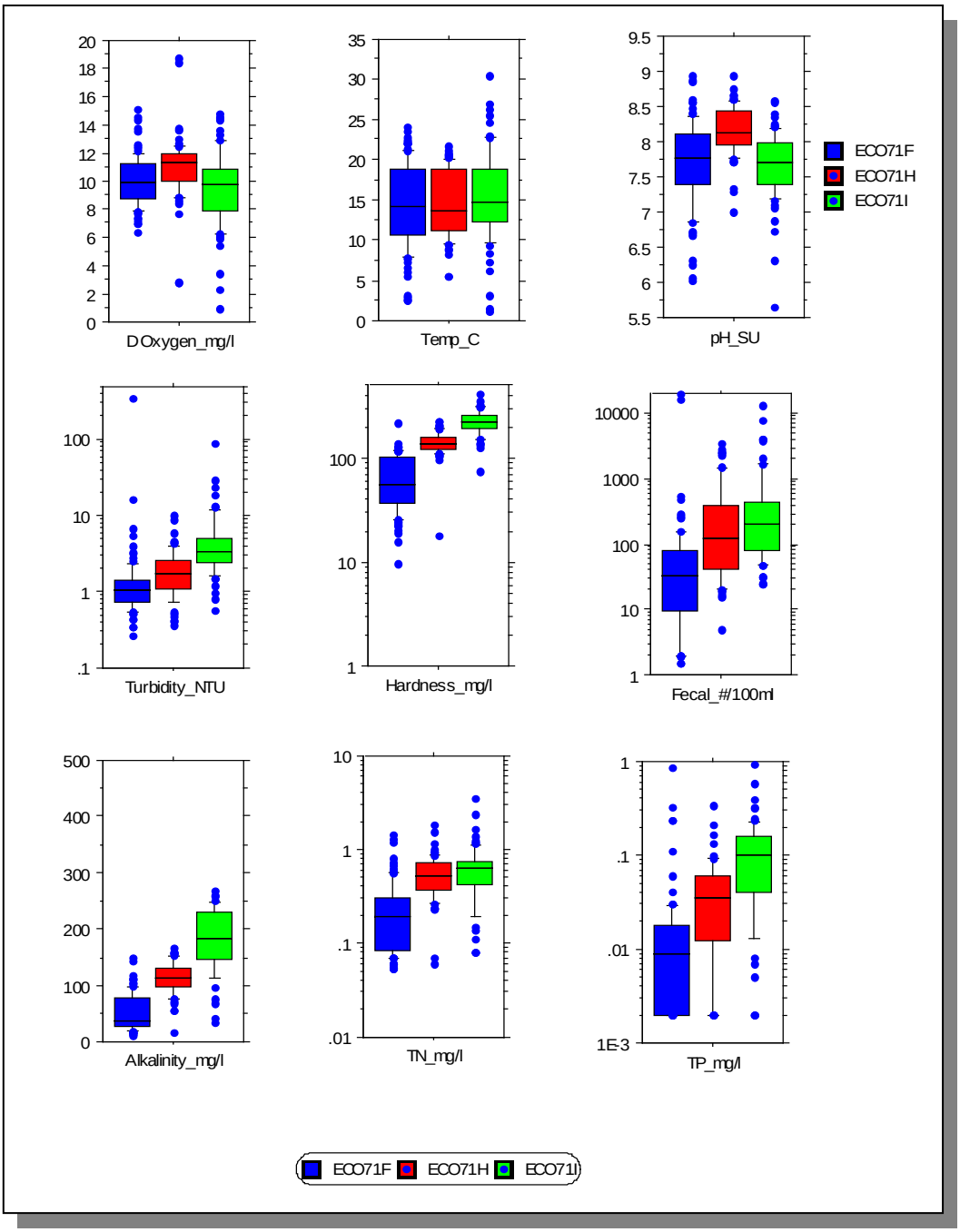


Figure 3-3. Select Chemical Data Collected in Lower Duck River Watershed Ecoregion Sites. *Boxes and bars illustrate 10th, 25th, median, 75th, and 90th percentiles. Extreme values are also shown as dots. Fecal, fecal coliform bacteria; TN, Total Nitrogen; TP, Total Phosphorus.*

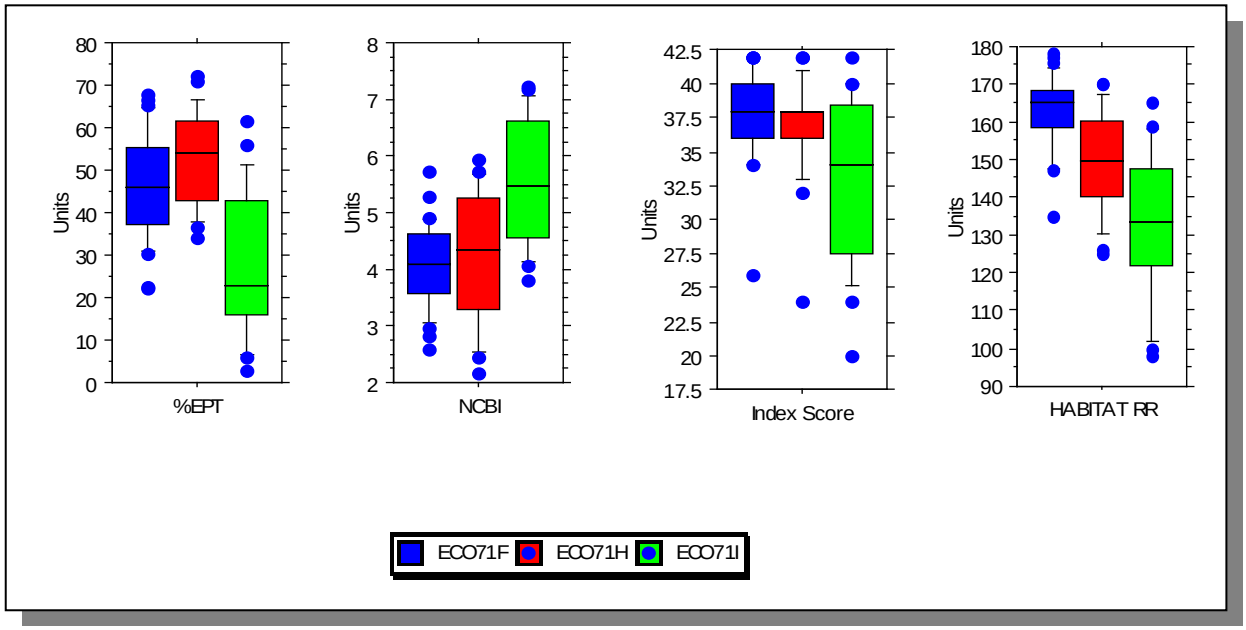


Figure 3-4. Benthic Macroinvertebrate and Habitat Scores for Lower Duck River Watershed Ecoregion Sites. *Boxes and bars illustrate 10th, 25th, median, 75th, and 90th percentiles. Extreme values are also shown as dots. NCBI, North Carolina Biotic Index. Index Score and Habitat Riffle/Run scoring system 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.

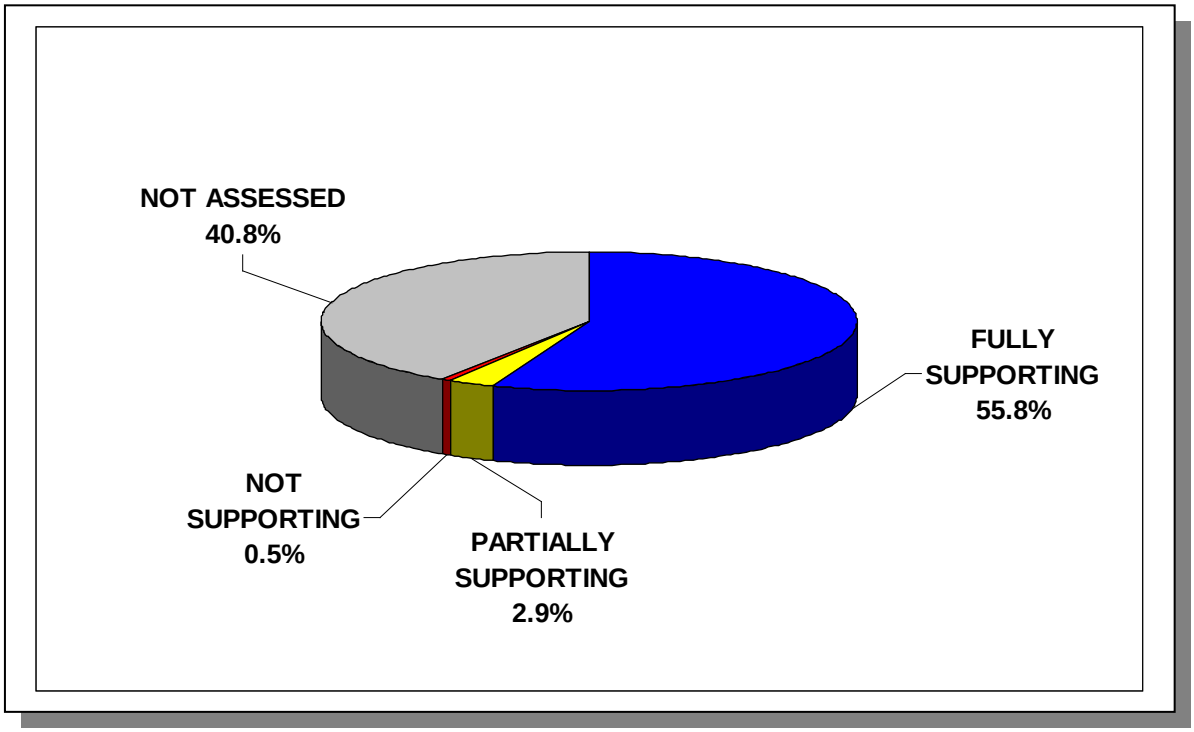


Figure 3-5. Water Quality Assessment of Streams and Rivers in the Lower Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment of 2,461.8 miles in the watershed. More information is provided in Appendix III.*

3.3.A. Assessment Summary.

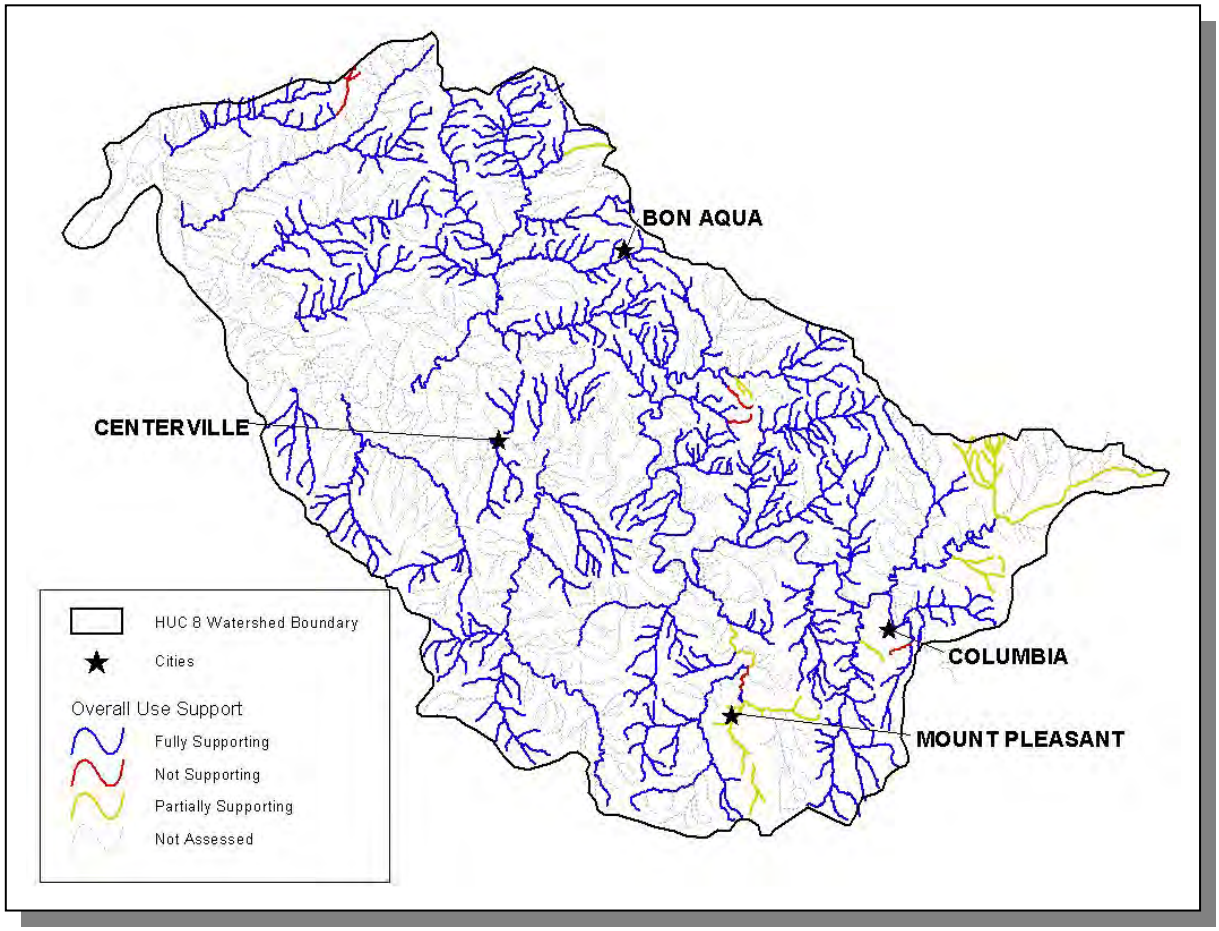


Figure 3-6a. Overall Use Support Attainment in the Lower Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Locations of Bon Aqua, Centerville, Columbia, and Mount Pleasant are shown for reference. More information is provided in Appendix III.*

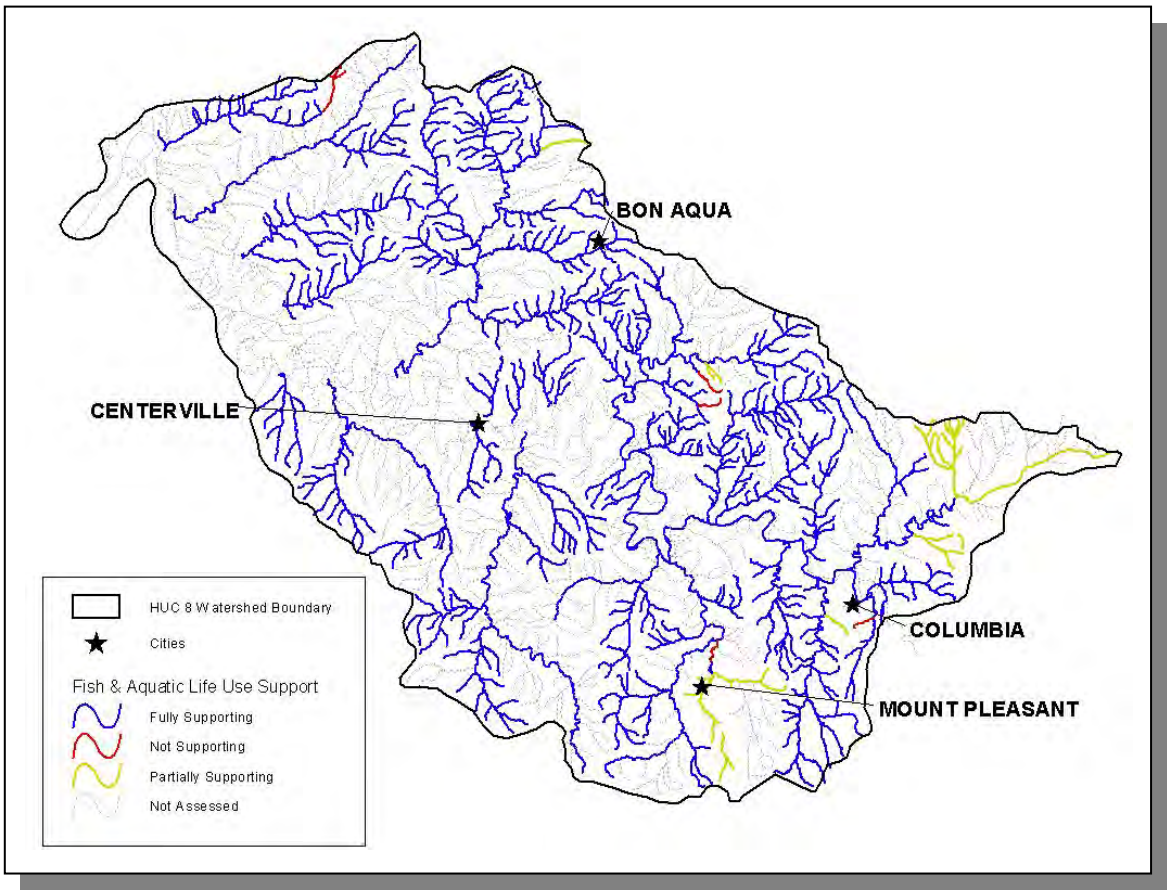


Figure 3-6b. Fish and Aquatic Life Use Support Attainment in the Lower Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Locations of Bon Aqua, Centerville, Columbia, and Mount Pleasant are shown for reference. More information is provided in Appendix III.*

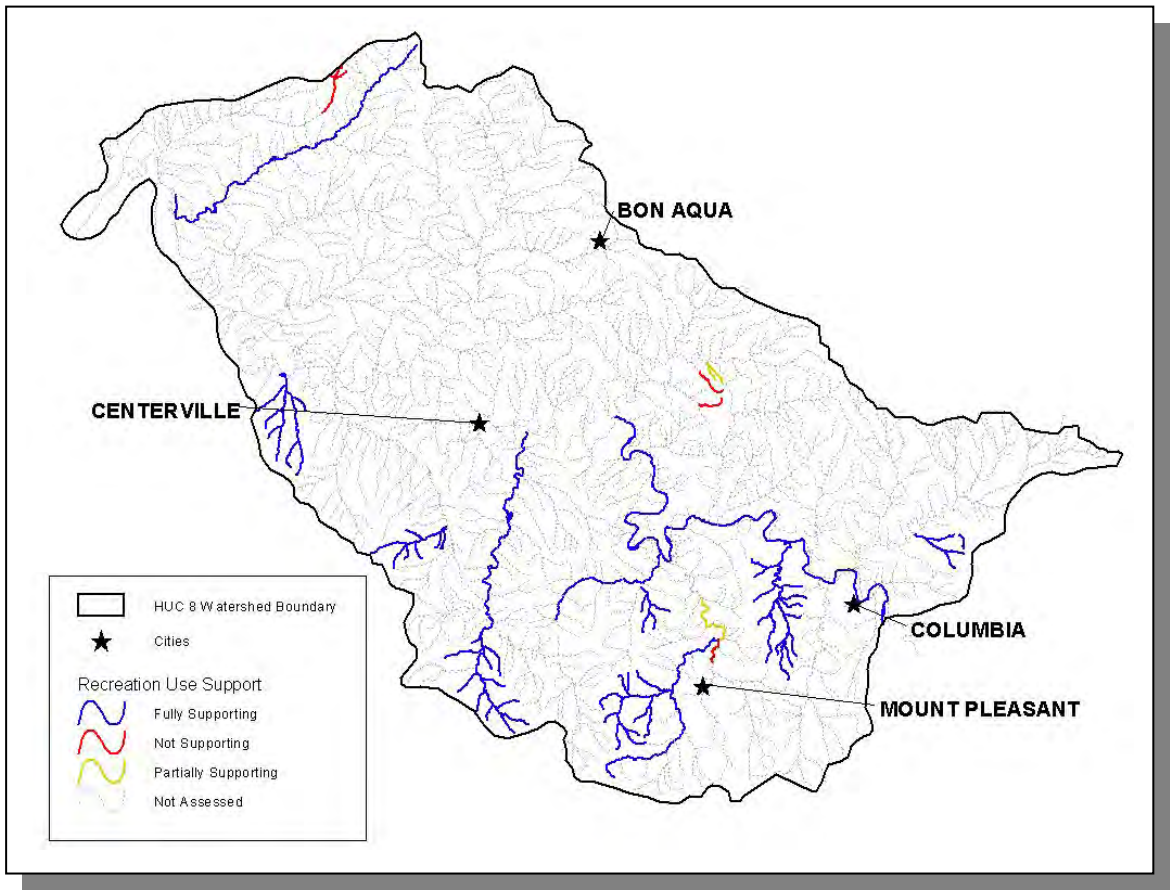


Figure 3-6c. Recreation Use Support Attainment in the Lower Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Locations of Bon Aqua, Centerville, Columbia, and Mount Pleasant are shown for reference. More information is provided in Appendix III.*

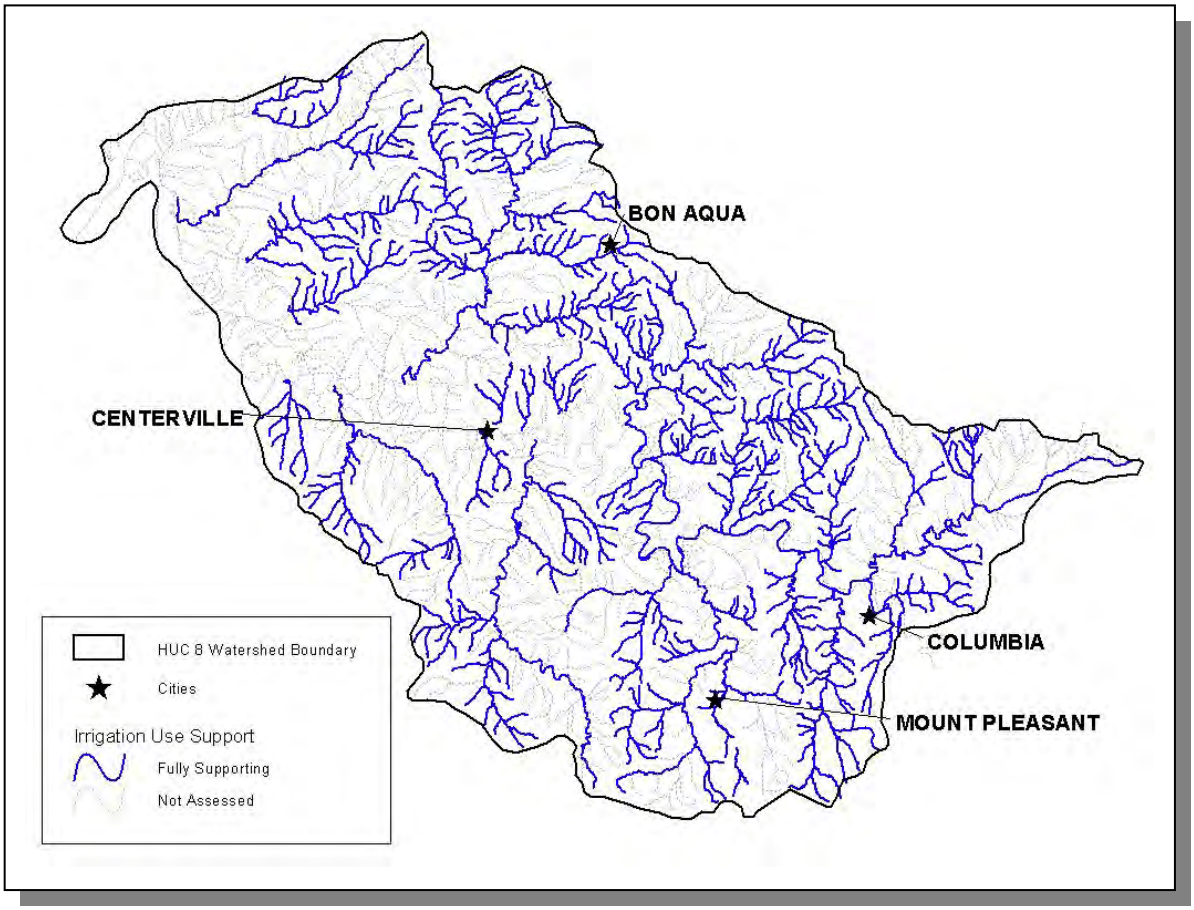


Figure 3-6d. Irrigation Use Support Attainment in the Lower Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Locations of Bon Aqua, Centerville, Columbia, and Mount Pleasant are shown for reference. More information is provided in Appendix III.*

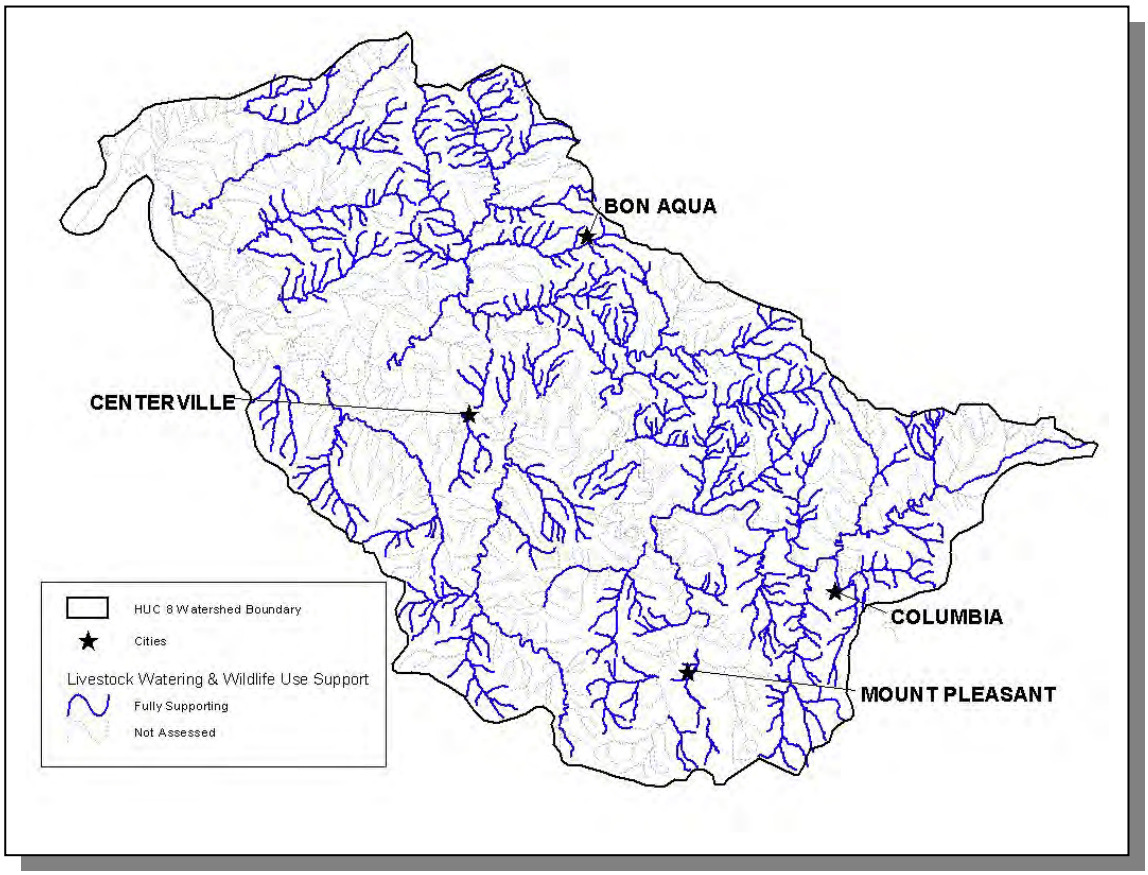


Figure 3-6e. Livestock Watering and Wildlife Use Support Attainment in the Lower Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Locations of Bon Aqua, Centerville, Columbia, and Mount Pleasant are shown for reference. More information is provided in Appendix III.*

3.3.B. Use Impairment Summary.

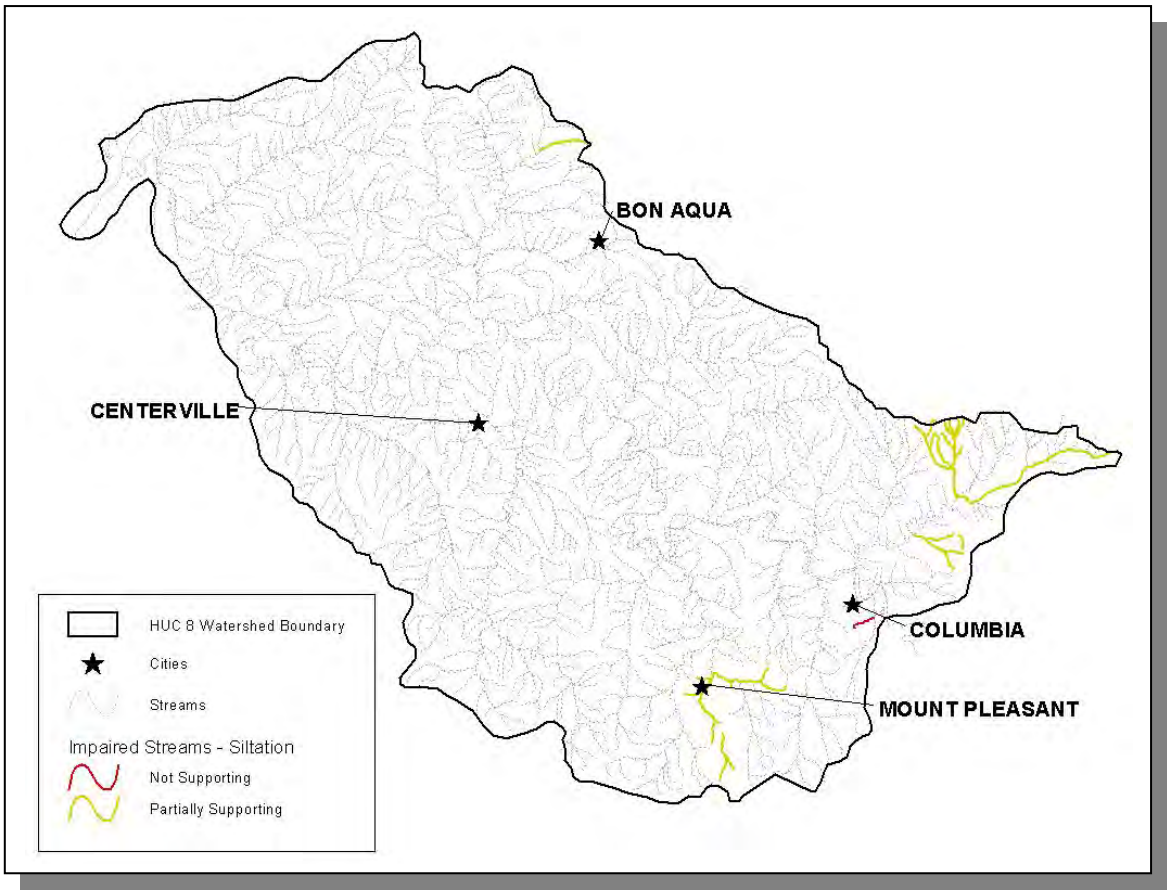


Figure 3-7a. Impaired Streams Due to Siltation in the Lower Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Locations of Bon Aqua, Centerville, Columbia, and Mount Pleasant are shown for reference. More information is provided in Appendix III.*

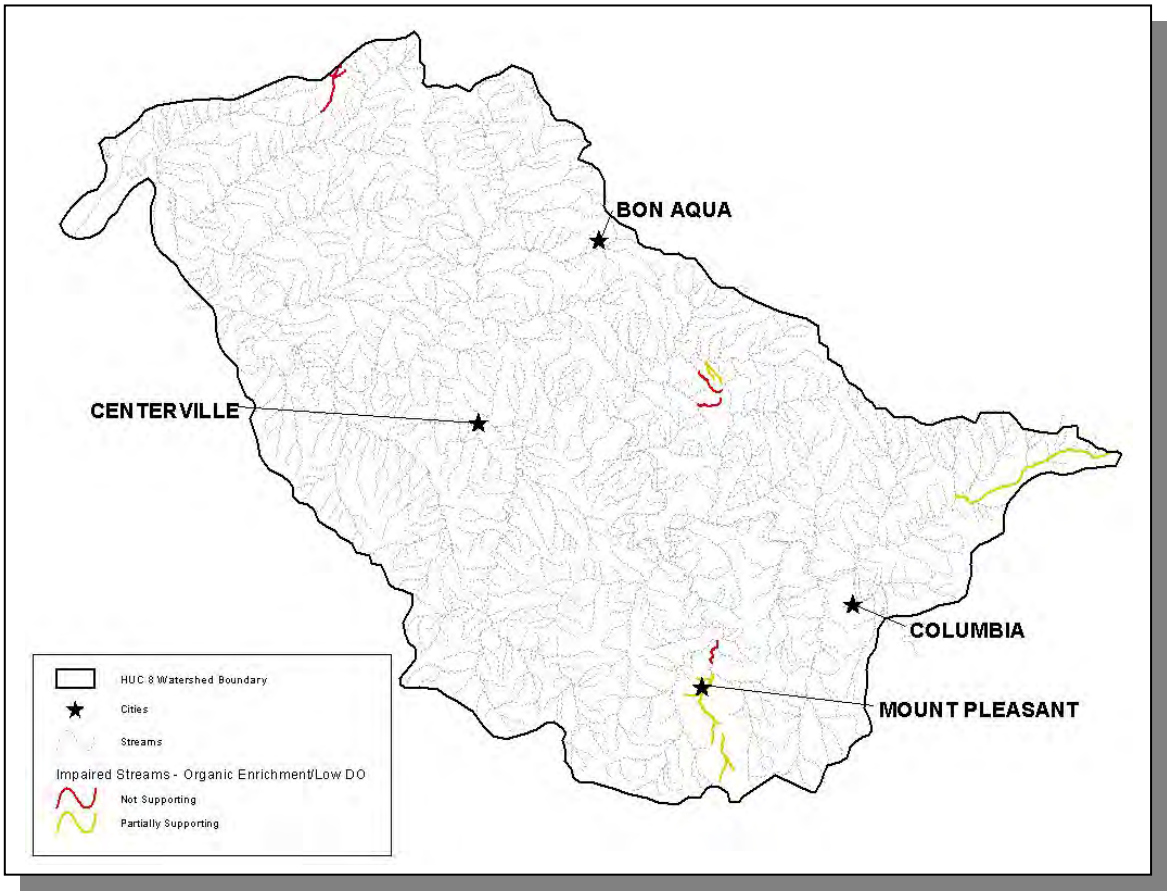


Figure 3-7b. Impaired Streams Due to Organic Enrichment or Low Dissolved Oxygen in the Lower Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Locations of Bon Aqua, Centerville, Columbia, and Mount Pleasant are shown for reference. More information is provided in Appendix III.*

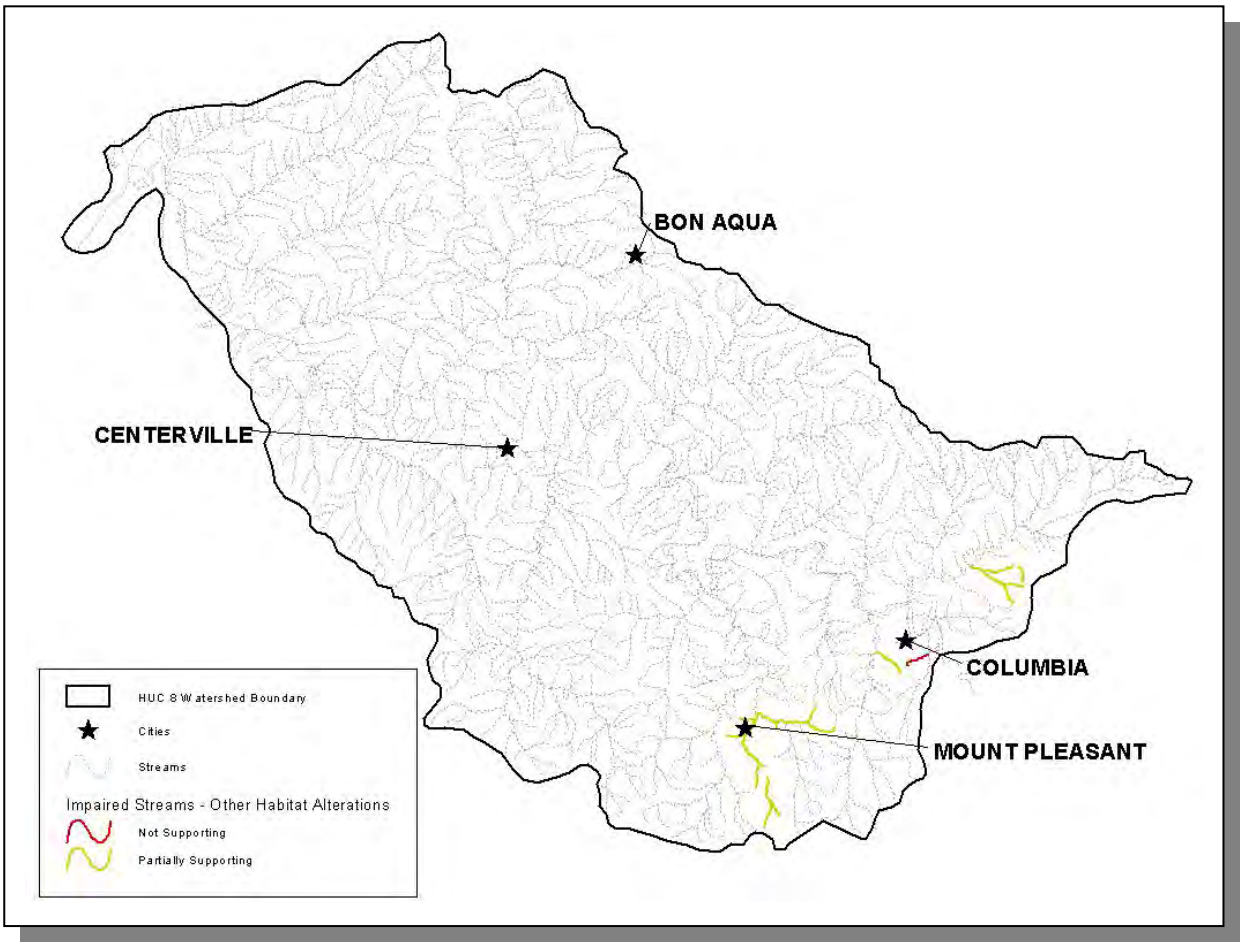


Figure 3-7c. Impaired Streams Due to Habitat Alterations in the Lower Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Locations of Bon Aqua, Centerville, Columbia, and Mount Pleasant are shown for reference. More information is provided in Appendix III.*

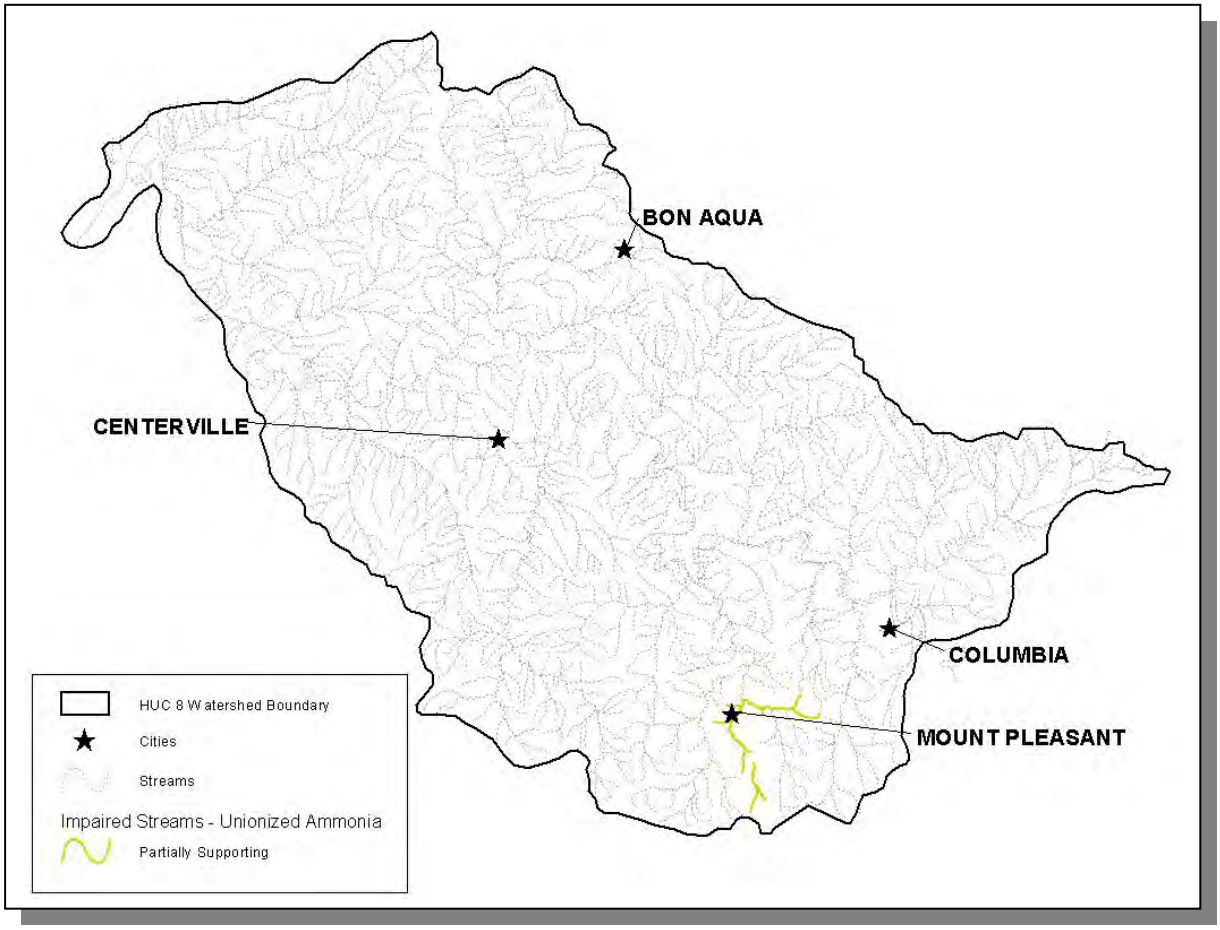


Figure 3-7d. Impaired Streams Due to Unionized Ammonia in the Lower Duck River Watershed. *Assessment data are based on the 2002 Water Quality Assessment. Locations of Bon Aqua, Centerville, Columbia, and Mount Pleasant are shown for reference. More information is provided in Appendix III.*

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 LOWER 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 Lower Duck River Watershed (HUC 06040003) has been delineated into nine 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.

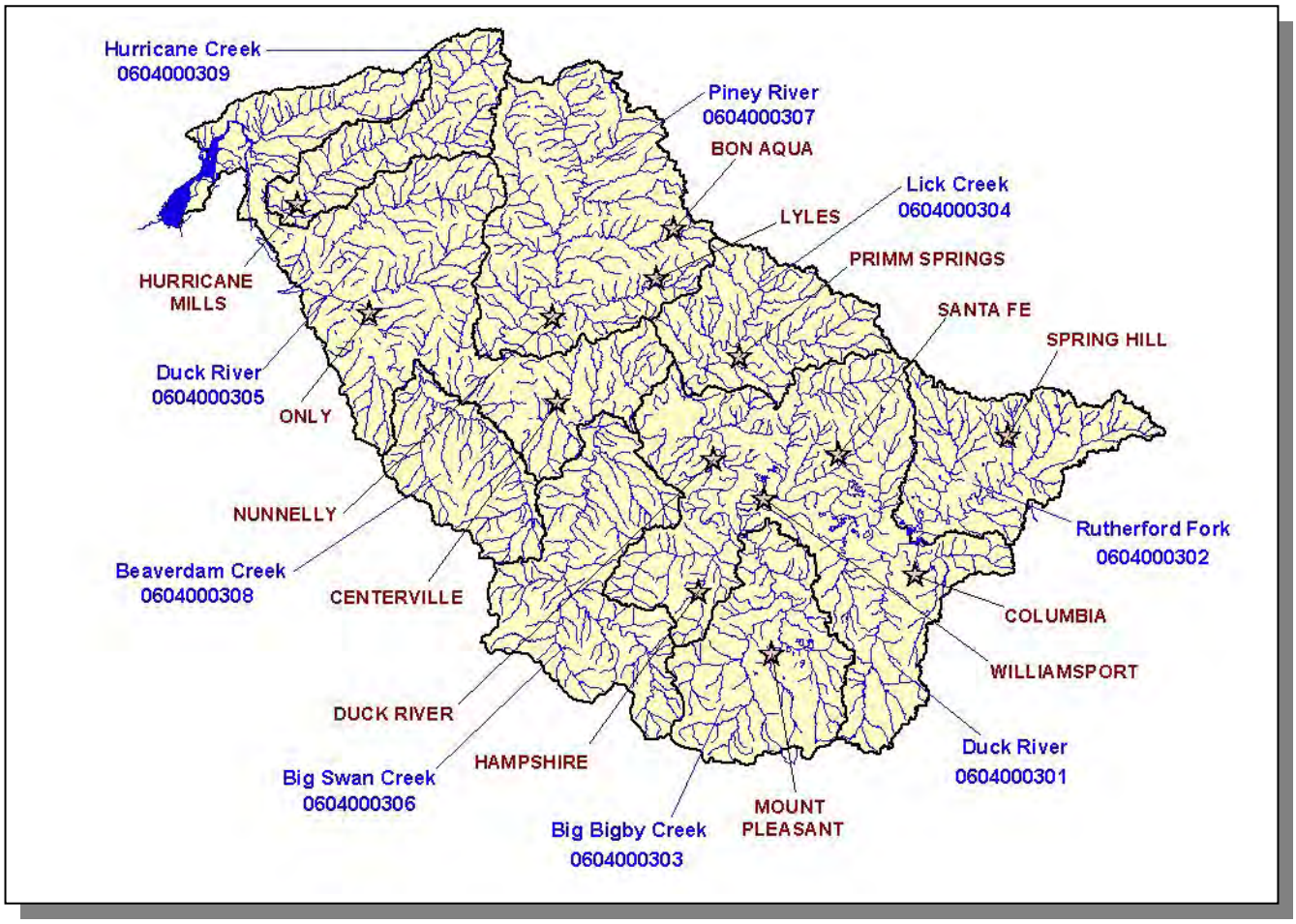


Figure 4-1. The Lower Duck River Watershed is Composed of Nine USGS-Delineated Subwatersheds (10-Digit Subwatersheds). *Locations of Bon Aqua, Centerville, Columbia, Duck River, Hampshire, Hurricane Mills, Lyles, Mount Pleasant, Nunnelly, Only, Primm Springs, Santa Fe, Spring Hill and Williamsport are 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 Lower Duck River Watershed.

HUC-10	HUC-12	
0604000301	060400030101 (Duck River)	060400030105 (Snow Creek)
	060400030102 (Little Bigby Creek)	060400030106 (Leipers Creek)
	060400030103 (Duck River)	060400030107 (Duck River)
	060400030104 (Knob Creek)	060400030108 (Catheys Creek)
0604000302	060400030201 (Upper Rutherford Fork)	060400030203 (Carters Creek)
	060400030202 (Lower Rutherford Fork)	
0604000303	060400030301 (Upper Big Bigby Creek)	060400030303 (Sugar Creek)
	060400030302 (Lower Big Bigby Creek)	
0604000304	060400030401 (Upper Lick Creek)	060400030402 (Lower Lick Creek)
0604000305	060400030501 (Duck River)	060400030505 (Duck River)
	060400030502 (Duck River)	060400030506 (Tumbling Creek)
	060400030503 (Duck River)	060400030507 (Blue Creek)
	060400030504 (Sugar Creek)	
0604000306	060400030601 (Upper Big Swan Creek)	060400030603 (Lower Big Swan Creek)
	060400030602 (Middle Big Swan Creek)	
0604000307	060400030701 (Upper Piney River)	060400030704 (Middle Piney River)
	060400030702 (Lower Piney River)	060400030705 (Mill Creek)
	060400030703 (Garners Creek)	
0604000308	060400030801 (Beaverdam Creek)	060400030802 (Sulpher Fork Creek)
0604000309	060400030901 (Upper Hurricane Creek)	060400030902 (Lower Hurricane 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. 0604000301 (Duck River).

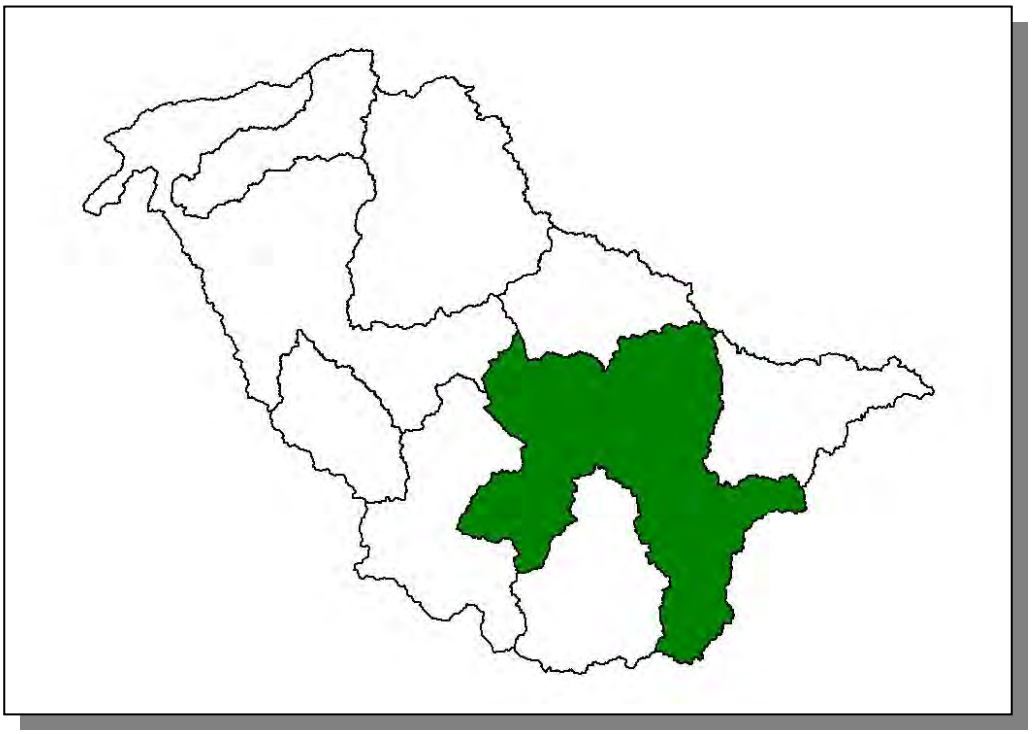


Figure 4-2. Location of Subwatershed 0604000301. *All Lower Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.A.i. General Description.

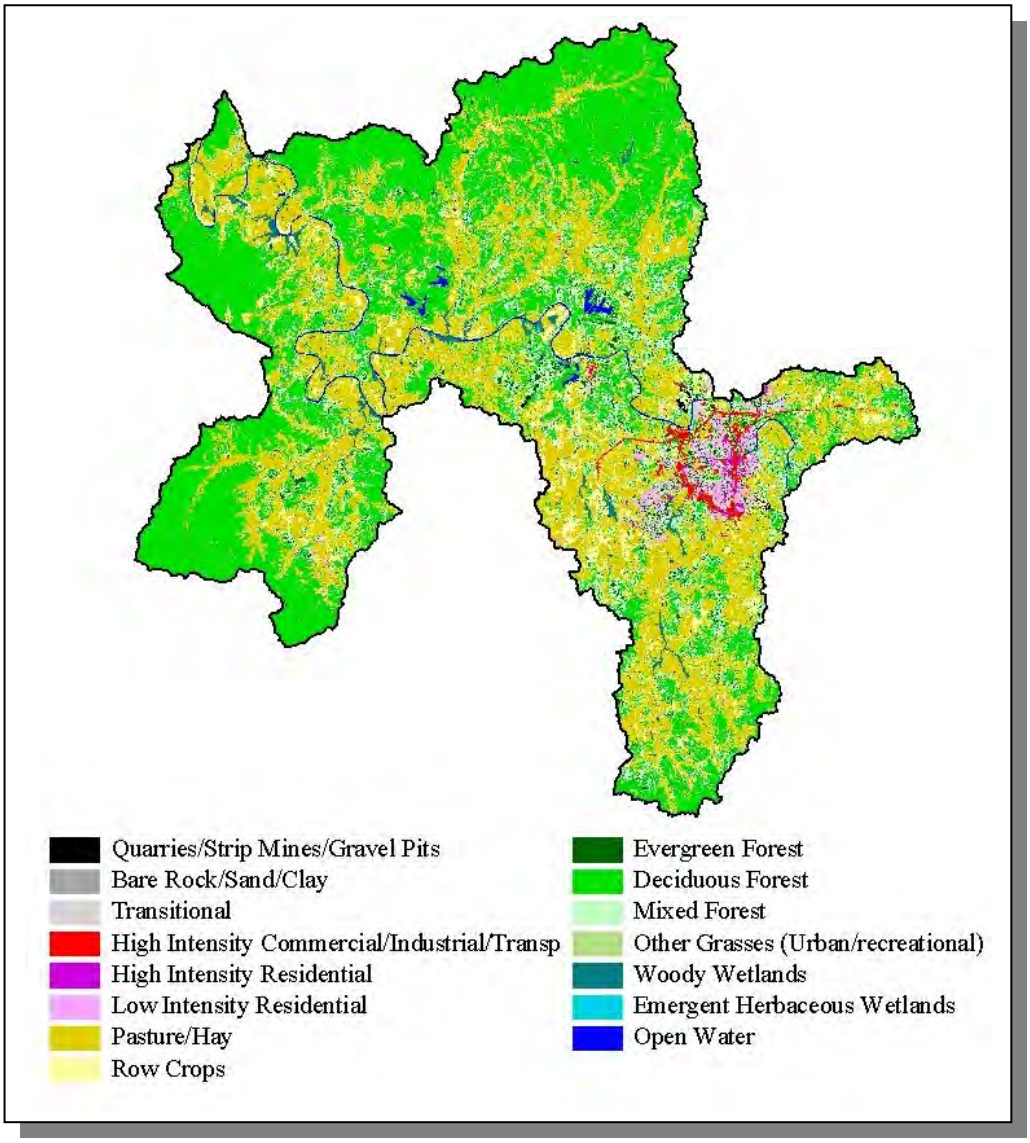


Figure 4-3. Illustration of Land Use Distribution in Subwatershed 0604000301.

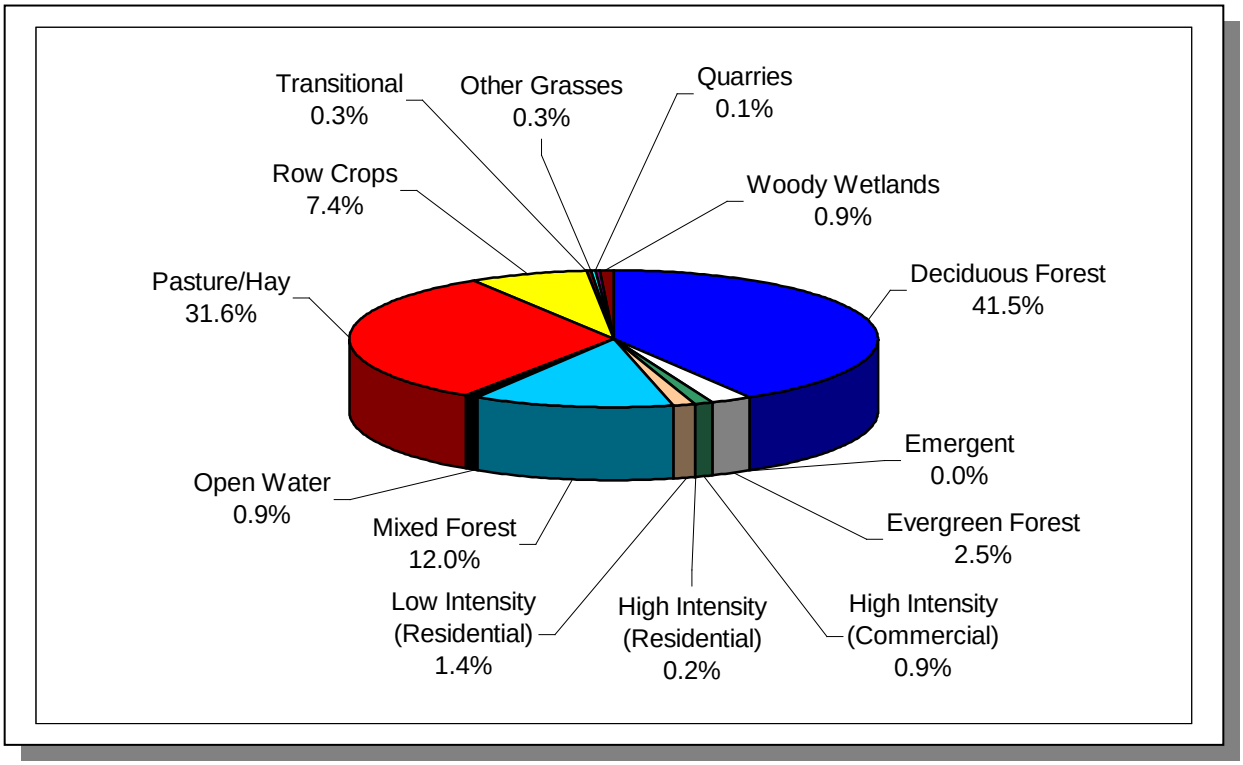


Figure 4-4. Land Use Distribution in Subwatershed 0604000301. *More information is provided in Appendix IV.*

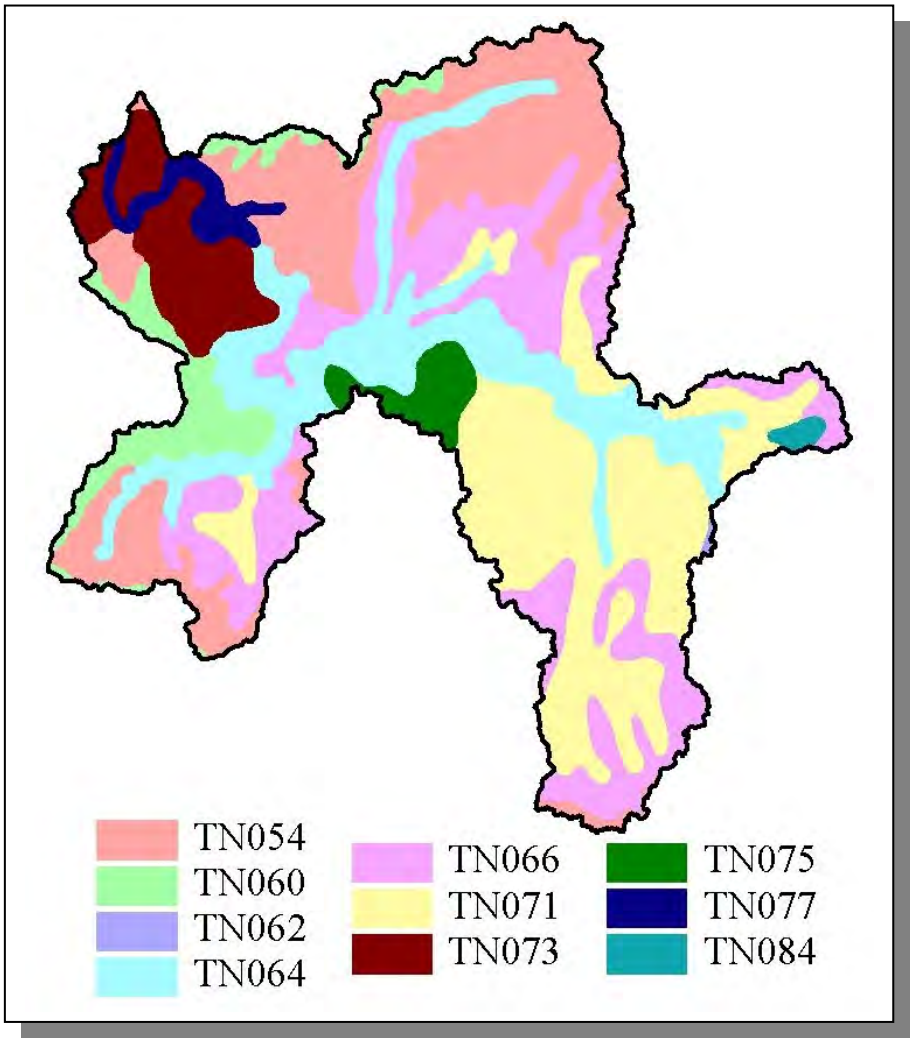


Figure 4-5. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000301.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN054	0.00	C	3.04	4.84	Loam	0.32
TN060	5.00	B	1.30	5.32	Silty Loam	0.39
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
TN073	0.00	B	2.97	5.21	Loam	0.34
TN075	0.00	B	1.33	5.24	Loam	0.31
TN077	4.00	C	2.16	5.03	Loam	0.34
TN084	0.00	C	1.80	4.99	Silty Loam	0.28

Table 4-2. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000301. *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)
Giles	25,741	28,515	29,447	0.30	76	84	87	14.5
Hickman	16,754	19,926	22,295	8.12	1,360	1,617	1,810	33.1
Lewis	9,247	10,789	11,367	6.33	585	683	719	22.9
Maury	54,812	68,268	69,498	41.98	23,012	28,661	29,177	26.8
Williamson	81,021	111,453	126,638	0.58	467	642	730	56.3
Totals	**187,575**	**238,951**	**259,245**		**25,500**	**31,687**	**32,523**	**27.5**

Table 4-3. Population Estimates in Subwatershed 0604000301

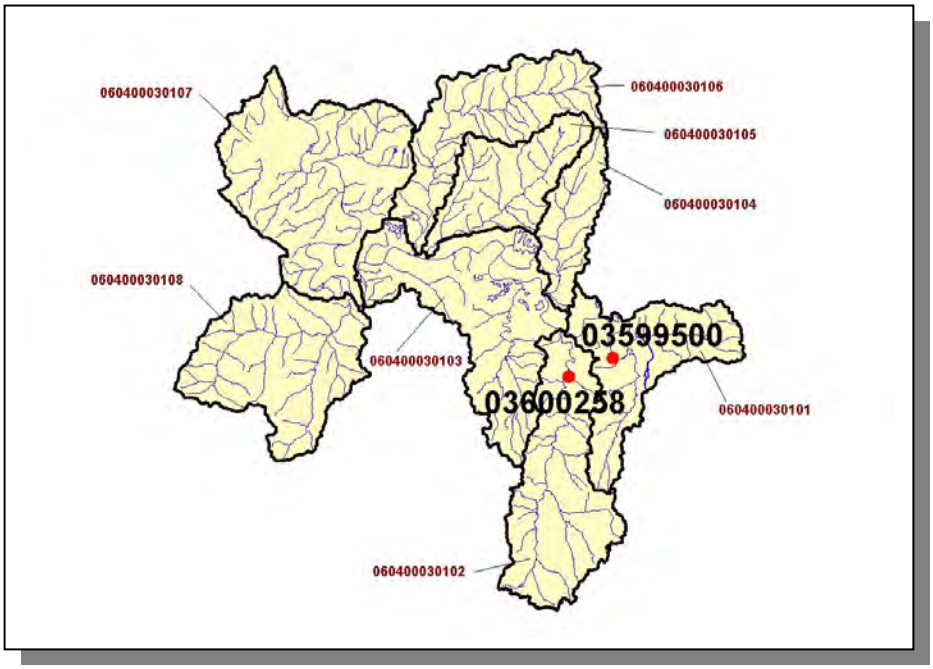


Figure 4-6. Location of Historical Streamflow Data Collection Sites in Subwatershed 0604000301. *Subwatershed 060400030101, 060400030102, 060400030103, 060400030104, 060400030105, 060400030106, 060400030107 and 060400030108 boundaries are shown for reference. More information is provided in Appendix IV.*

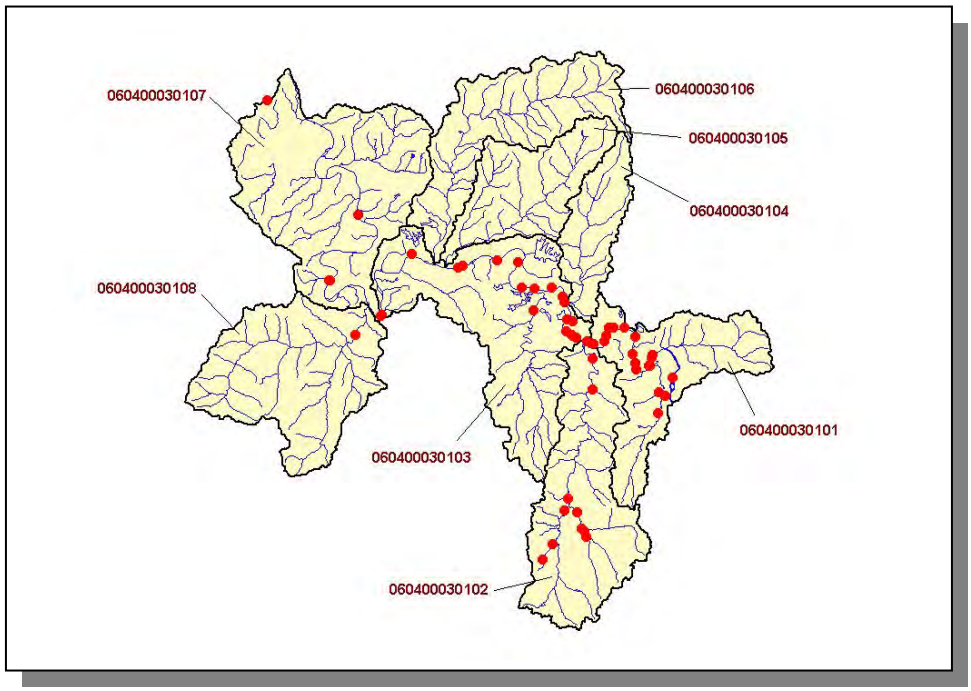


Figure 4-7. Location of STORET Monitoring Sites in Subwatershed 0604000301. *Subwatershed 060400030101, 060400030102, 060400030103, 060400030104, 060400030105, 060400030106, 060400030107 and 060400030108 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.A.ii Point Source Contributions.

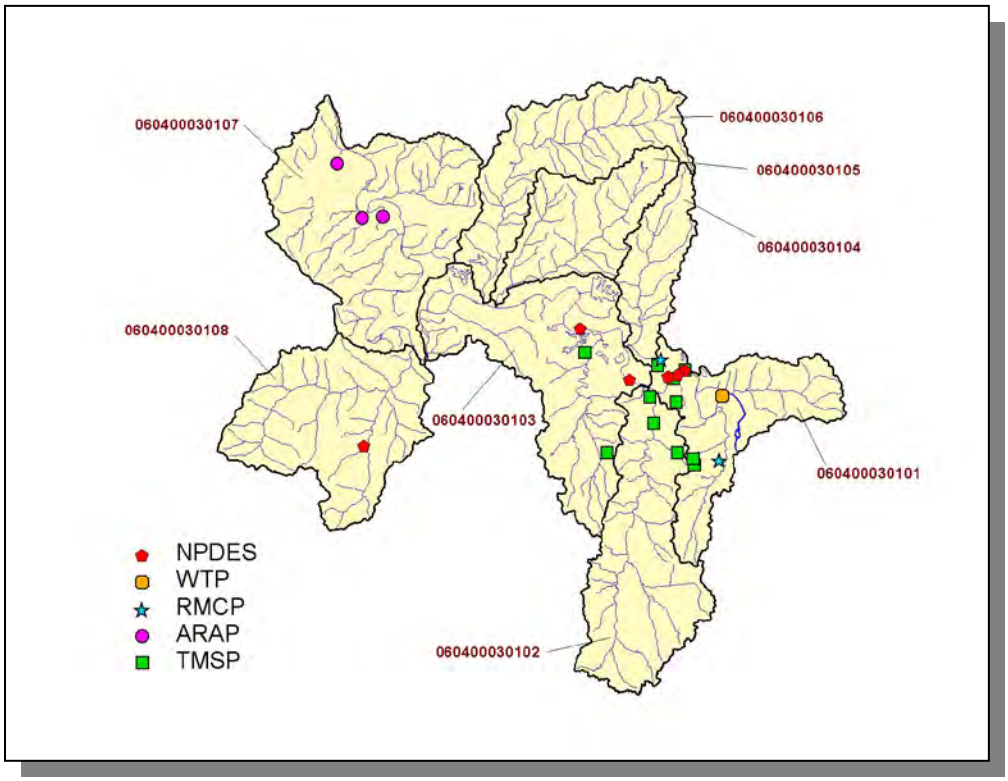


Figure 4-8. Location of Active Point Source Facilities in Subwatershed 0604000301. *Subwatershed 060400030101, 060400030102, 060400030103, 060400030104, 060400030105, 060400030106, 060400030107, and 060400030108 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

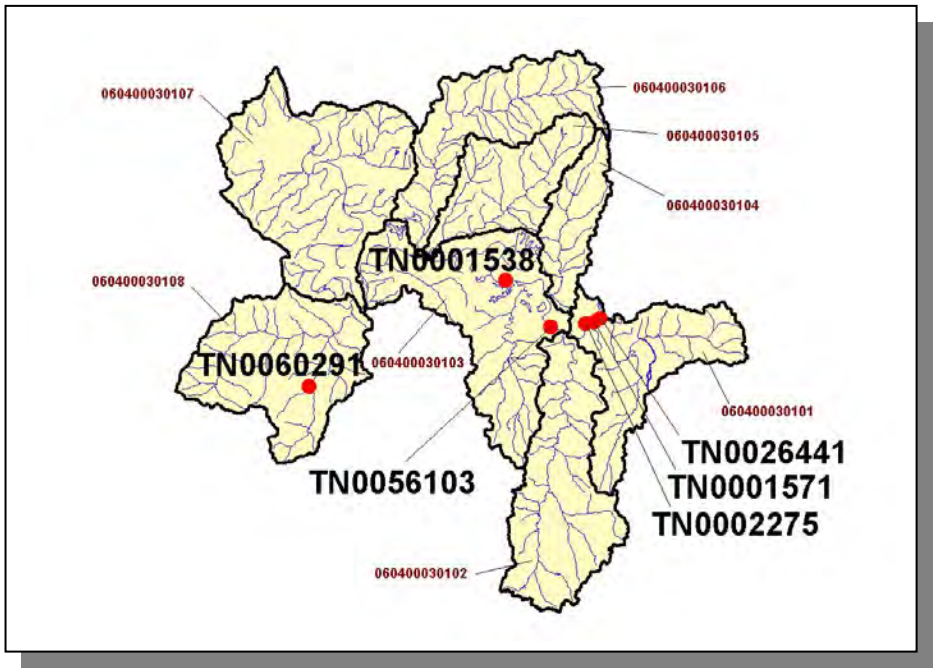


Figure 4-9. Location of NPDES Facilities in Subwatershed 0604000301. *Subwatershed 060400030101, 060400030102, 060400030103, 060400030104, 060400030105, 060400030106, 060400030107, and 060400030108 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-10. Location of Water Treatment Plants in Subwatershed 0604000301. *Subwatershed 060400030101, 060400030102, 060400030103, 060400030104, 060400030105, 060400030106, 060400030107, and 060400030108 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-11. Location of Ready Mix Concrete Plants in Subwatershed 0604000301. *Subwatershed 060400030101, 060400030102, 060400030103, 060400030104, 060400030105, 060400030106, 060400030107, and 060400030108 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

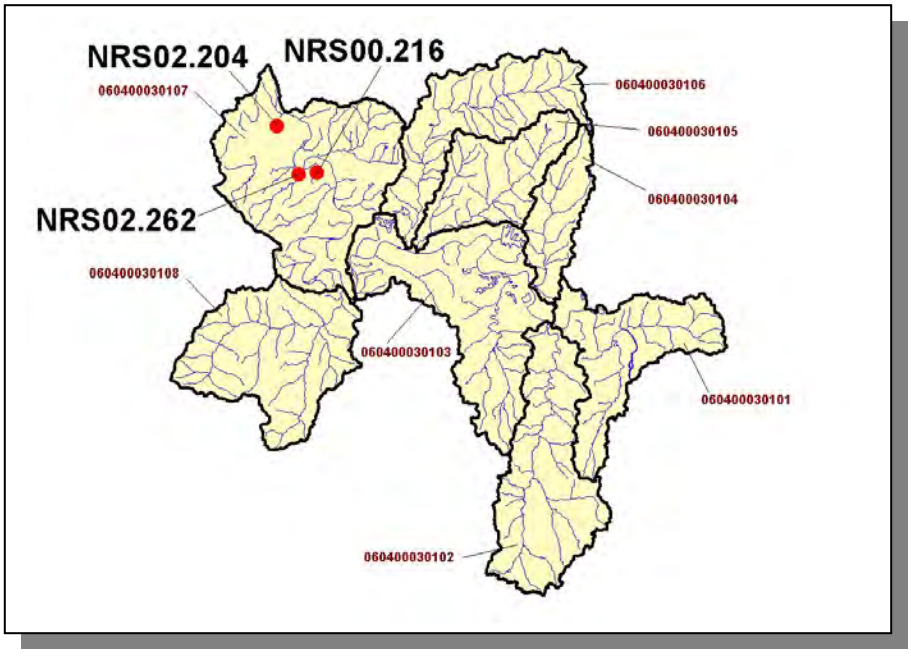


Figure 4-12. Location of ARAP Sites (Individual Permits) in Subwatershed 0604000301. *Subwatershed 060400030101, 060400030102, 060400030103, 060400030104, 060400030105, 060400030106, 060400030107, and 060400030108 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

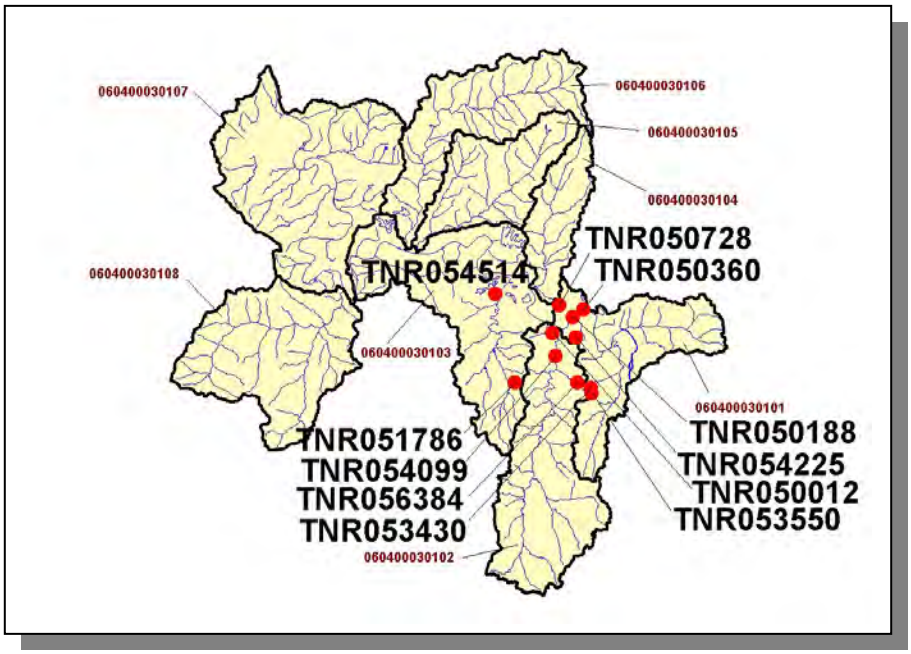


Figure 4-13. Location of TMSP Facilities in Subwatershed 0604000301. *Subwatershed 060400030101, 060400030102, 060400030103, 060400030104, 060400030105, 060400030106, 060400030107, and 060400030108 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

4.2.A.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens (Layers)	Chickens (Broilers Sold)	Hogs	Sheep
15,679	31,683	1,254	43	<5	1,417	165

Table 4-4. Summary of Livestock Count Estimates in Subwatershed 0604000301. *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
Hickman	297.2	297.2	5.8	23.0
Lewis	158.00	158.0	4.0	10.2
Total	**627.0**	**627.0**	**13.1**	**44.6**

Table 4-5. Forest Acreage and Annual Removal Rates (1987-1994) in Subwatershed 0604000301.

CROPS	TONS/ACRE/YEAR
Legume (Pastureland)	0.66
Grass (Pastureland)	0.81
Grass (Hayland)	0.28
Legumes (Hayland)	1.05
Legumes, Grass (Hayland)	0.28
Grass, Forbs, Legumes (Mixed Pasture)	0.36
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	4.69
Soybeans (Row Crops)	7.57
Tobacco (Row Crops)	7.62
All Other Row Crops	11.39
Barley (Close-Grown Cropland)	1.08
Wheat (Close-Grown Cropland)	1.49
Summer Fallow (Other Cropland)	0.35
Other Cropland not Planted	4.20
Other Vegetable and Truck Crop	4.29
Conservation Reserve Program Lands	0.49
Non-Agricultural Land Use	0.00
Other Land in Farms	0.12
Farmsteads and Ranch Headquarters	0.39

Table 4-6. Annual Estimated Total Soil Loss in Subwatershed 0604000301.

4.2.B. 0604000302 (Rutherford Fork).

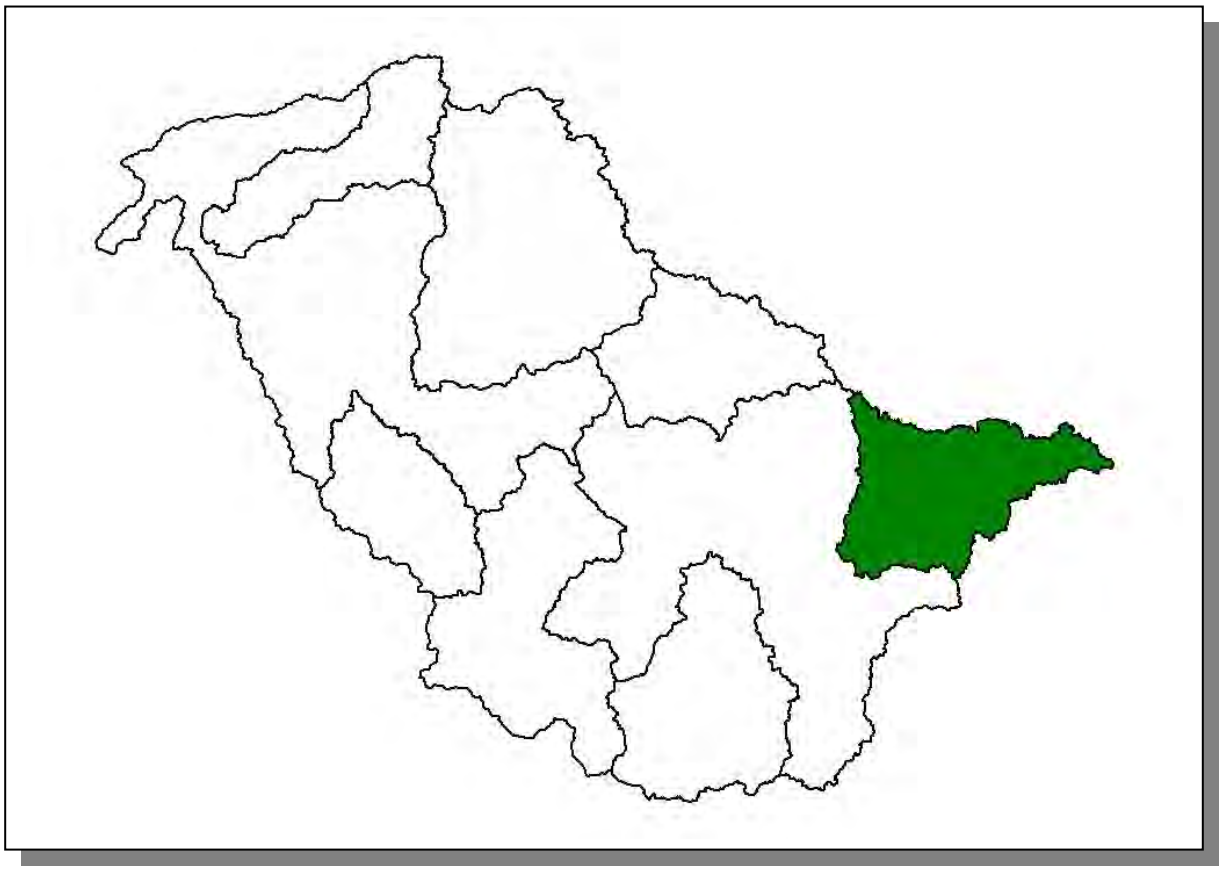


Figure 4-14. Location of Subwatershed 0604000302. *All Lower Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.B.i. General Description.

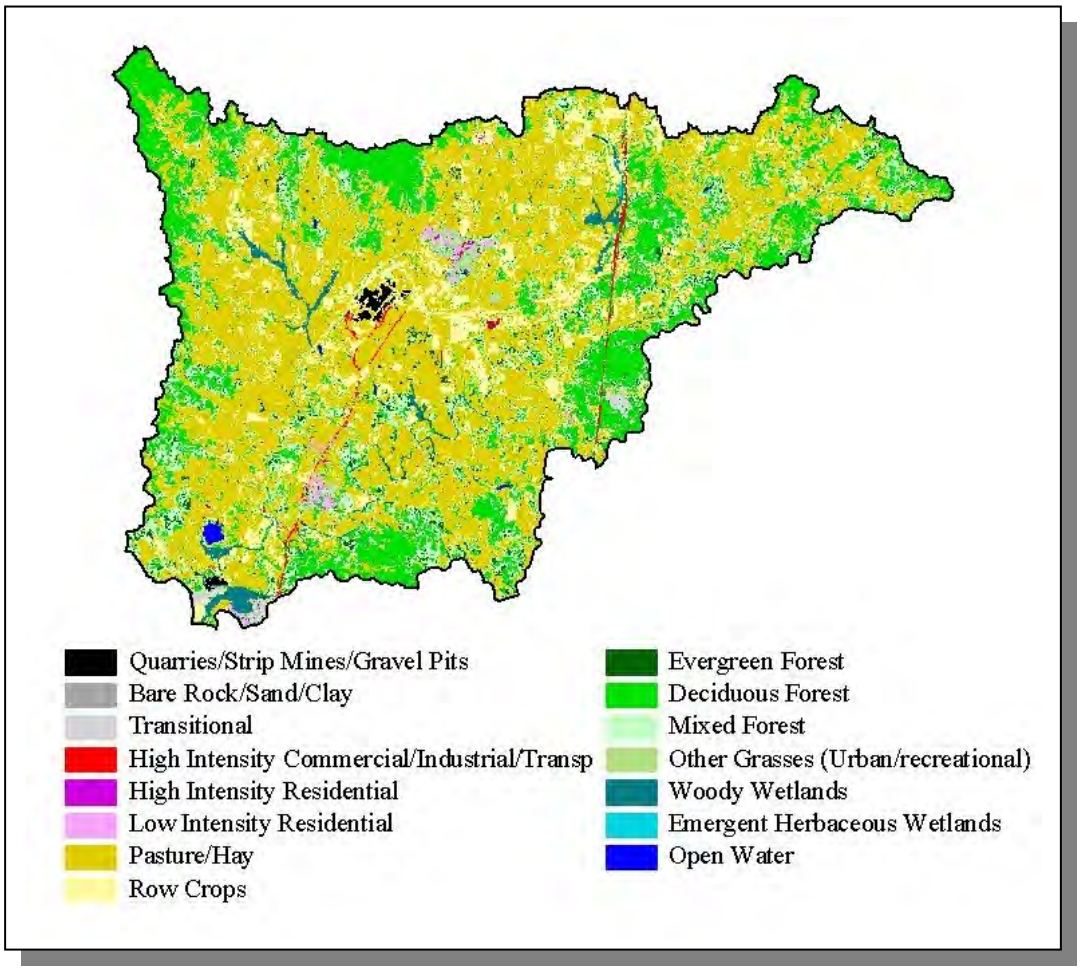


Figure 4-15. Illustration of Land Use Distribution in Subwatershed 0604000302.

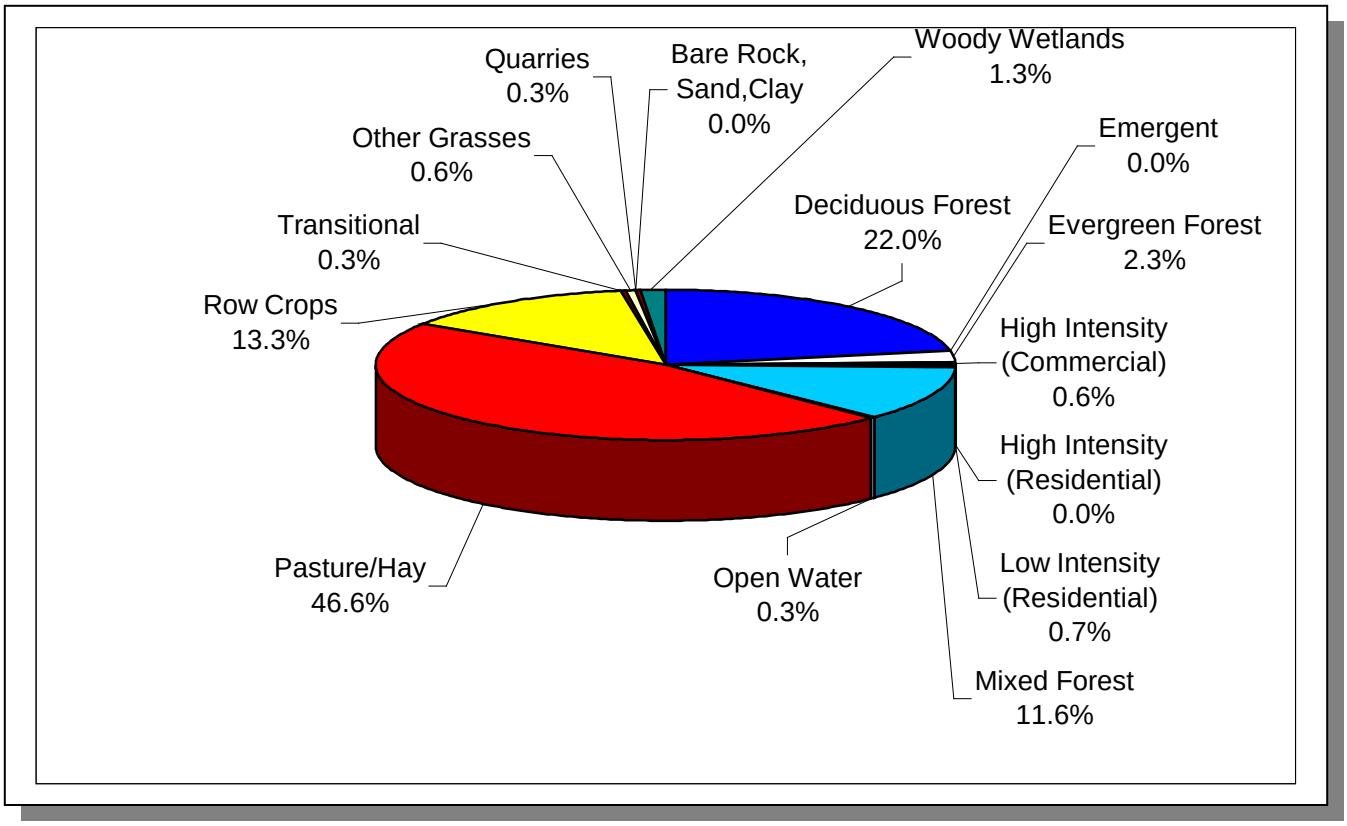


Figure 4-16. Land Use Distribution in Subwatershed 0604000302. *More information is provided in Appendix IV.*

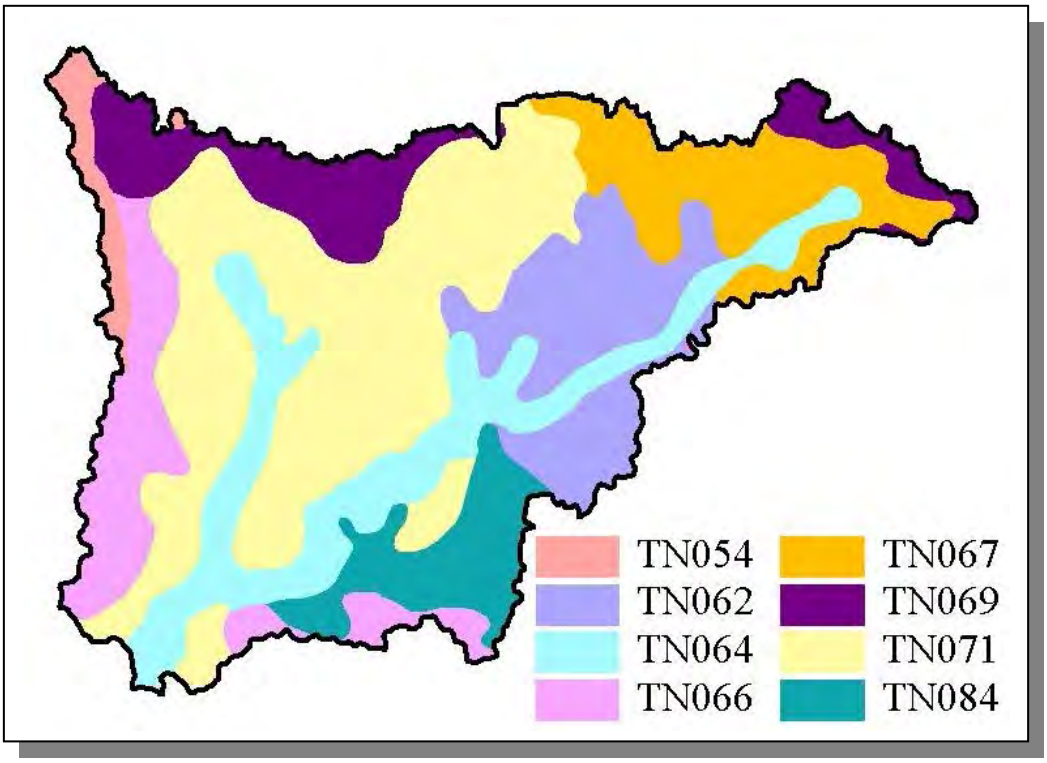


Figure 4-17. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000302.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	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
TN084	0.00	C	1.80	4.99	Silty Loam	0.28

Table 4-7. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000302. *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)
Maury	54,812	68,268	69,498	13.97	7,657	9,536	9,708	26.8
Williamson	81,021	111,453	126,638	5.22	4,235	5,825	6,619	56.3
Totals	**135,833**	**179,721**	**196,136**		**11,892**	**15,361**	**16,327**	**37.3**

Table 4-8. Population Estimates in Subwatershed 0604000302.

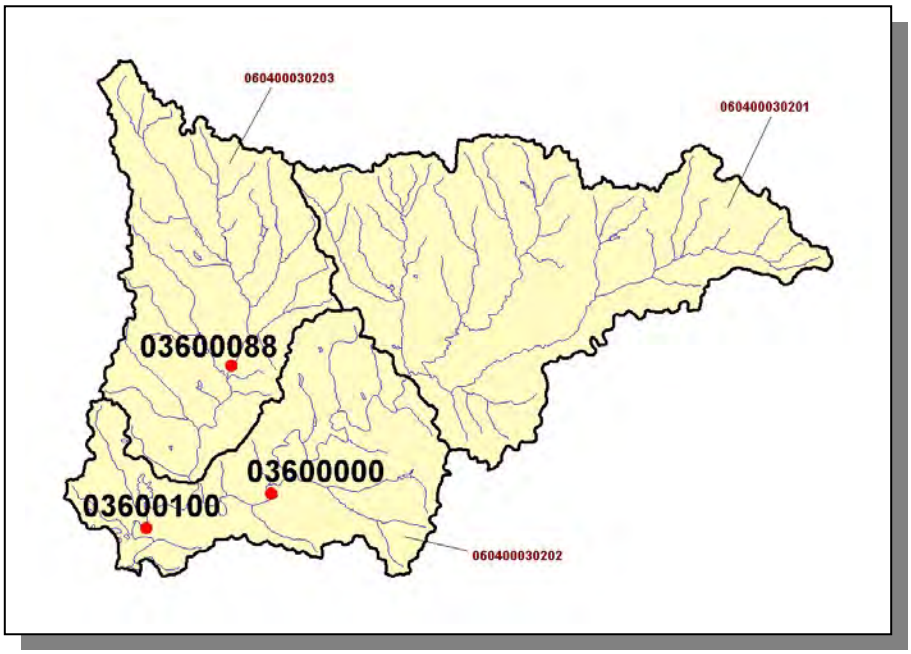


Figure 4-18. Location of Historical Streamflow Data Collection Sites in Subwatershed 0604000302. *Subwatershed 060400030201, 060400030202, and 060400030203, boundaries are shown for reference. More information is provided in Appendix IV.*

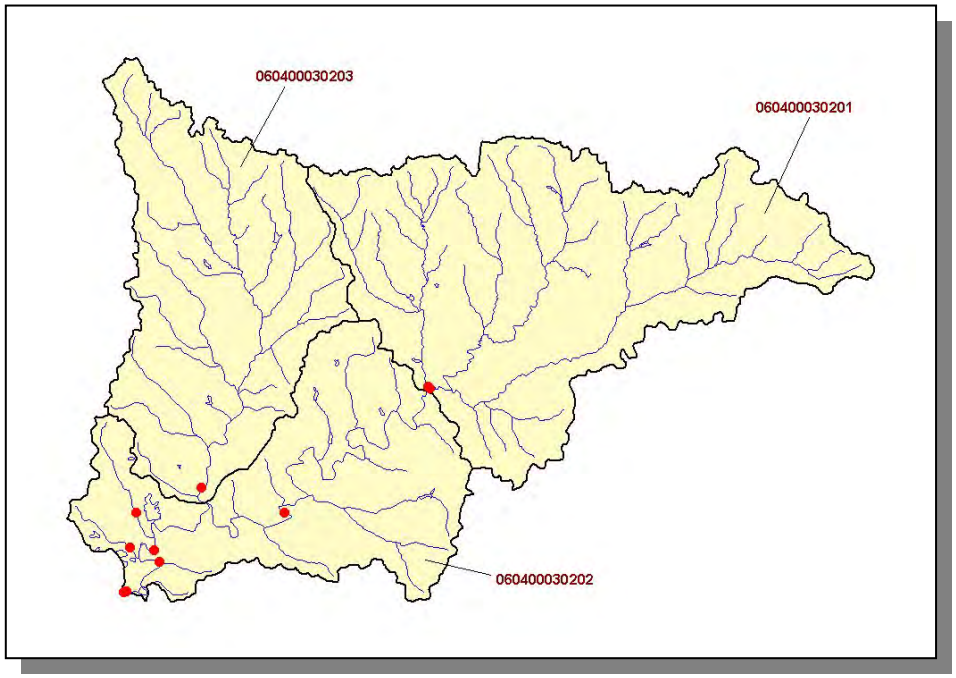


Figure 4-19. Location of STORET Monitoring Sites in Subwatershed 0604000302. *Subwatershed 060400030201, 060400030202, and 060400030203, boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.B.ii. Point Source Contributions.

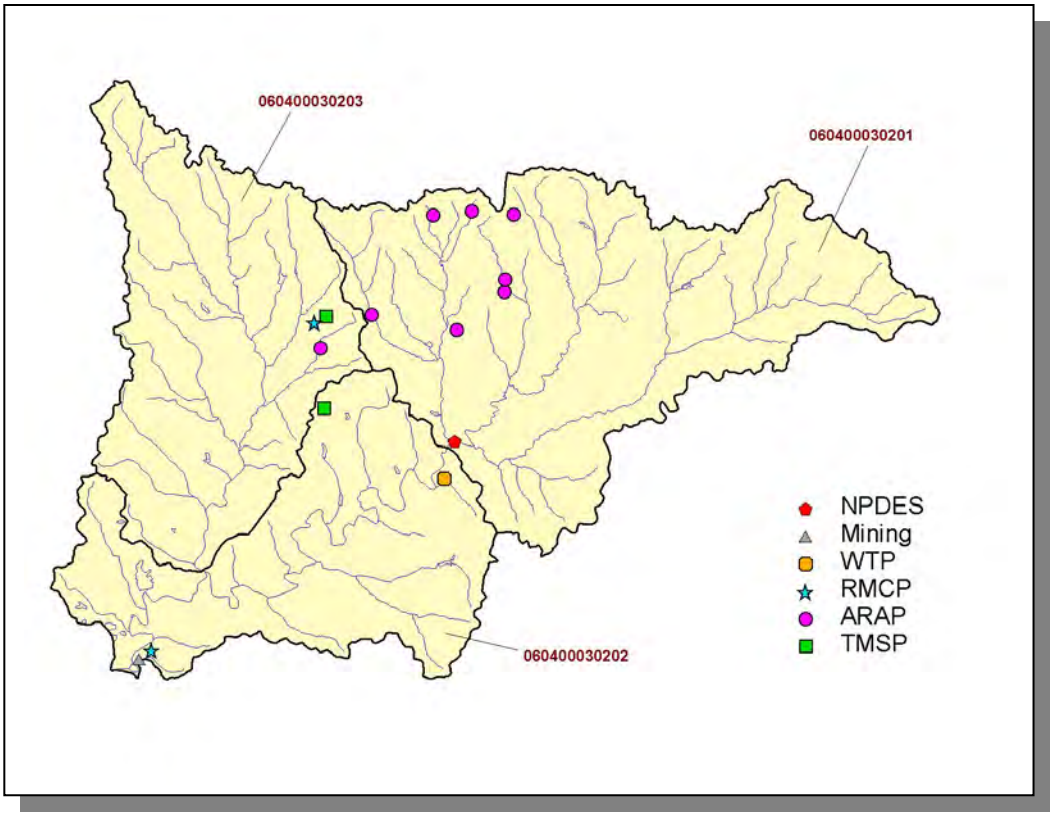


Figure 4-20. Location of Active Point Source Facilities in Subwatershed 0604000302. *Subwatershed 060400030201, 060400030202, and 060400030203 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

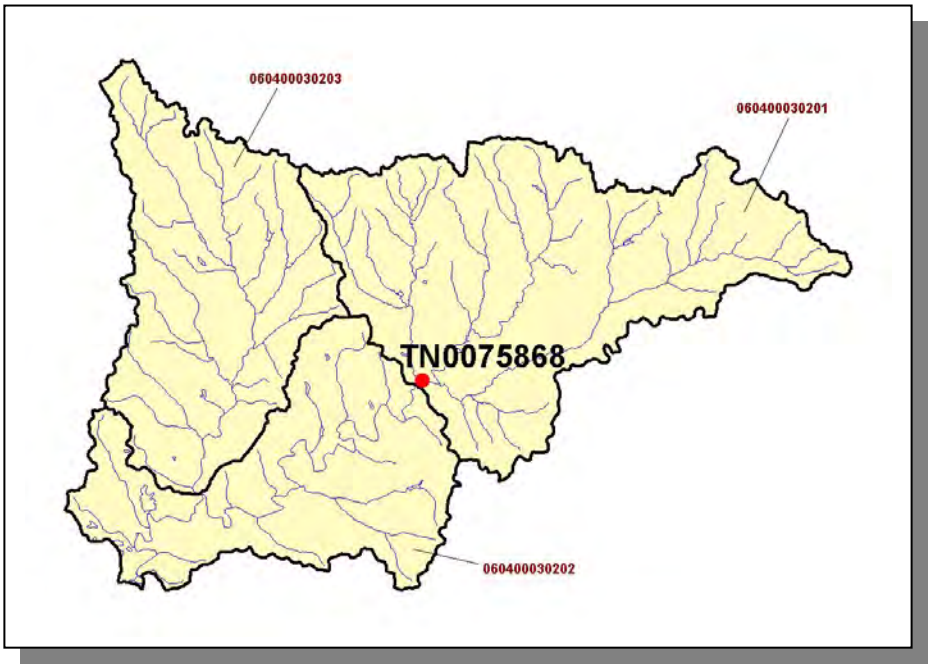


Figure 4-21. Location of NPDES Facilities in Subwatershed 0604000302. *Subwatershed 060400030201, 060400030202, and 060400030203 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-22. Location of Active Mining Facilities in Subwatershed 0604000302. *Subwatershed 060400030201, 060400030202, and 060400030203 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

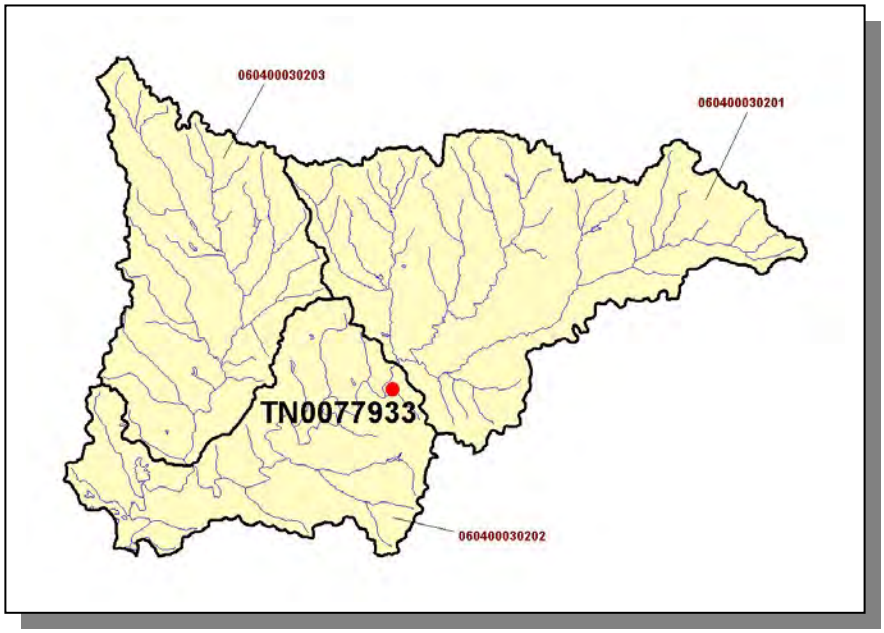


Figure 4-23. Location of Water Treatment Plants in Subwatershed 0604000302. *Subwatershed 060400030201, 060400030202, and 060400030203 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

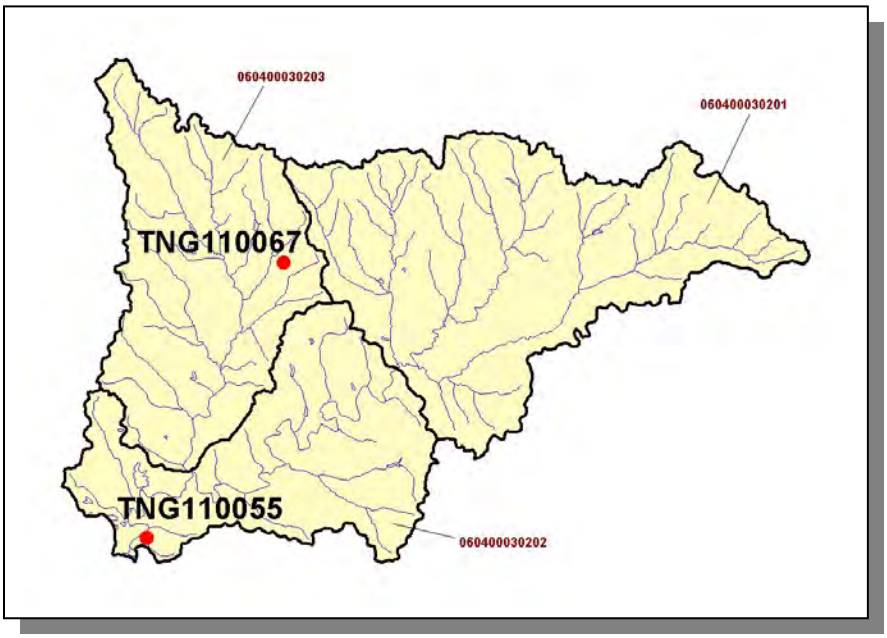


Figure 4-24. Location of Ready Mix Concrete Plants in Subwatershed 0604000302. *Subwatershed 060400030201, 060400030202, and 060400030203 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

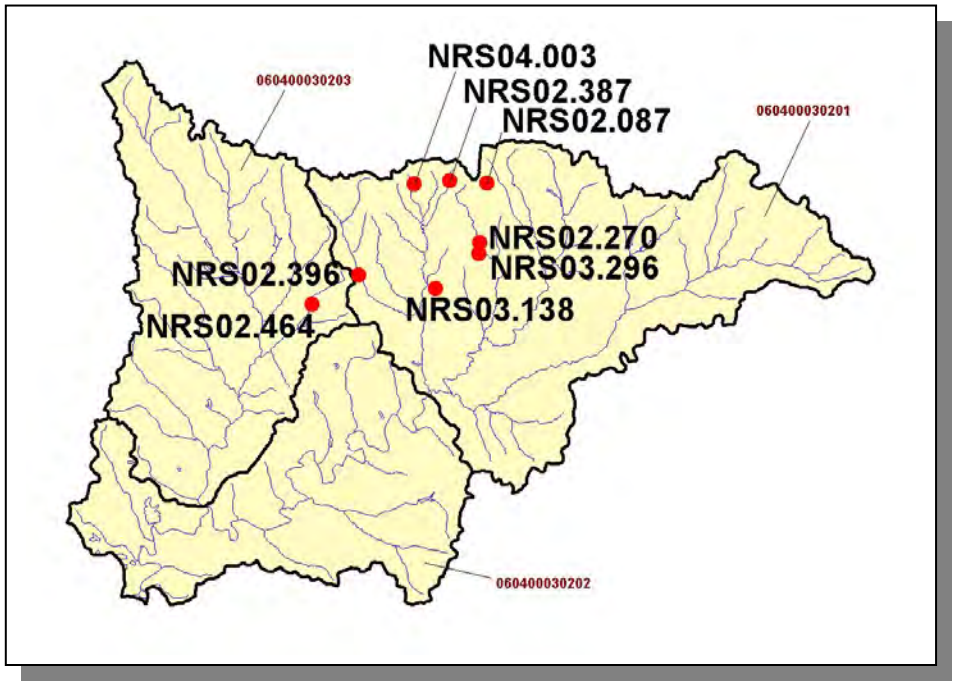


Figure 4-25. Location of ARAP Sites (Individual Permits) in Subwatershed 0604000302. *Subwatershed 060400030201, 060400030202, and 060400030203 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-26. Location of TMSP Facilities in Subwatershed 0604000302. *Subwatershed 060400030201, 060400030202, and 060400030203 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

4.2.B.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens (layers)	Chickens Sold	Hogs	Sheep
7,672	15,541	726	18	<5	398	122

Table 4-9. Summary of Livestock Count Estimates in Subwatershed 0604000302. *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.*

CROPS	TONS/ACRE/YEAR
Legume (Pastureland)	0.33
Grass (Pastureland)	0.65
Grass (Hayland)	0.26
Legumes (Hayland)	0.98
Legumes, Grass (Hayland)	0.24
Grass, Forbs, Legumes (Mixed Pasture)	0.30
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	4.87
Soybeans (Row Crops)	6.84
Tobacco (Row Crops)	6.75
All Other Row Crops	11.45
Wheat (Close-Grown Cropland)	1.27
Other Cropland not Planted	4.98
Conservation Reserve Program Lands	0.37
Non-Agricultural Land Use	0.00
Other Land in Farms	0.12
Farmsteads and Ranch Headquarters	0.42

Table 4-10. Annual Estimated Total Soil Loss in Subwatershed 0604000302.

4.2.C. 0604000303 (Big Bigby Creek).

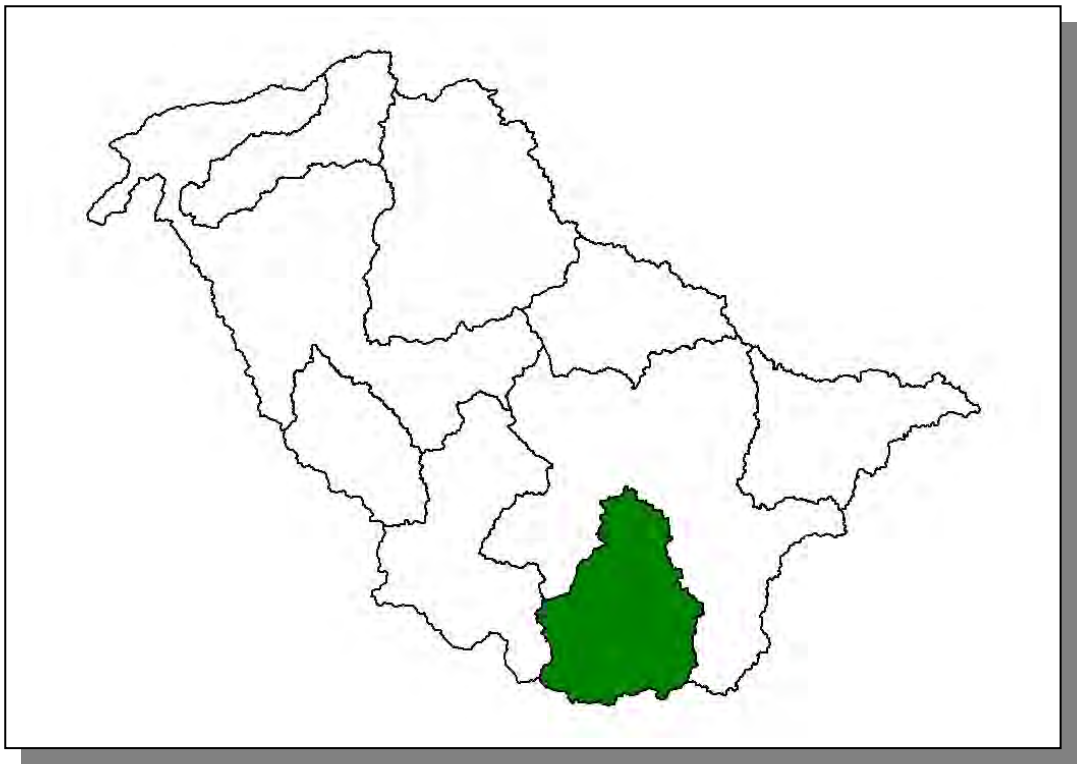


Figure 4-27. Location of Subwatershed 0604000303. *All Lower Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.C.i. General Description.

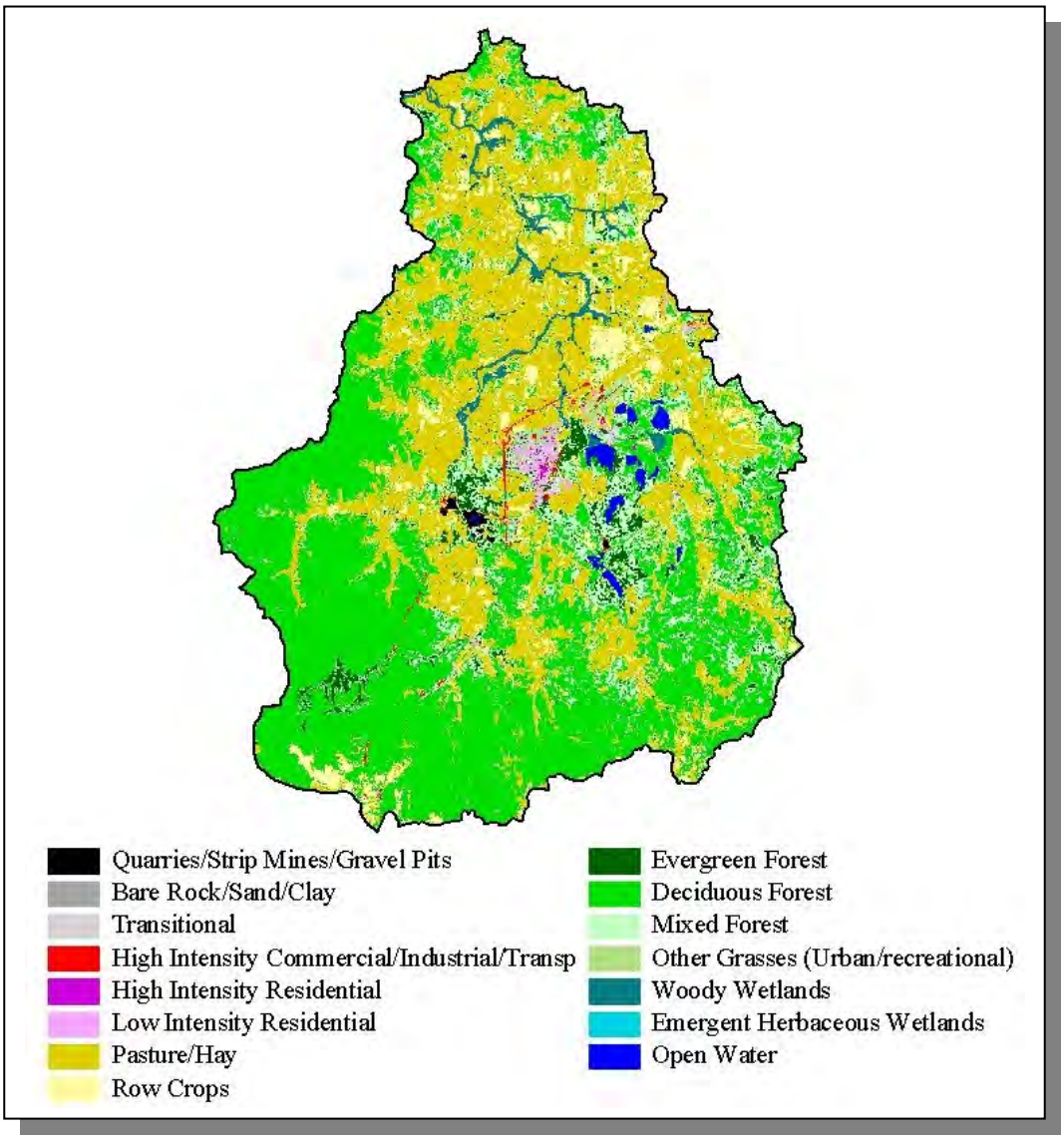


Figure 4-28. Illustration of Land Use Distribution in Subwatershed 0604000303.

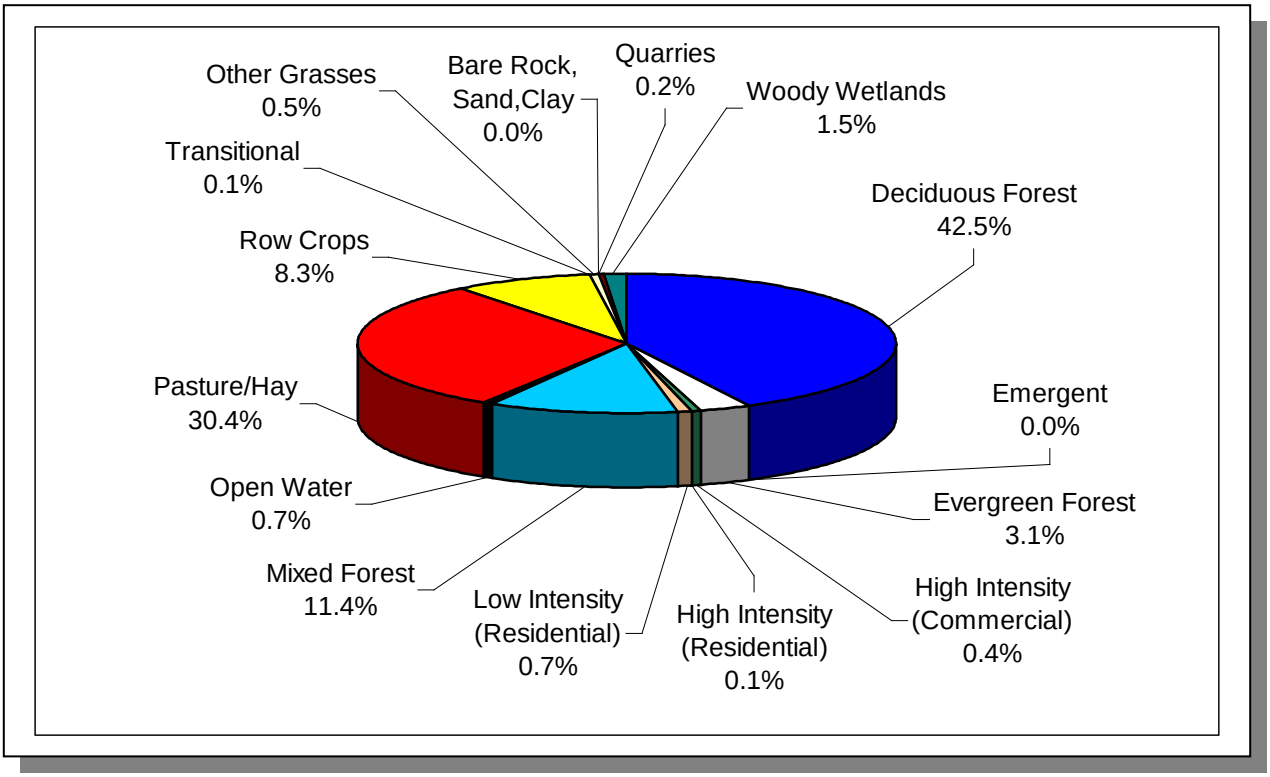


Figure 4-29. Land Use Distribution in Subwatershed 0604000303. *More information is provided in Appendix IV.*

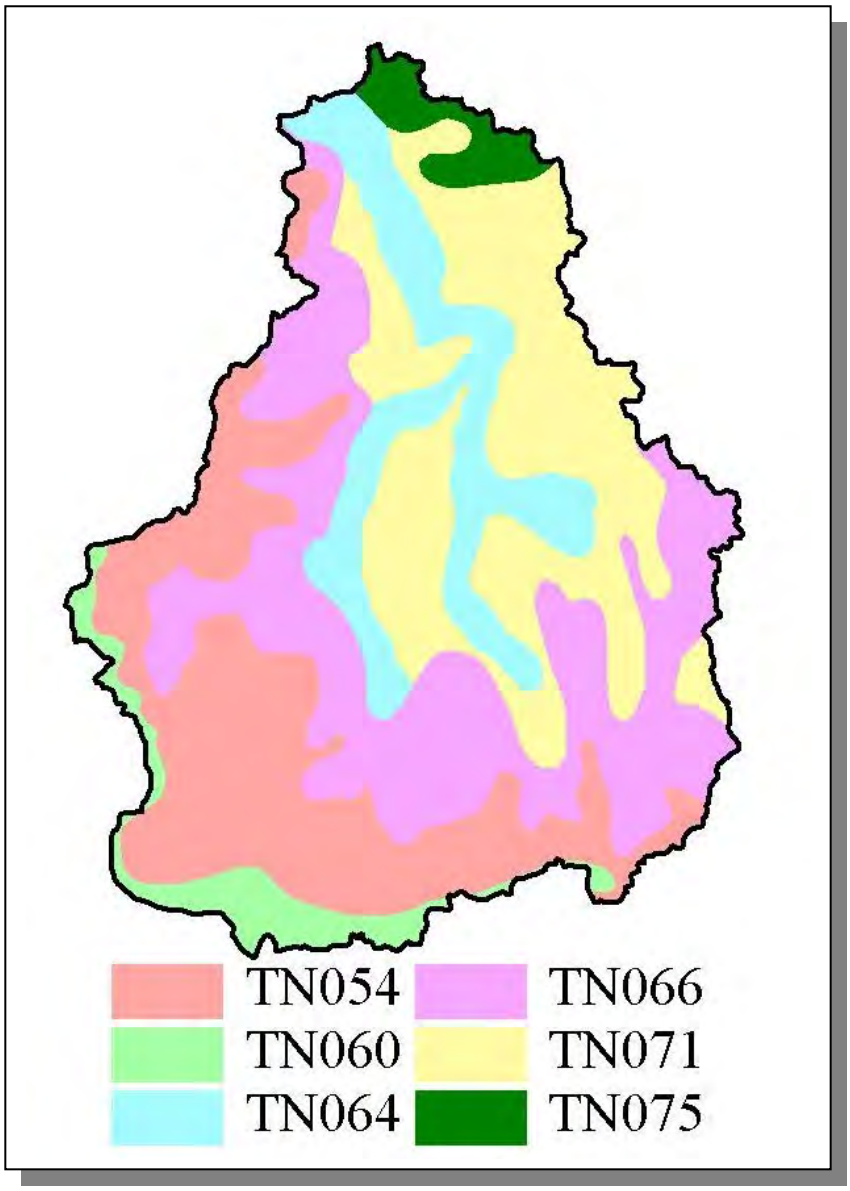


Figure 4-30. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000303.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN054	0.00	C	3.04	4.84	Loam	0.32
TN060	5.00	B	1.30	5.32	Silty Loam	0.39
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	0.22
TN075	0.00	B	1.33	5.24	Loam	0.31

Table 4-11. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000303. *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	0.36	92	102	105	14.1
Lawrence	35,303	39,095	39,926	0.96	338	374	382	13.0
Lewis	9,247	10,789	11,367	5.81	537	626	660	22.9
Maury	54,812	68,268	69,498	17.1	9,375	11,677	11,887	26.8
Totals	**125,103**	**146,667**	**150,238**		**10,342**	**12,779**	**13,034**	**26.0**

Table 4-12. Population Estimates in Subwatershed 0604000303.

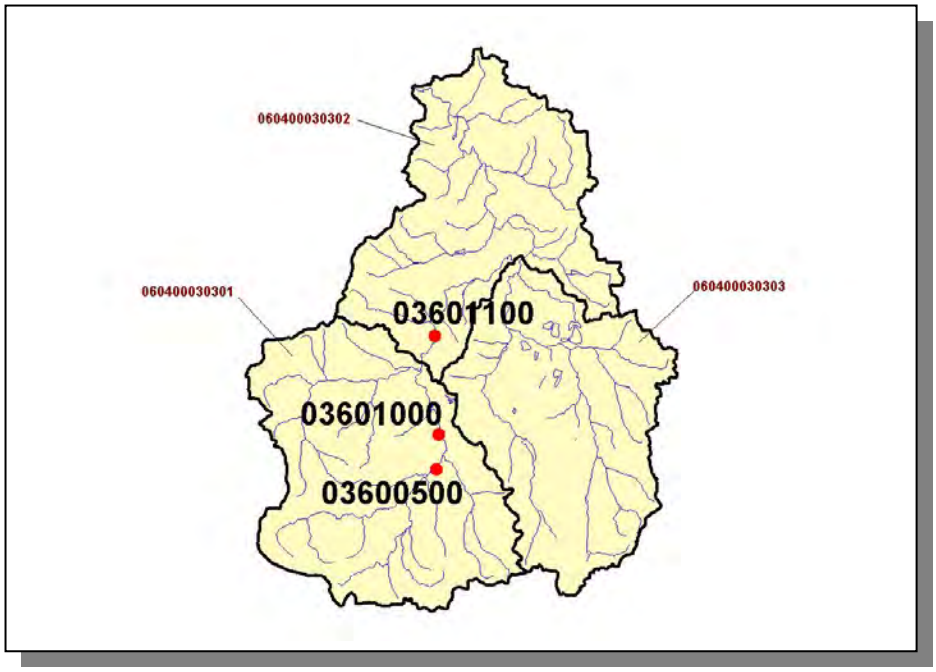


Figure 4-31. Location of Historical Streamflow Data Collection Sites in Subwatershed 0604000303. *Subwatershed 060400030301, 060400030302, and 060400030303 boundaries are shown for reference. More information is provided in Appendix IV.*

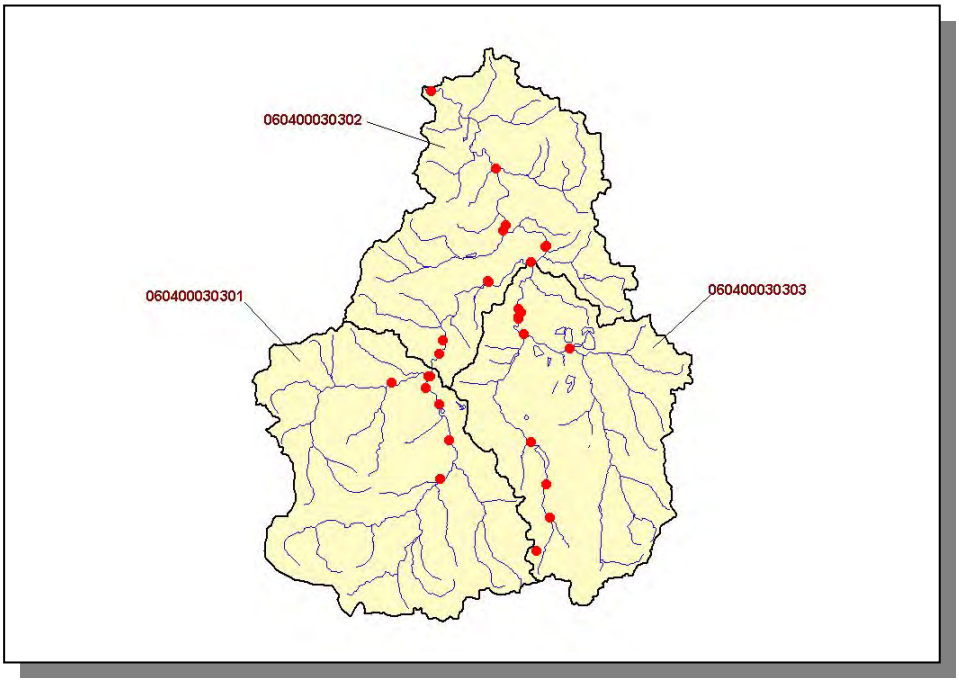


Figure 4-32. Location of STORET Monitoring Sites in Subwatershed 0604000303. *Subwatershed 060400030301, 060400030302, and 060400030303 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.C.ii. Point Source Contributions.

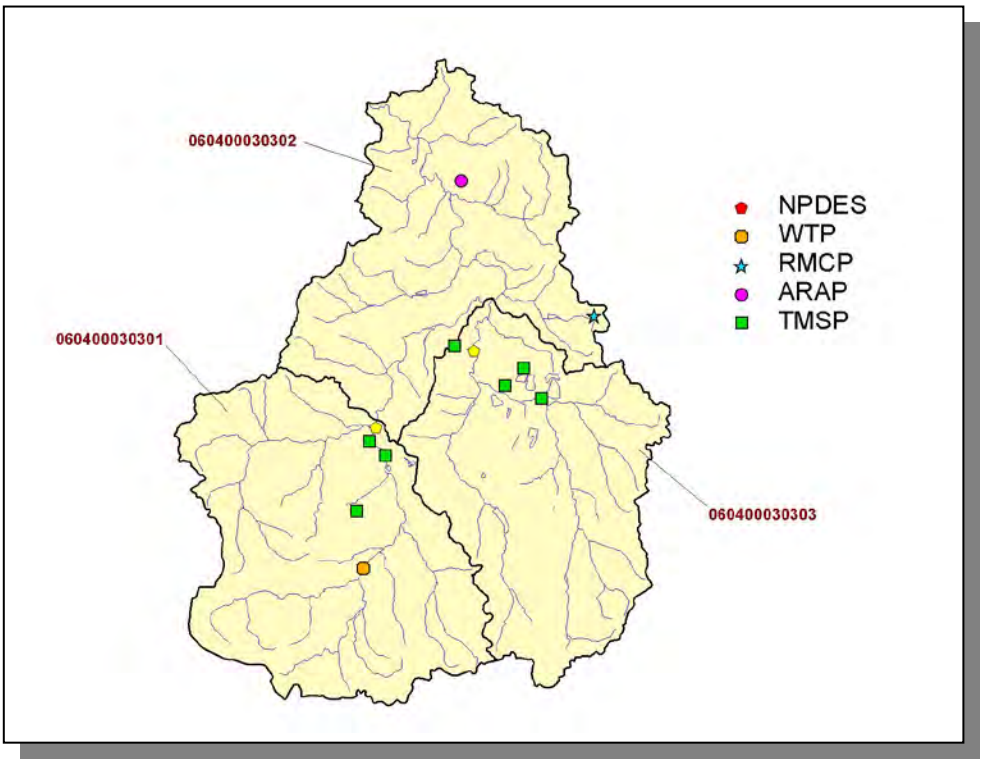


Figure 4-33. Location of Active Point Source Facilities in Subwatershed 0604000303. *Subwatershed, 060400030301, 060400030302, and 060400030303 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

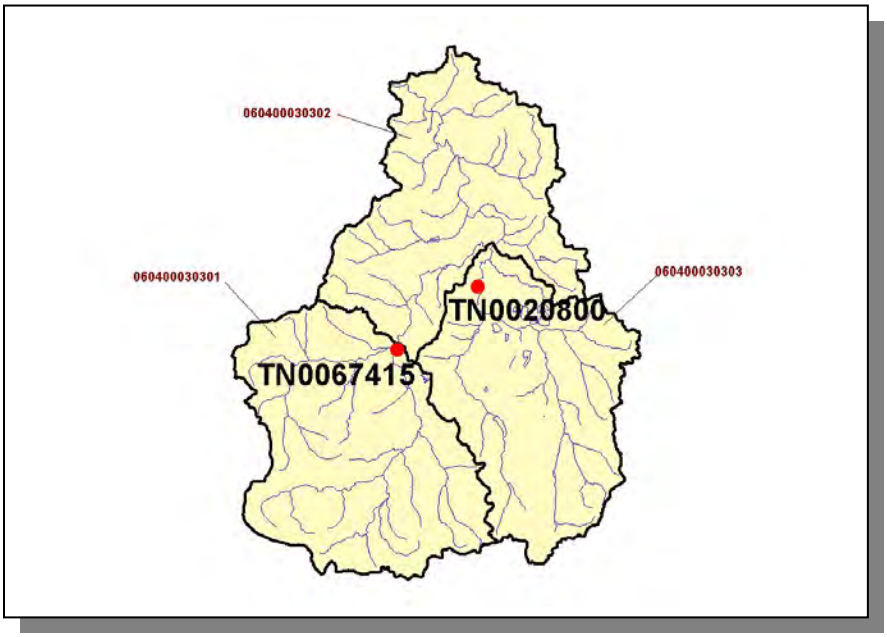


Figure 4-34. Location of NPDES Facilities in Subwatershed 0604000303. *Subwatershed, 060400030301, 060400030302, and 060400030303 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-35. Location of Water Treatment Plants in Subwatershed 0604000303. *Subwatershed, 060400030301, 060400030302, and 060400030303 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

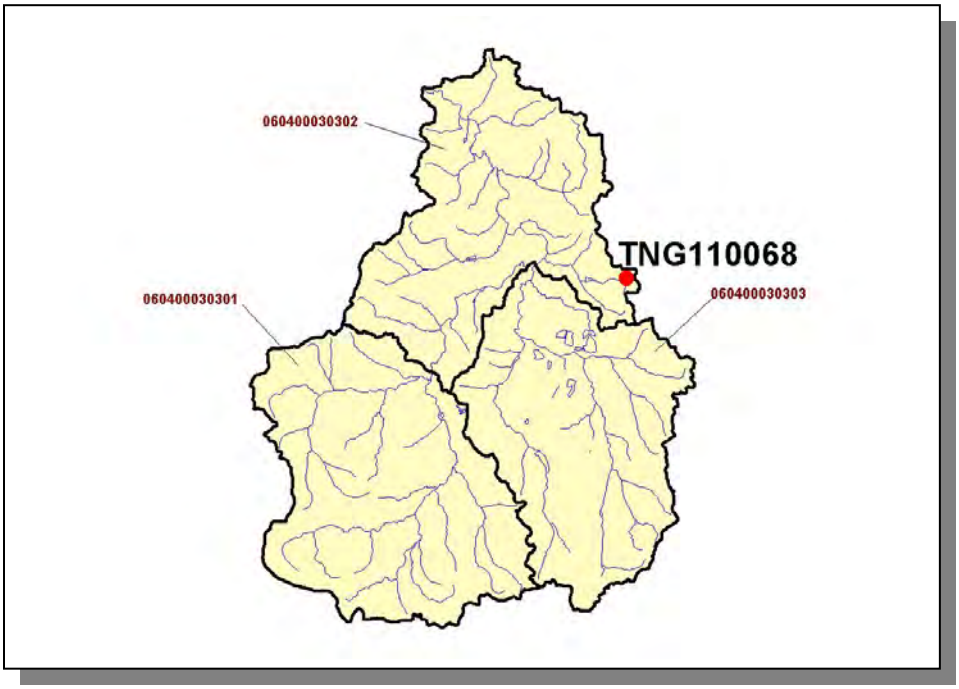


Figure 4-36. Location of Ready Mix Concrete Plants in Subwatershed 0604000303. *Subwatershed, 060400030301, 060400030302, and 060400030303 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

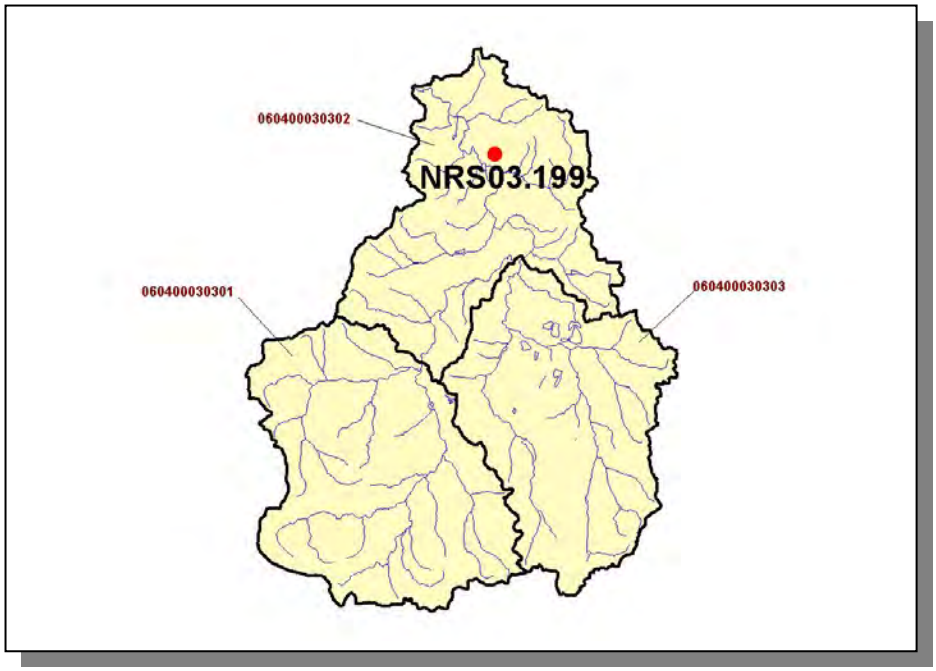


Figure 4-37. Location of ARAP Sites (Individual Permits) in Subwatershed 0604000303. *Subwatershed, 060400030301, 060400030302, and 060400030303 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

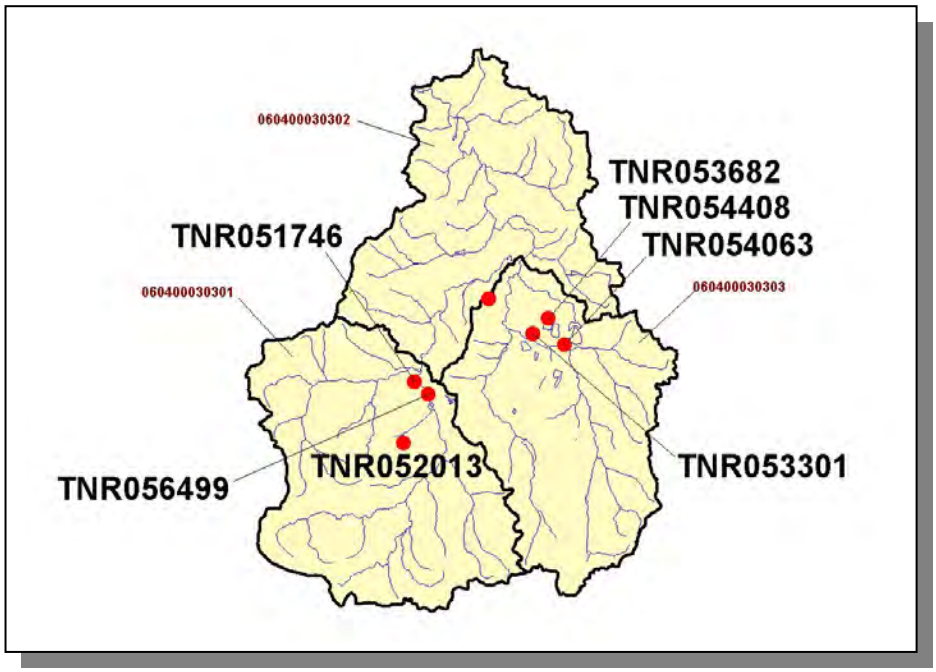


Figure 4-38. Location of TMSP Facilities in Subwatershed 0604000303. *Subwatershed, 060400030301, 060400030302, and 060400030303 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

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 0604000303:

- TN0020800 (Mount Pleasant STP) discharges to Sugar Fork Creek @ RM 1.9
- TN0067415 (CYTEC Industries) discharges to Big Bigby Creek @ RM 15.1, 15.4, and 15.6

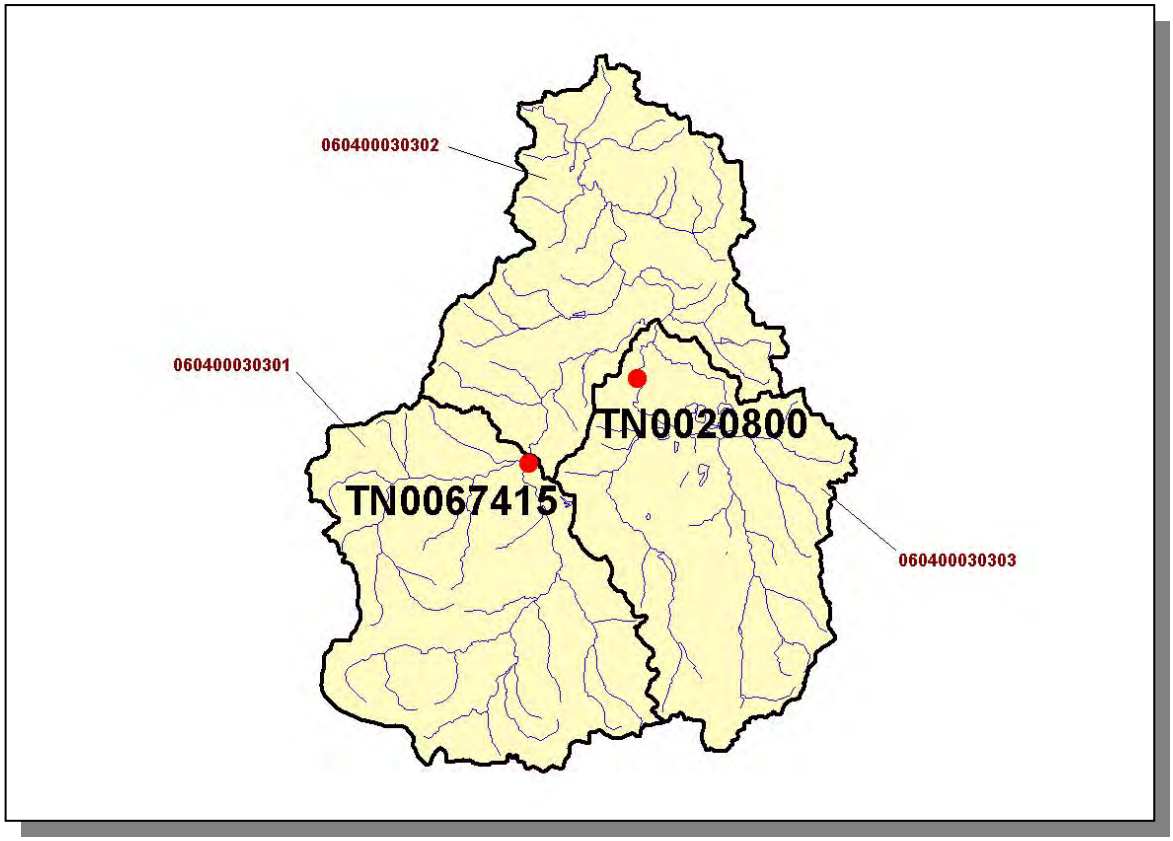


Figure 4-39. Location of NPDES Dischargers to Water Bodies Listed on the 2002 303(d) List in Subwatershed 0604000303. *Subwatershed, 060400030301, 060400030302, and 060400030303 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

PERMIT #	1Q10	3Q10	7Q10	3Q20	QDESIGN
TN0020800	0.34	0.36	0.40	0.28	0.71
TN0067415	3.9	4.1	4.3	3.2	

Table 4-13. Receiving Stream Flow Information for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000303. *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	CN	DO	pH
TN0020800	X	X	X	X	X	X	X	X	X	X	X
TN0067415	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 0604000303. *WET, Whole Effluent Toxicity; $CBOD_5$, Carbonaceous Biochemical Oxygen Demand (5-Day); TRC, Total Residual Chlorine; TSS, Total Suspended Solids.*

PERMIT #	Pb	Cu	Ni	Zn	Cr
TN0020800	X	X	X		
TN0067415	X	X	X	X	X

Table 4-15. Metals Monitored for Daily Maximum Limits for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000303.

PERMIT #	NITROBENZENE	PHENOL	TOLUENE	TRICHLOROETHYLENE
TN0067415	X	X	X	X

Table 4-16. Organic Parameters Monitored for Daily Maximum Limits for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000303.

4.2.C.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens (Layers)	Chickens (Broilers Sold)	Hogs	Sheep
6,334	12,977	609	17	<5	519	73

Table 4-17. Summary of Livestock Count Estimates in Subwatershed 0604000303. *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
Lawrence	199.8	199.8	6.6	27.1
Lewis	158.0	158.0	4.0	10.2
Totals	**529.6**	**529.6**	**13.9**	**48.7**

Table 4-18. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 0604000303.

CROPS	TONS/ACRE/YEAR
Grass (Pastureland)	0.78
Grass (Hayland)	0.30
Legumes, Grass (Hayland)	0.30
Grass, Forbs, Legumes (Mixed Pasture)	0.27
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	4.71
Cotton (Row Crops)	8.07
Soybeans (Row Crops)	9.10
All Other Row Crops	11.27
Barley (Close-Grown Cropland)	1.08
Wheat (Close-Grown Cropland)	10.82
All Other Close-Grown Cropland	1.80
Summer Fallow (Other Cropland)	0.35
Other Cropland not Planted	4.32
Other Vegetable and Truck Crop	4.29
Conservation Reserve Program Lands	0.46
Non-Agricultural Land Use	0.00
Farmsteads and Ranch Headquarters	0.69

Table 4-19. Annual Estimated Total Soil Loss in Subwatershed 0604000303.

4.2.D. 0604000304 (Lick Creek).

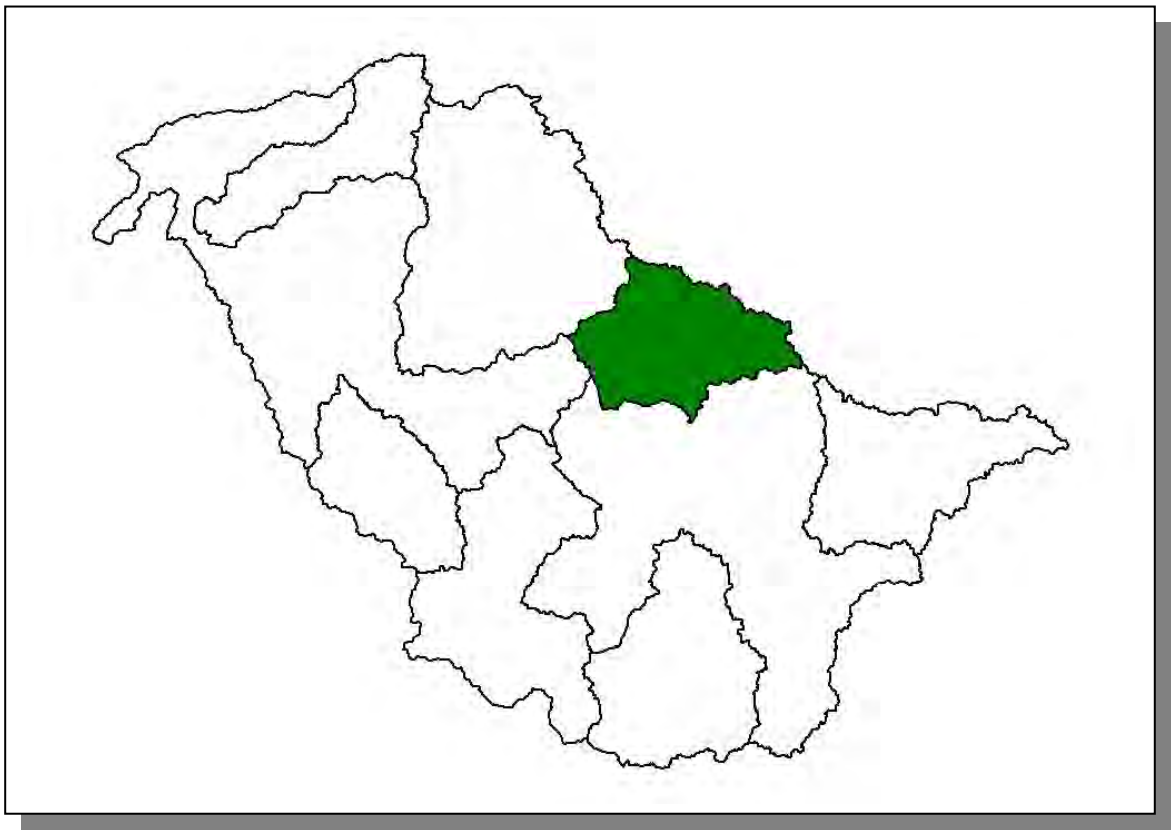


Figure 4-40. Location of Subwatershed 0604000304. *All Lower Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.D.i. General Description.

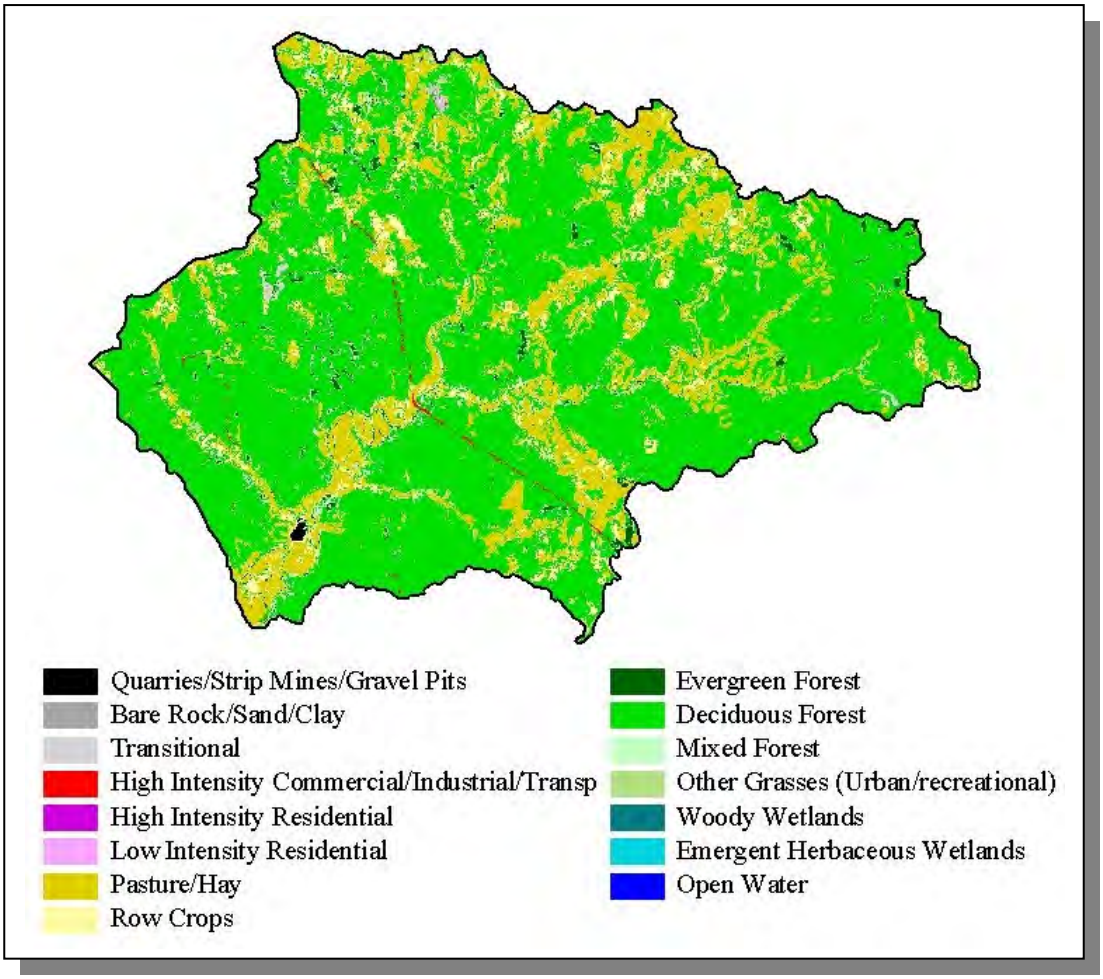


Figure 4-41. Illustration of Land Use Distribution in Subwatershed 0604000304.

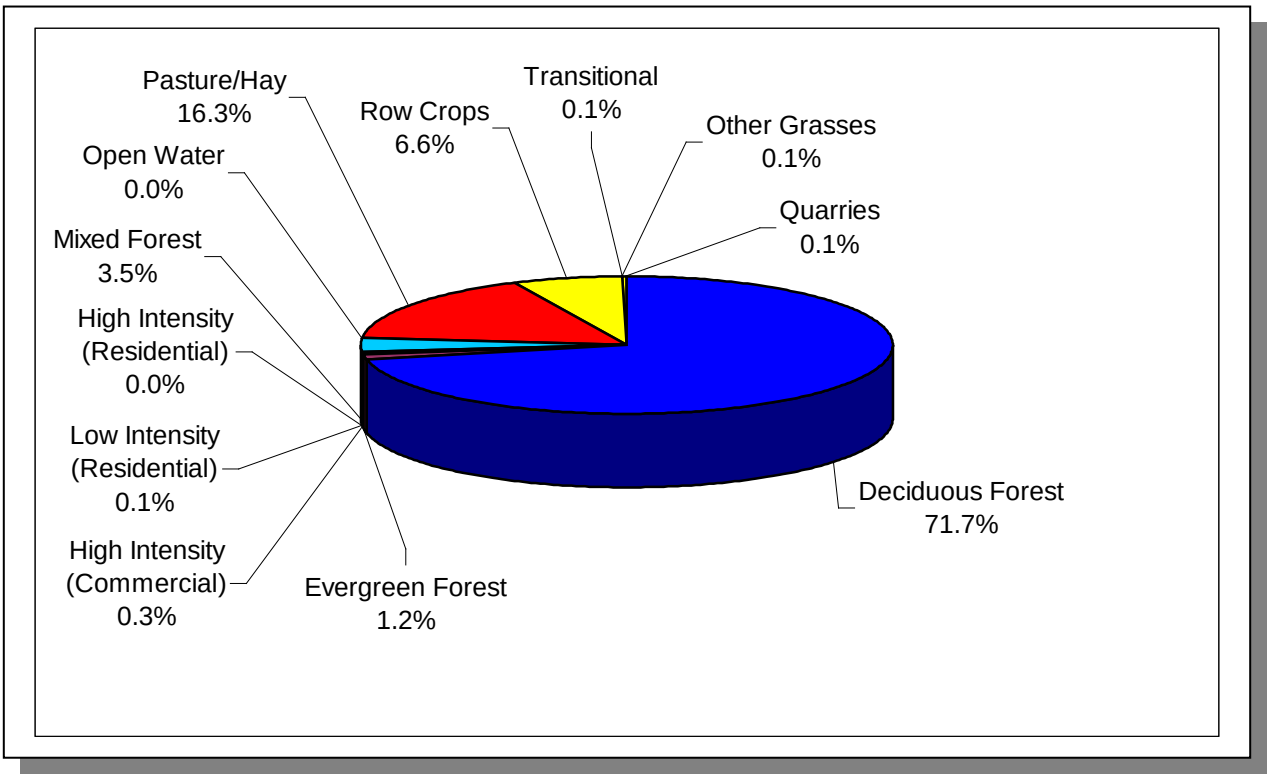


Figure 4-42. Land Use Distribution in Subwatershed 0604000304. *More information is provided in Appendix IV.*

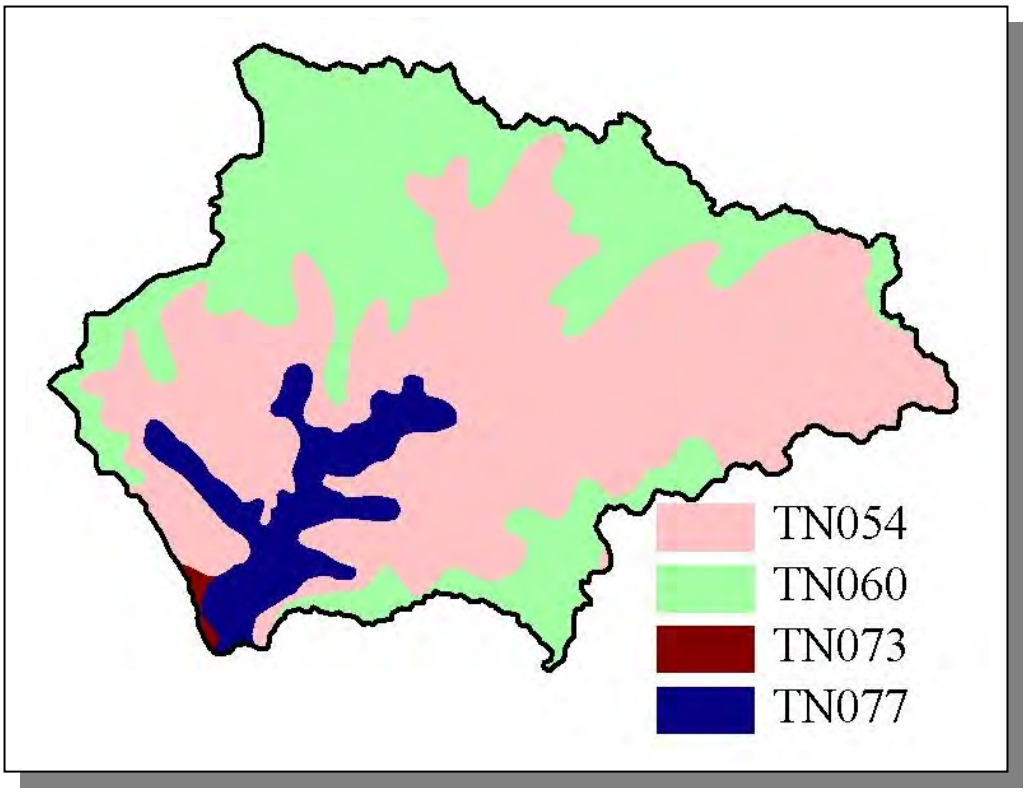


Figure 4-43. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000304.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN054	0.00	C	3.04	4.84	Loam	0.32
TN060	5.00	B	1.30	5.32	Silty Loam	0.39
TN073	0.00	B	2.97	5.21	Loam	0.34
TN077	4.00	C	2.16	5.03	Loam	0.34

Table 4-20. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000304. *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)
Hickman	16,754	19,926	22,295	9.40	1,575	1,873	2,096	33.1
Maury	54,812	68,268	69,498	2.14	1,171	1,458	1,485	26.8
Williamson	81,021	111,453	126,638	5.08	4,117	5,663	6,435	56.3
Totals	**152,587**	**199,647**	**218,432**		**6,863**	**8,994**	**10,106**	**45.9**

Table 4-21. Population Estimates in Subwatershed 0604000304.

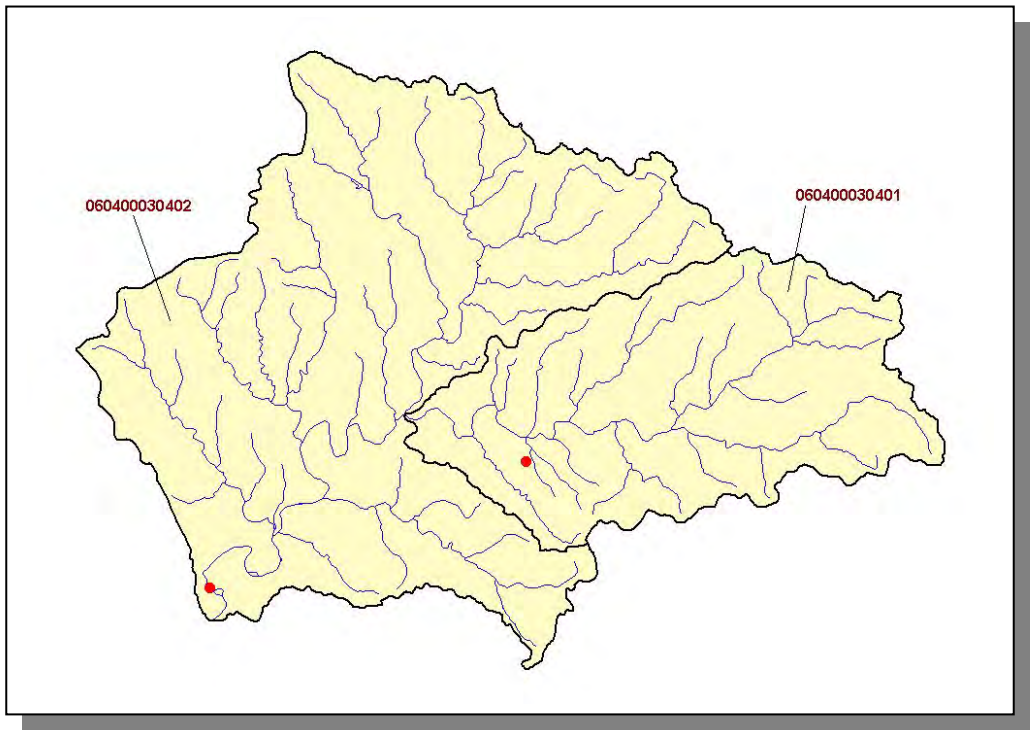


Figure 4-44. Location of STORET Monitoring Sites in Subwatershed 0604000304. *Subwatershed 060400030401 and 060400030402 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.D.ii. Point Source Contributions.

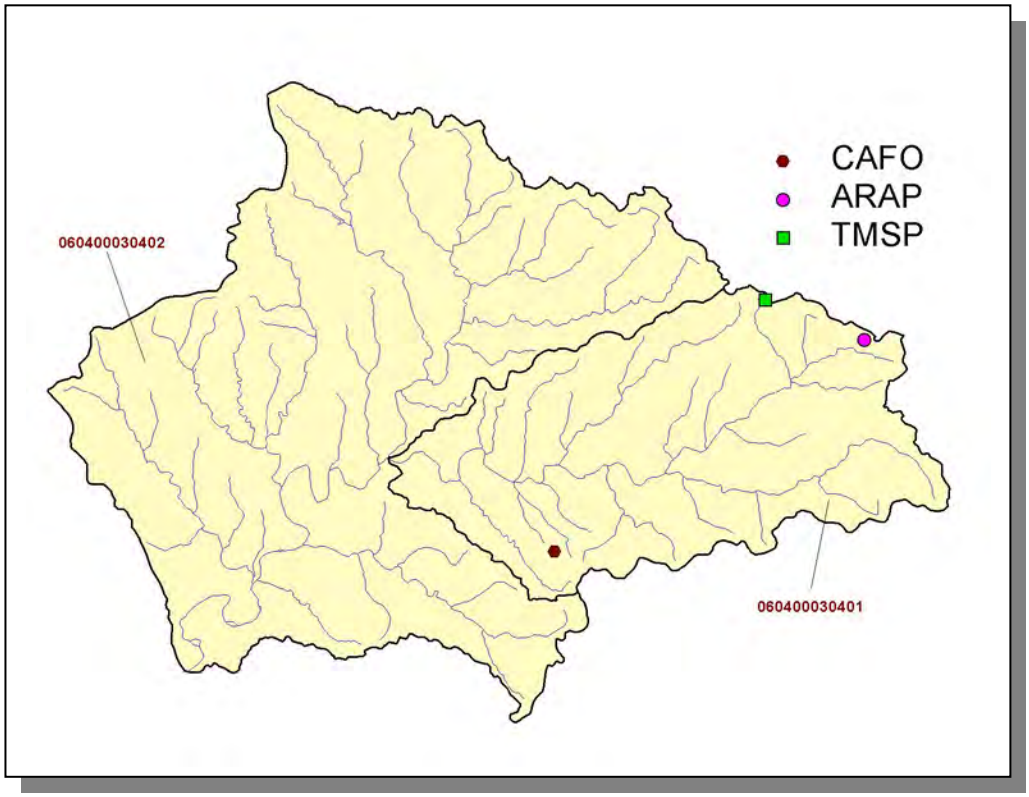


Figure 4-45. Location of Active Point Source Facilities in Subwatershed 0604000304. *Subwatershed 060400030401 and 060400030402 boundaries are shown for reference. More information is provided in Appendix IV.*

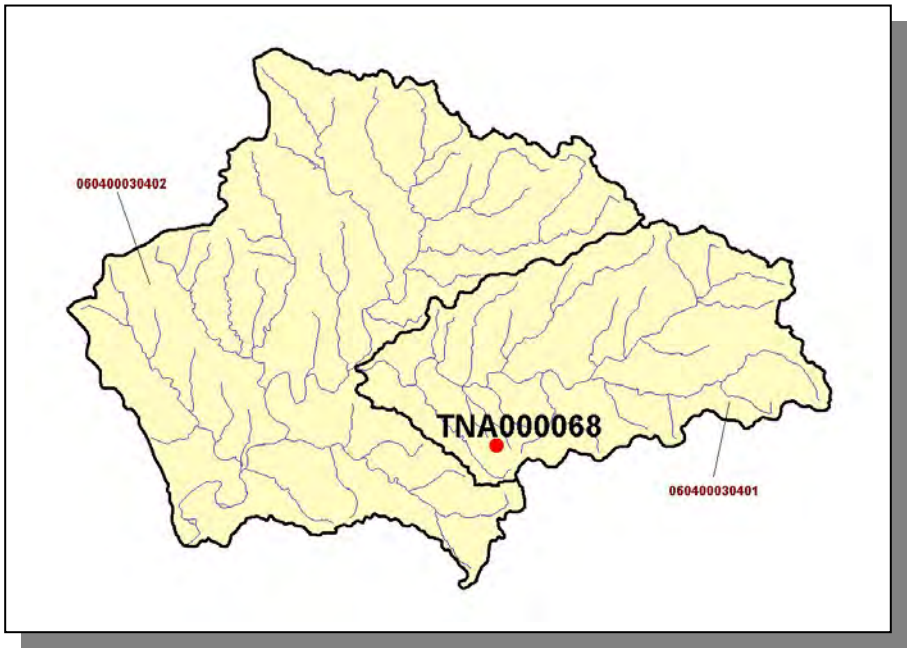


Figure 4-46. Location of Concentrated Animal Feeding Operations (CAFO) in Subwatershed 0604000304. *Subwatershed 060400030401 and 060400030402 boundaries are shown for reference. More information is provided in Appendix IV.*

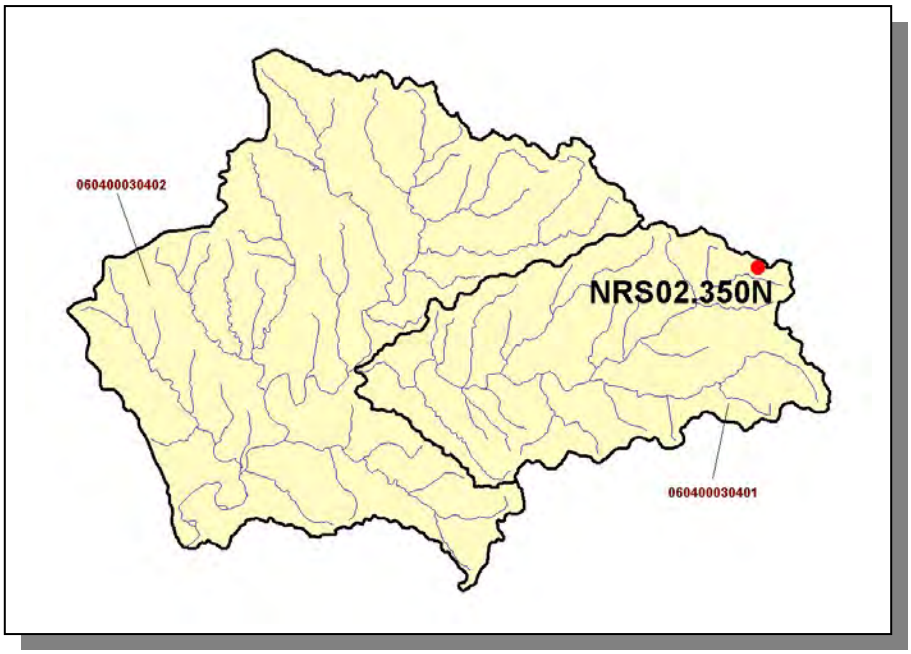


Figure 4-47. Location of ARAP Sites (Individual Permits) in Subwatershed 0604000304. *Subwatershed 060400030401 and 060400030402 boundaries are shown for reference. More information is provided in Appendix IV.*

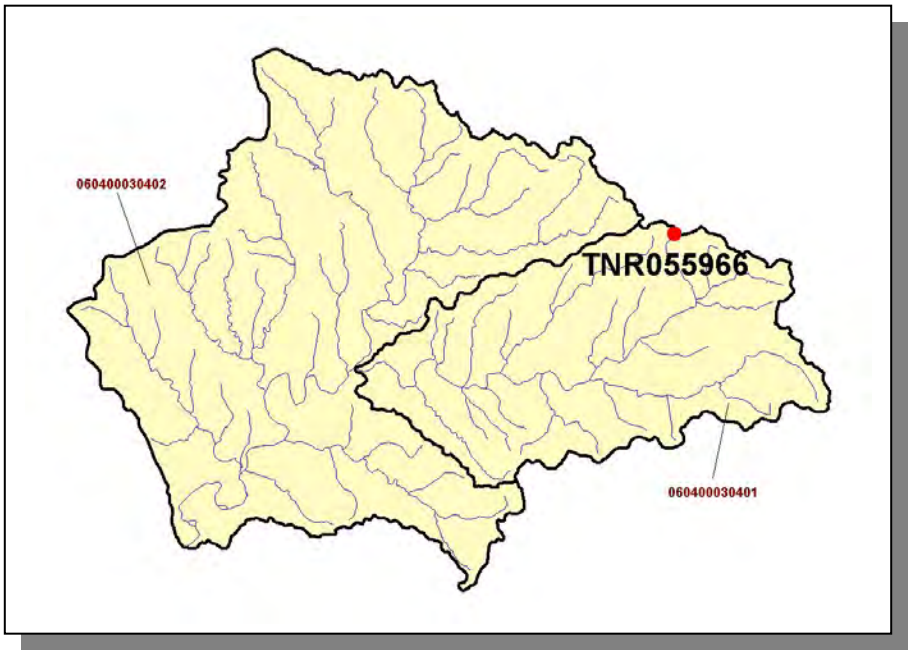


Figure 4-48. Location of TMSP Facilities in Subwatershed 0604000304. *Subwatershed 060400030401 and 060400030402 boundaries are shown for reference. More information is provided in Appendix IV.*

4.2.D.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Milk Cow	Cattle	Chickens (Layers)	Chickens Sold	Hogs	Sheep
2,780	112	5,317	8	<5	601	34

Table 4-22. Summary of Livestock Count Estimates in Subwatershed 0604000304*. 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)
Hickman	297.2	297.2	5.8	23.0

Table 4-23. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 0604000304.

CROPS	TONS/ACRE/YEAR
Legume (Pastureland)	0.56
Grass (Pastureland)	0.96
Grass (Hayland)	0.14
Legumes (Hayland)	1.03
Legumes, Grass (Hayland)	0.25
Grass, Forbs, Legumes (Mixed Pasture)	0.65
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	5.18
Soybeans (Row Crops)	5.12
Tobacco (Row Crops)	7.37
All Other Row Crops	11.45
Wheat (Close-Grown Cropland)	1.27
Other Cropland not Planted	5.84
Conservation Reserve Program Lands	0.52
Non-Agricultural Land Use	0.00
Other Land in Farms	0.12
Farmsteads and Ranch Headquarters	0.22

Table 4-24. Annual Soil Loss in Subwatershed 0604000304.

4.2.E. 0604000305 (Duck River).

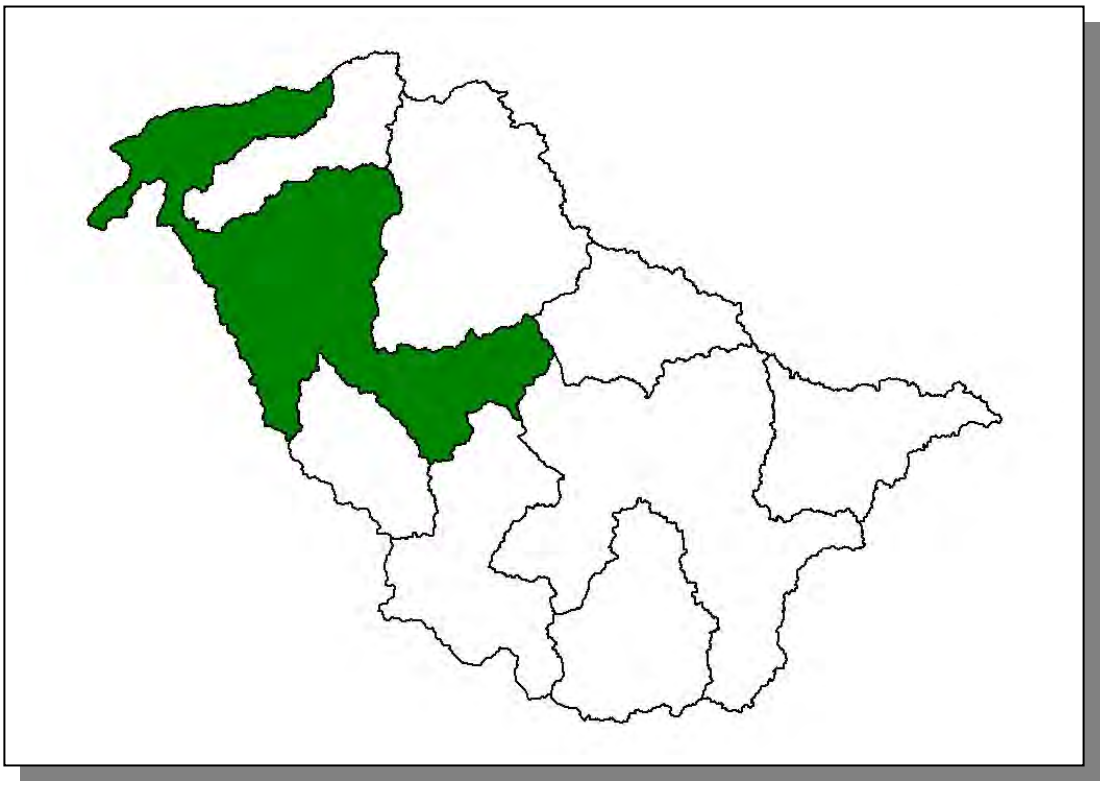


Figure 4-49. Location of Subwatershed 0604000305. *All Lower Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.E.i. General Description.

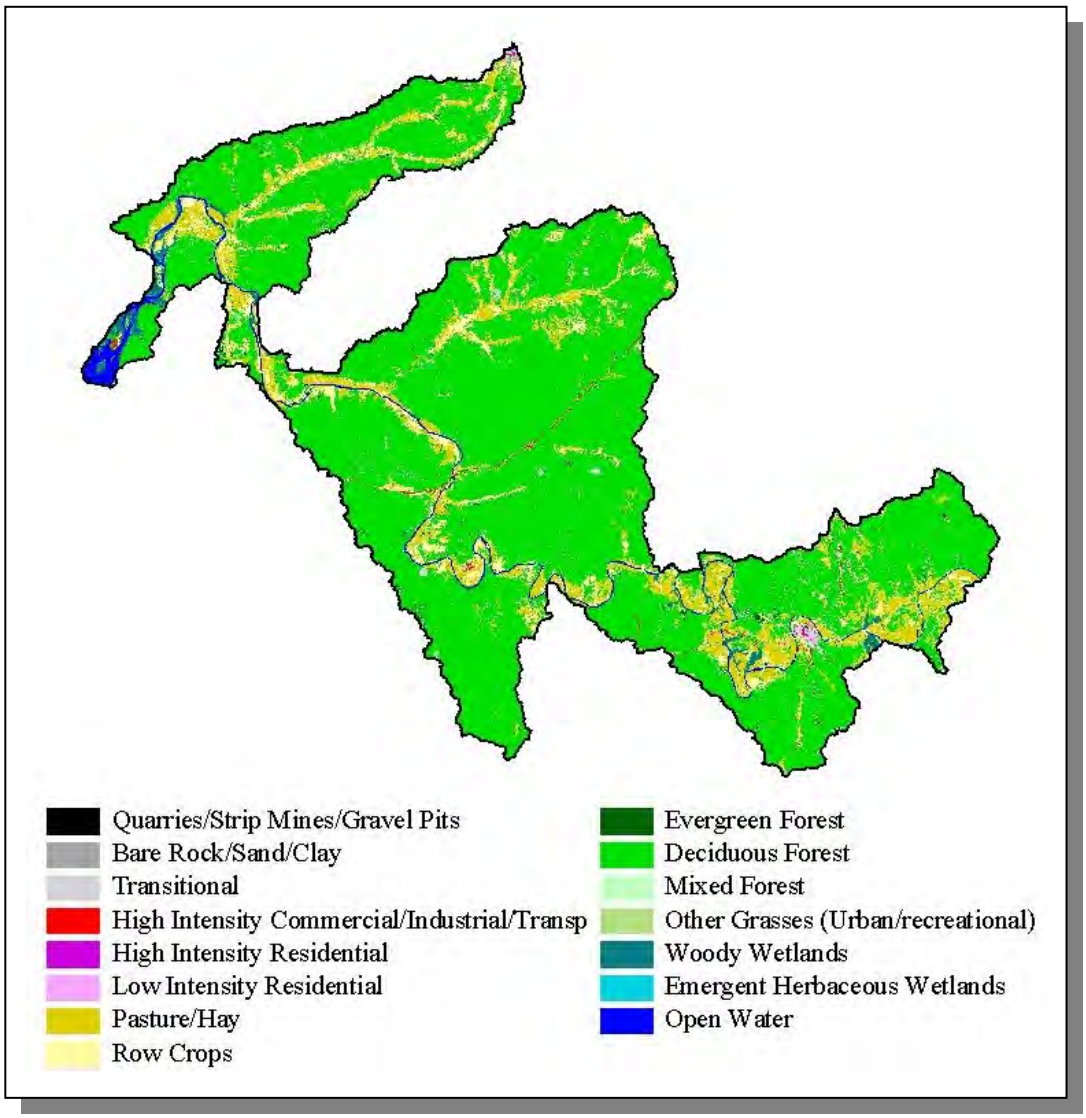


Figure 4-50. Illustration of Land Use Distribution in Subwatershed 0604000305.

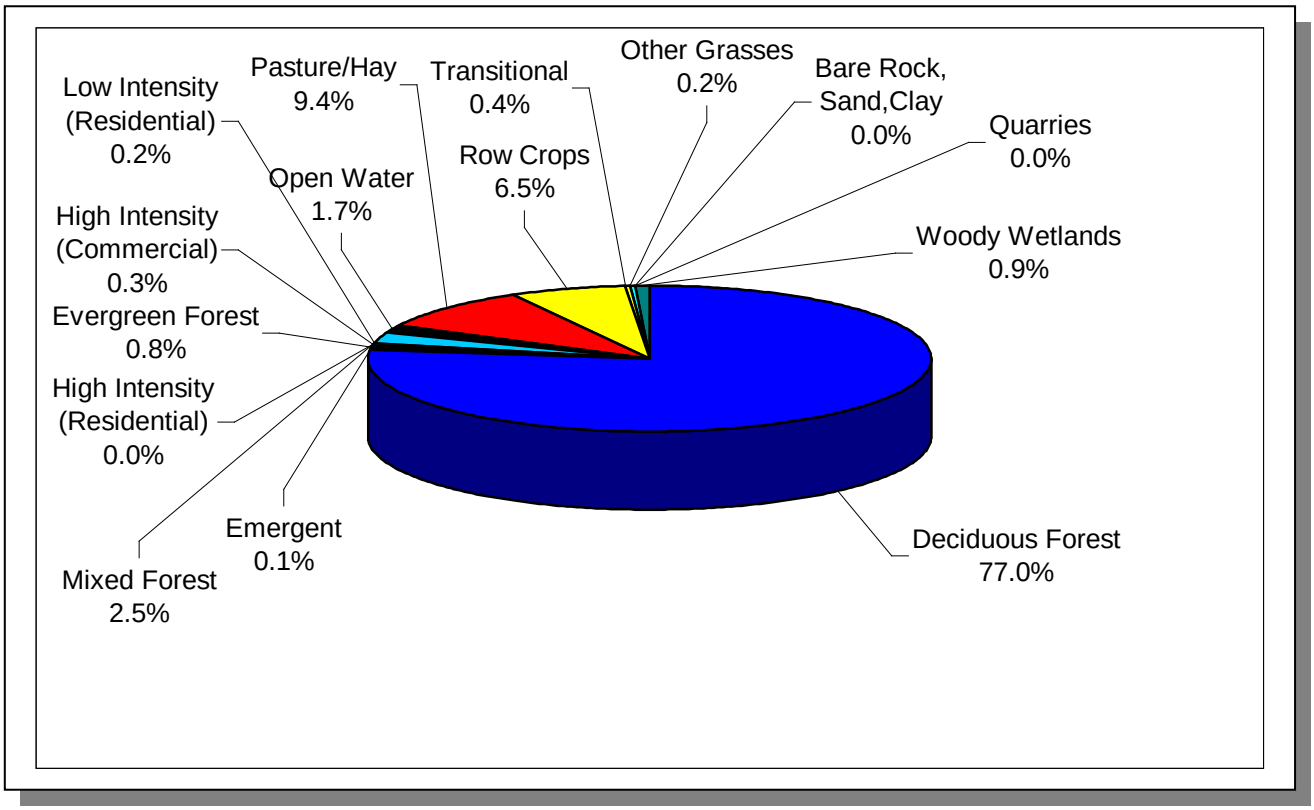


Figure 4-51. Land Use Distribution in Subwatershed 0604000305. *More information is provided in Appendix IV.*

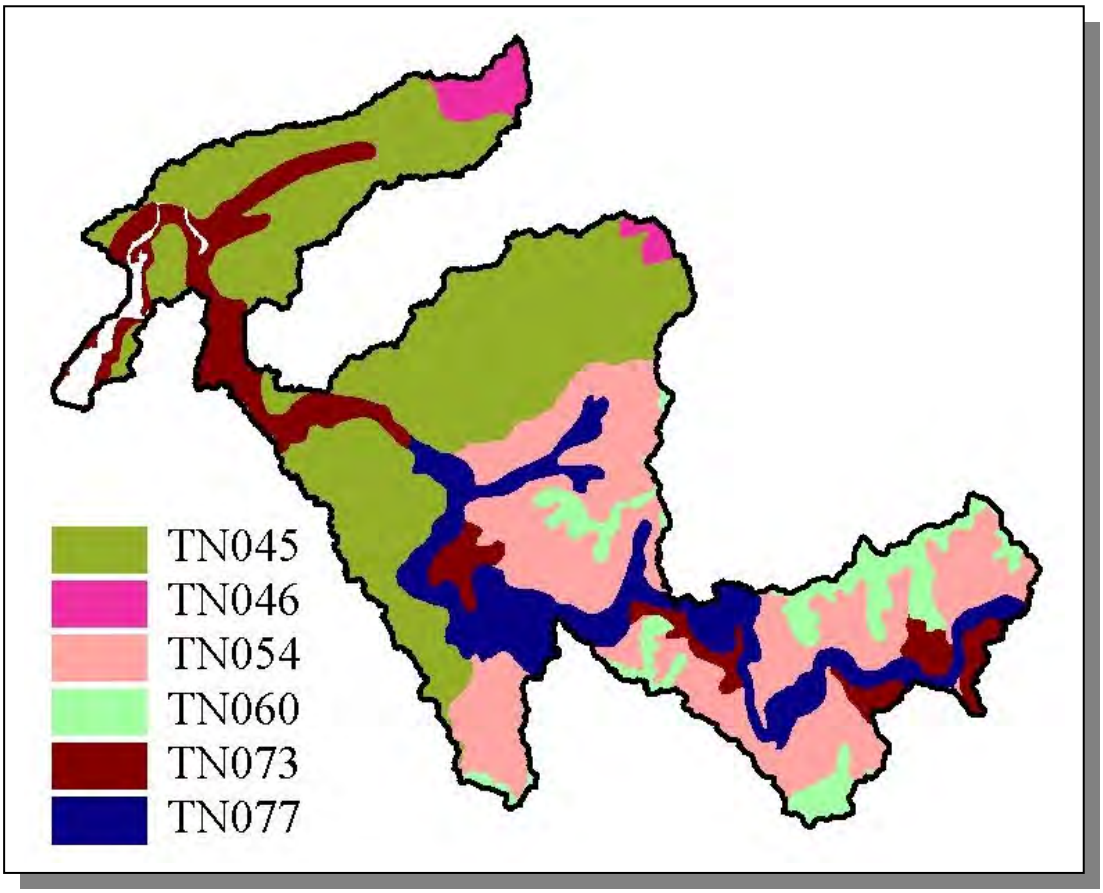


Figure 4-52. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000305.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hr)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN045	0.00	B	1.95	5.45	Loam	0.35
TN046	0.00	B	1.98	5.09	Silty Loam	0.38
TN054	0.00	C	3.04	4.84	Loam	0.32
TN060	5.00	B	1.30	5.32	Silty Loam	0.39
TN073	0.00	B	2.97	5.21	Loam	0.34
TN077	4.00	C	2.16	5.03	Loam	0.34

Table 4-25. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000305. *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)
Hickman	16,754	19,926	22,295	28.19	4,722	5,617	6,284	33.1
Humphreys	15,795	16,839	17,929	27.49	4,341	4,628	4,928	13.5
Perry	6,612	7,438	7,631	0.89	59	67	68	15.3
Totals	**39,161**	**44,203**	**47,855**		**9,122**	**10,312**	**11,280**	**23.7**

Table 4-26. Population Estimates in Subwatershed 0604000305.

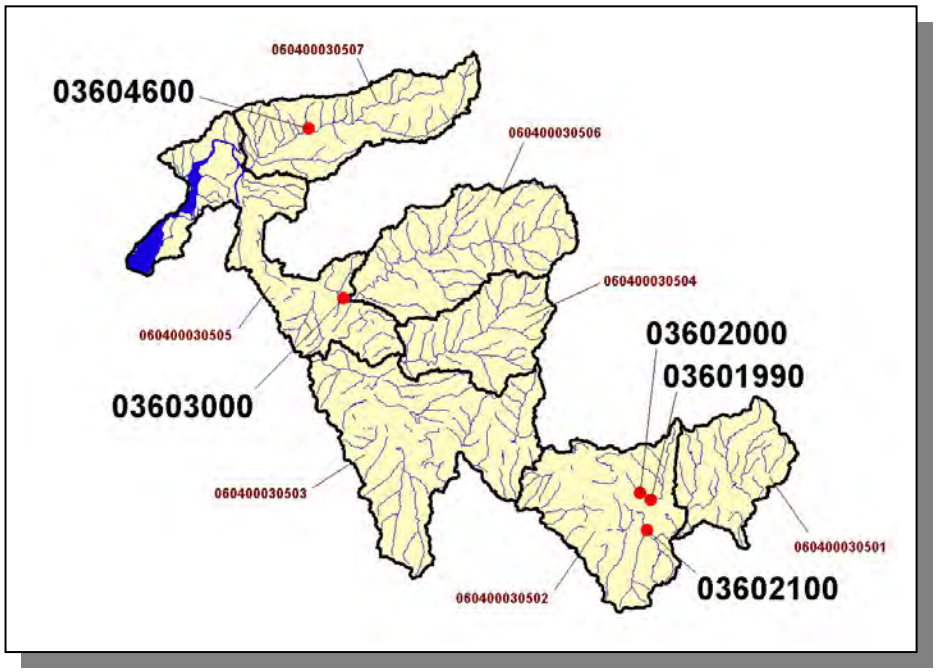


Figure 4-53. Location of Historical Streamflow Data Collection Sites in Subwatershed 0604000305. *Subwatershed 060400030501, 060400030502, 060400030503, 060400030504, 060400030505, 060400030506 and 060400030507 boundaries are shown for reference. More information is provided in Appendix IV.*

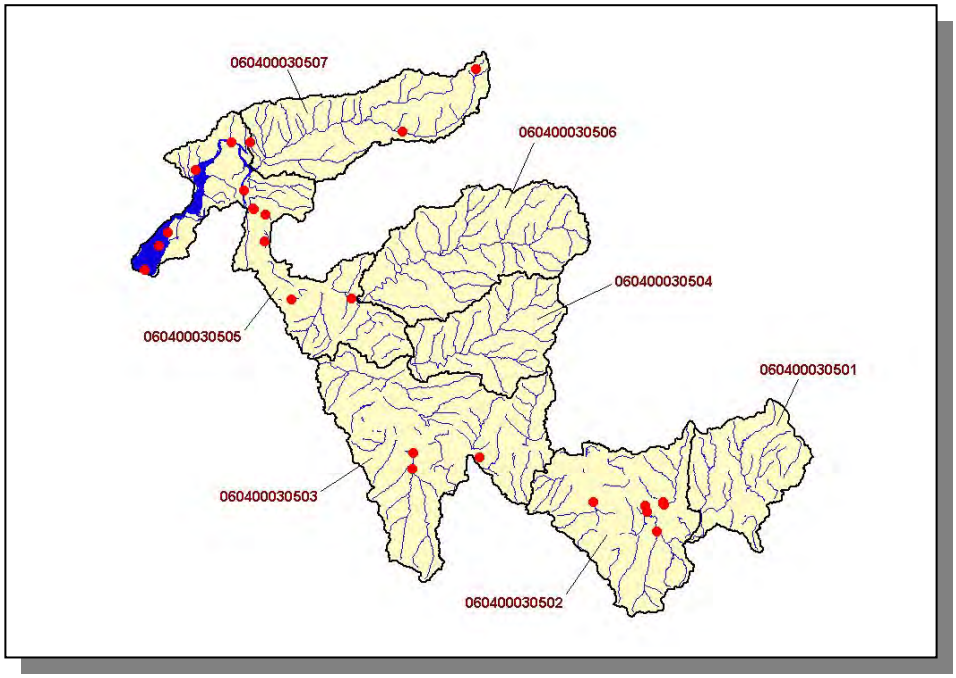


Figure 4-54. Location of STORET Monitoring Sites in Subwatershed 0604000305. *Subwatershed 060400030501, 060400030502, 060400030503, 060400030504, 060400030505, 060400030506 and 060400030507 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.E.ii. Point Source Contributions.

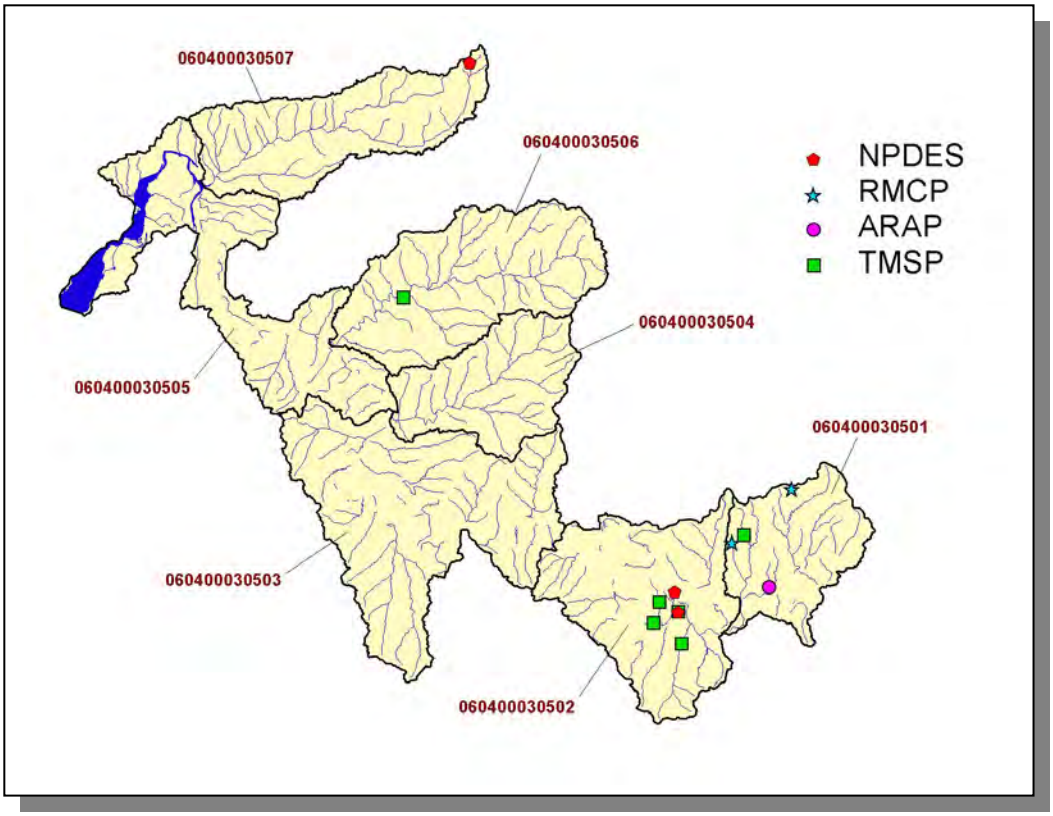


Figure 4-55. Location of NPDES Facilities in Subwatershed 0604000305. *Subwatershed 060400030501, 060400030502, 060400030503, 060400030504, 060400030505, 060400030506, and 060400030507 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

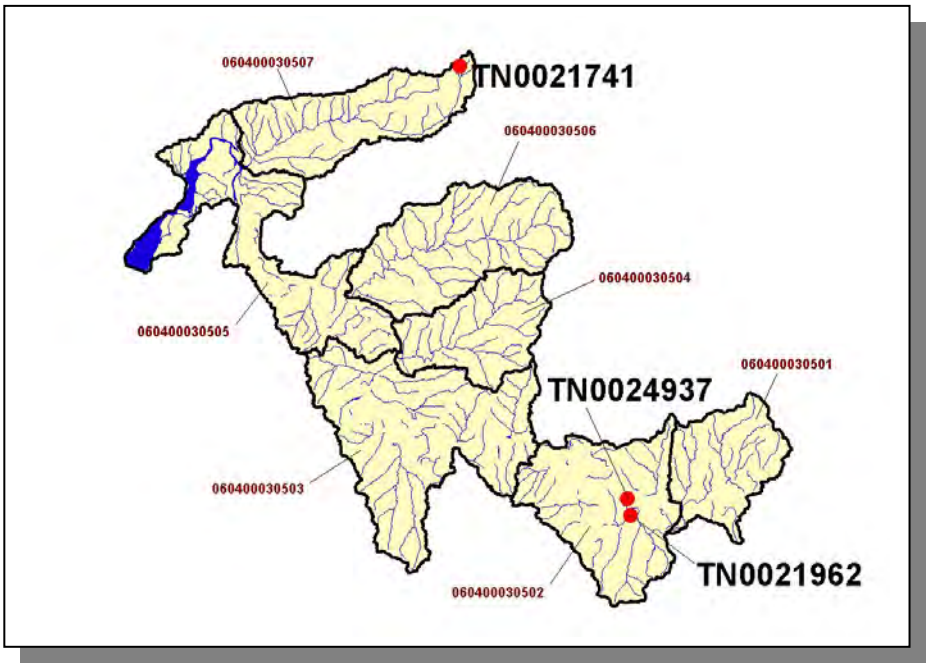


Figure 4-56. Location of NPDES Facilities in Subwatershed 0604000305. *Subwatershed 060400030501, 060400030502, 060400030503, 060400030504, 060400030505, 060400030506, and 060400030507 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

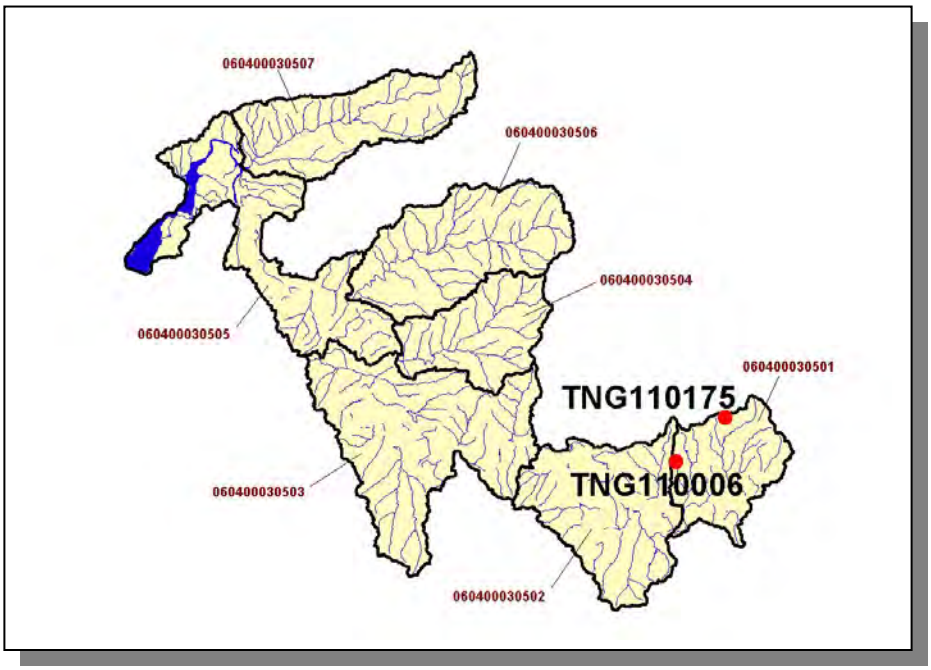


Figure 4-57. Location of Ready Mix Concrete Plants in Subwatershed 0604000305. *Subwatershed 060400030501, 060400030502, 060400030503, 060400030504, 060400030505, 060400030506, and 060400030507 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

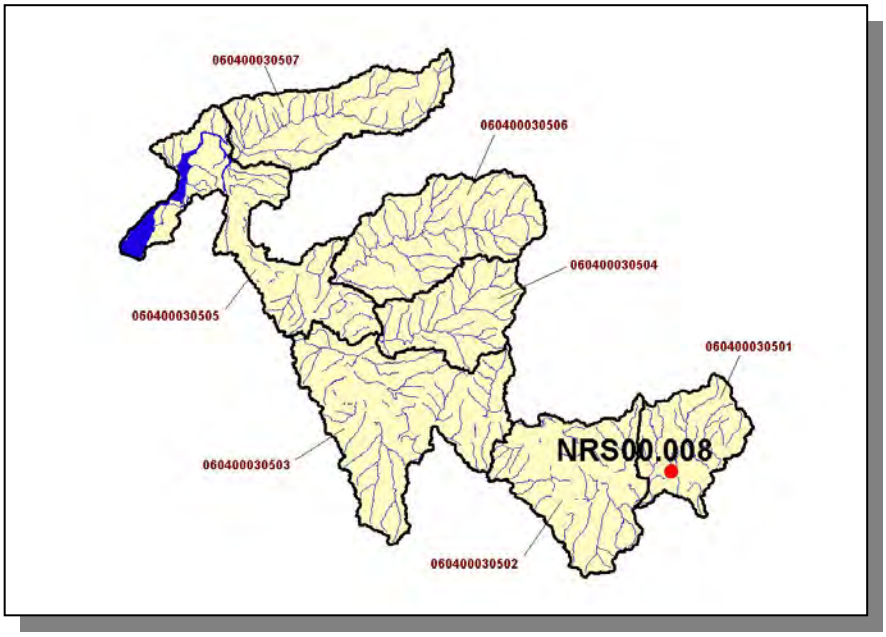


Figure 4-58. Location of ARAP Sites (Individual Permits) in Subwatershed 0604000305. *Subwatershed 060400030501, 060400030502, 060400030503, 060400030504, 060400030505, 060400030506, and 060400030507 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

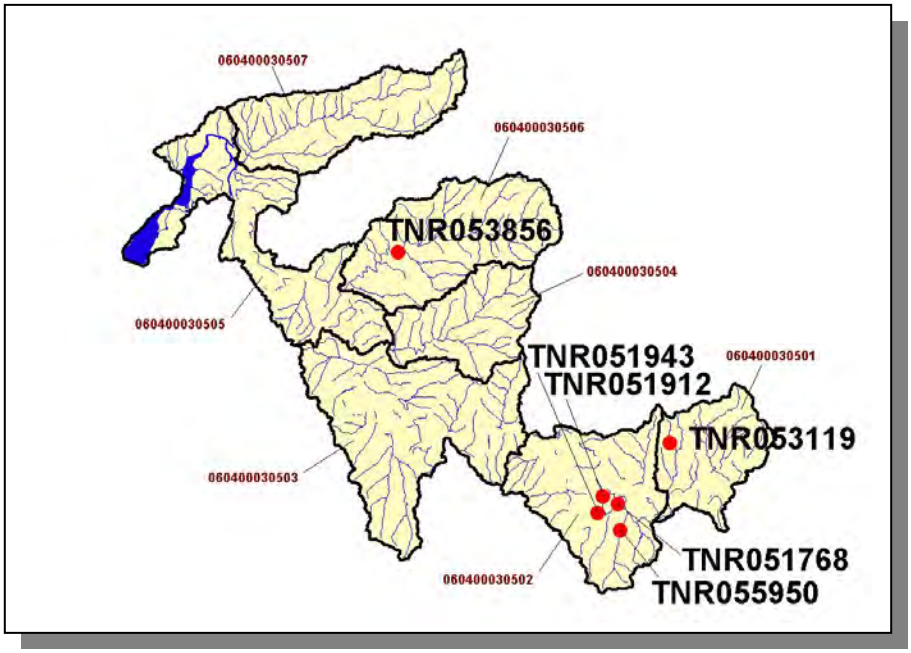


Figure 4-59. Location of TMSP Facilities in Subwatershed 0604000305. *Subwatershed 060400030501, 060400030502, 060400030503, 060400030504, 060400030505, 060400030506, and 060400030507 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

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

There is one NPDES facility discharging to water bodies listed on the 2002 303(d) list in Subwatershed 0604000305:

- TN0021741 (McEwen STP) discharges to Blue Creek @ RM 16.2

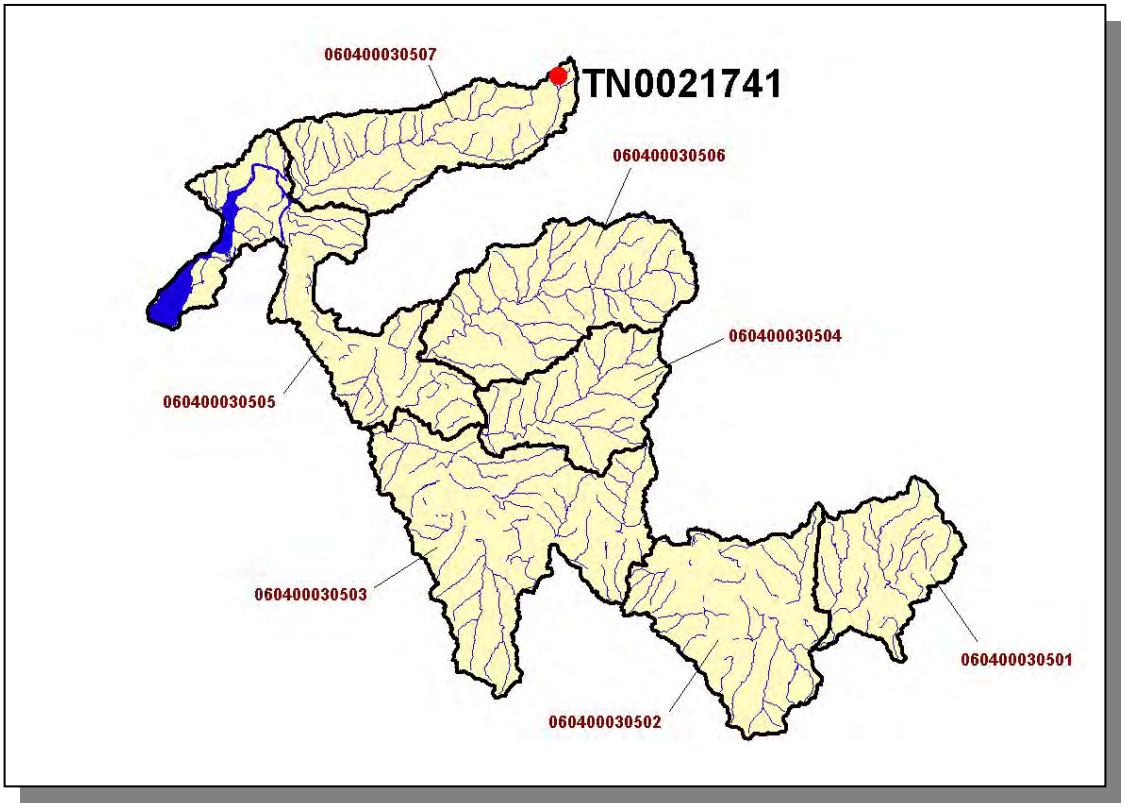


Figure 4-60. Location of NPDES Dischargers to Water Bodies Listed on the 2002 303(d) List in Subwatershed 0604000305. *Subwatershed 060400030501, 060400030502, 060400030503, 060400030504, 060400030505, 060400030506, and 060400030507 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

PERMIT #	1Q10	3Q10	7Q10	3Q20	QDESIGN
TN0021741	8.2	8.3	8.4	7.5	0.45

Table 4-27. Receiving Stream Flow Information for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000305. *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 #	$NO_2 + NO_3$	TOTAL P	TOTAL ORGANIC N
TN0021741	X	X	X

Table 4-28. Monitoring Requirements for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000305.

PERMIT #	WET	$CBOD_5$	NH_3	Pb	Cu	Se	TSS	DO	pH
TN0021741	X	X	X	X	X	X	X	X	X

Table 4-29. Parameters Monitored for Daily Maximum Limits for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000305. *WET, Whole Effluent Toxicity; $CBOD_5$, Carbonaceous Biochemical Oxygen Demand (5-Day); TSS, Total Suspended Solids.*

PERMIT #	2,4,6-TRICHLOROPHENOL
TN0021741	X

Table 4-30. Organic Parameters Monitored for Daily Maximum Limits for NPDES Dischargers to Waterbodies Listed on the 2002 303(d) List in Subwatershed 0604000305.

4.2.E.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Milk Cow	Cattle	Chickens (Layers)	Chickens Sold	Hogs	Sheep
6,077	115	11,904	21	<5	1,355	14

Table 4-31. Summary of Livestock Count Estimates in Subwatershed 0604000305. *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)
Hickman	297.2	297.2	5.8	23.0
Humphreys	241.2	241.2	3.7	14.4
Perry	223.6	223.6	5.1	22.0
Totals	**762.0**	**762.0**	**14.6**	**59.4**

Table 4-32. Forest Acreage and Annual Removal Rates (1987-1994) in Subwatershed 0604000305.

CROPS	TONS/ACRE/YEAR
Legume (Pastureland)	0.68
Grass (Pastureland)	1.28
Grass (Hayland)	0.18
Legumes (Hayland)	1.50
Legumes, Grass (Hayland)	0.19
Grass, Forbs, Legumes (Mixed Pasture)	1.06
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	24.88
Sorghum (Row Crops)	5.76
Soybeans (Row Crops)	13.83
Tobacco (Row Crops)	7.68
Conservation Reserve Program Lands	0.44
Non-Agricultural Land Use	0.00
Other Land in Farms	0.06
Farmsteads and Ranch Headquarters	0.31

Table 4-33. Annual Estimated Soil Loss in Subwatershed 0604000305.

4.2.F. 0604000306 (Big Swan Creek).

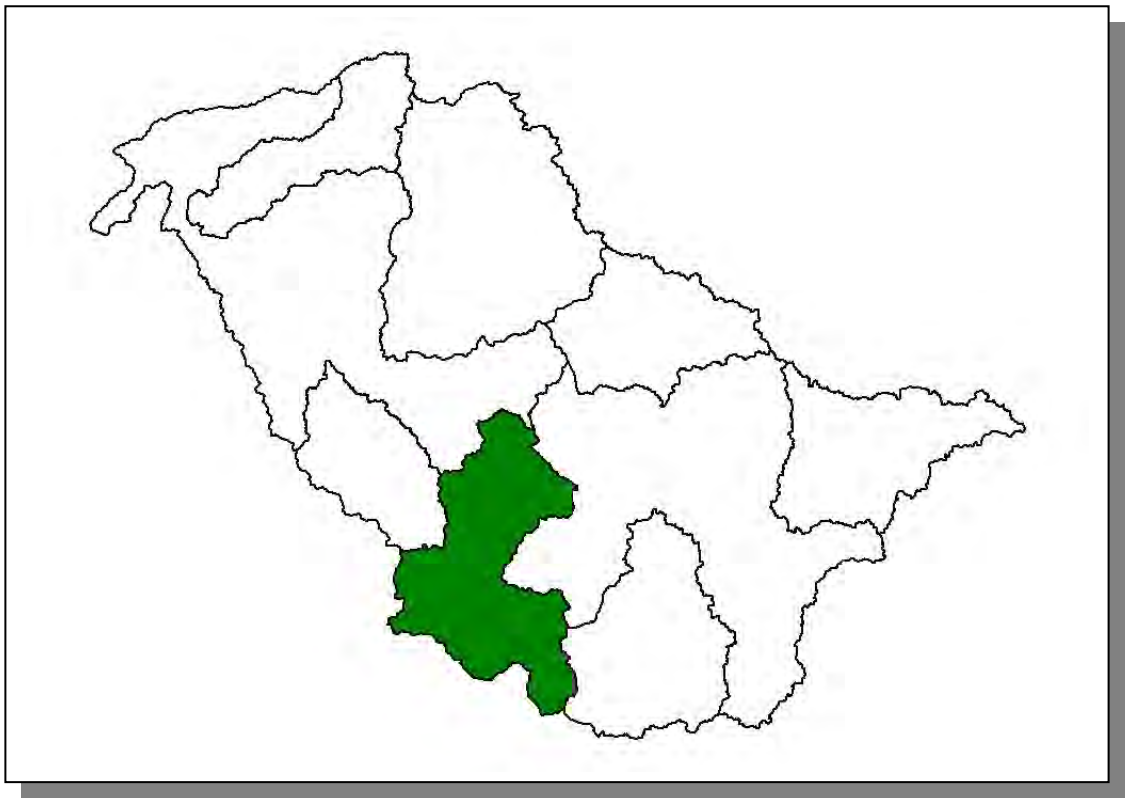


Figure 4-61. Location of Subwatershed 0604000306. *All Lower Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.F.i. General Description.

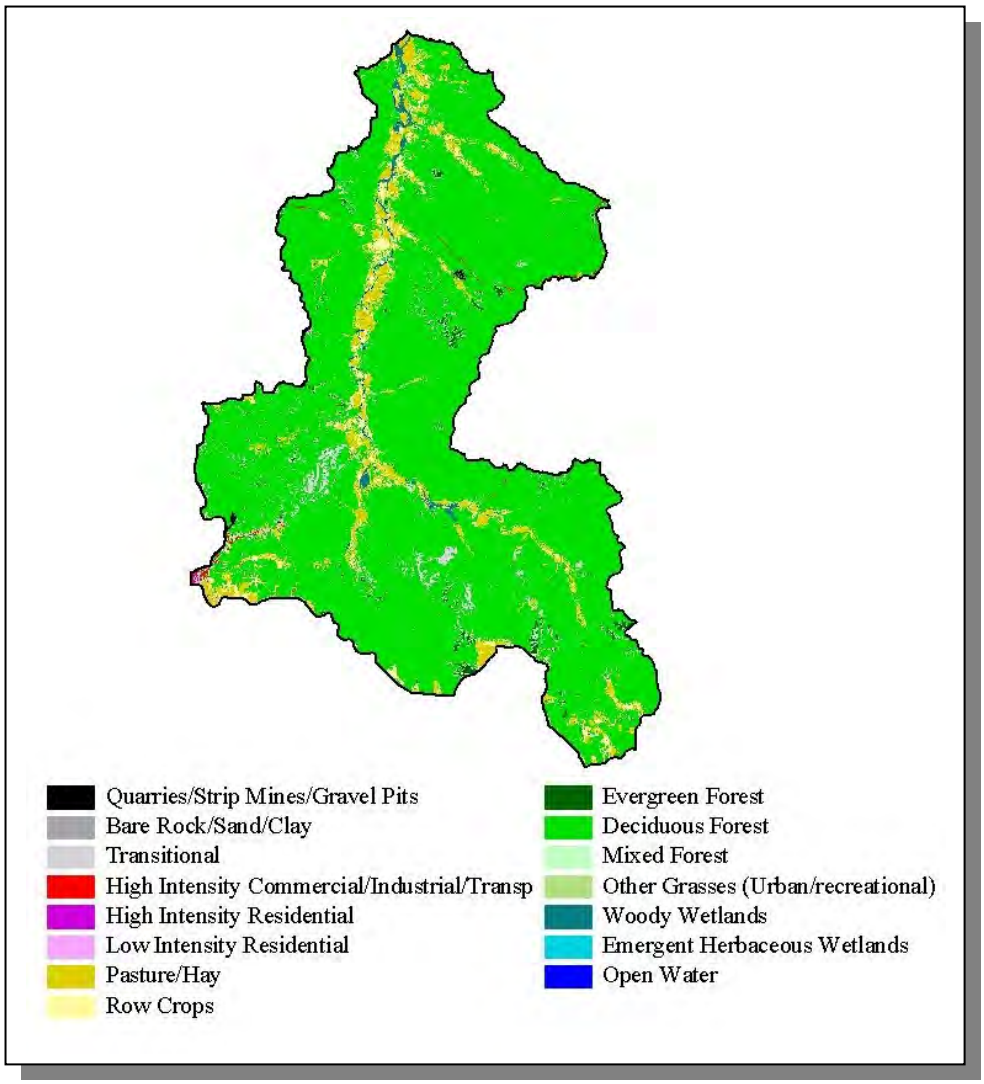


Figure 4-62. Illustration of Land Use Distribution in Subwatershed 0604000306.

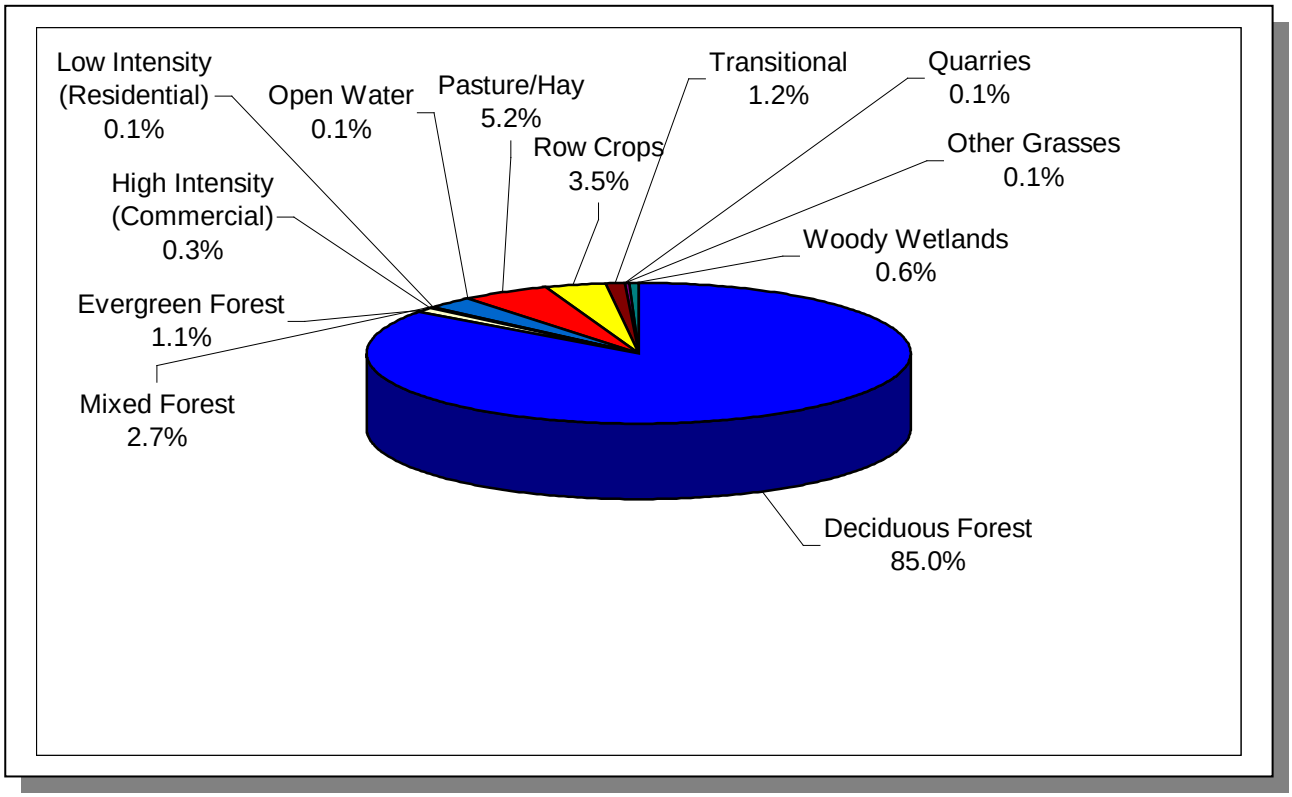


Figure 4-63. Land Use Distribution in Subwatershed 0604000306. *More information is provided in Appendix IV.*

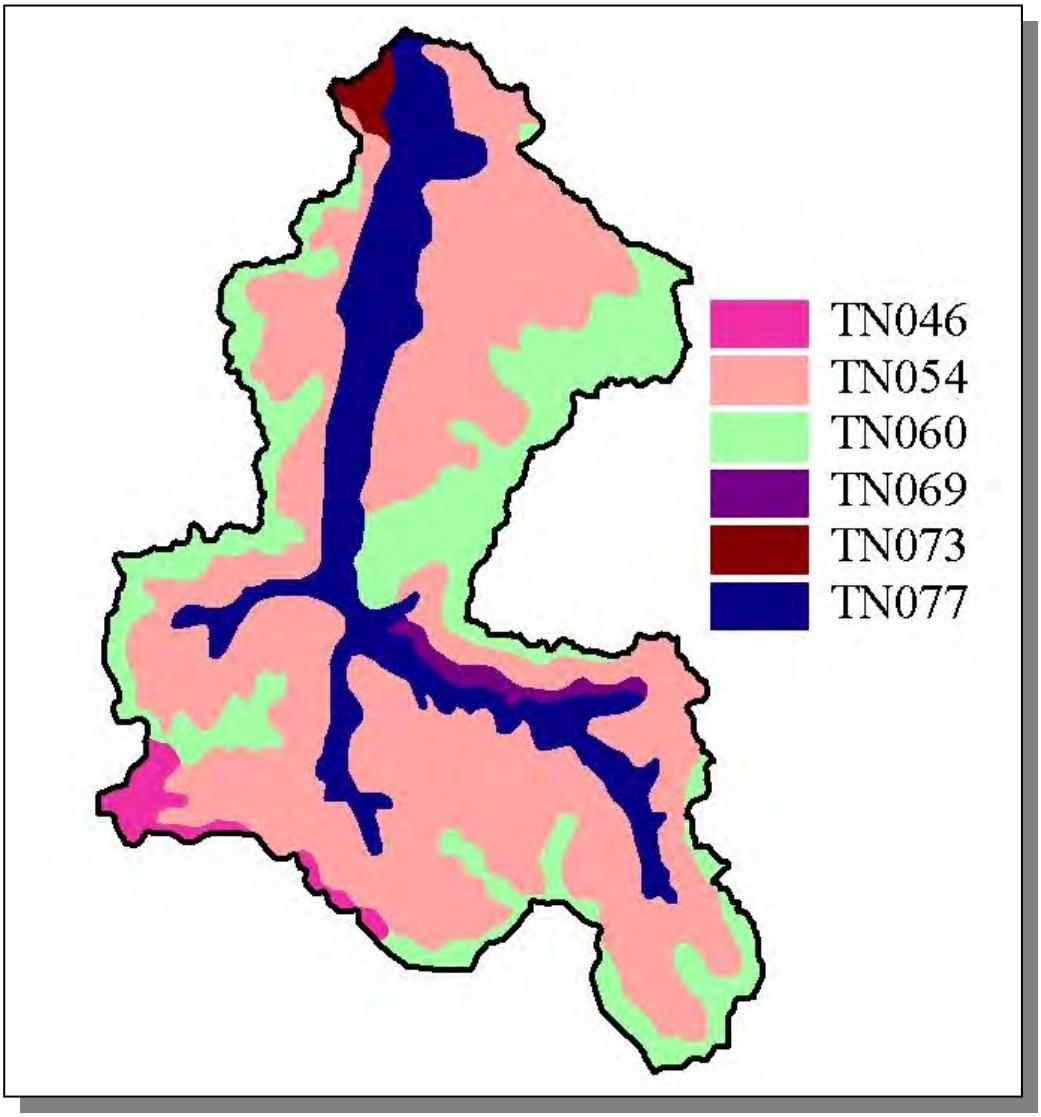


Figure 4-64. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000306.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hr)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN046	0.00	B	1.98	5.09	Silty Loam	0.38
TN054	0.00	C	3.04	4.84	Loam	0.32
TN060	5.00	B	1.30	5.32	Silty Loam	0.39
TN069	0.00	C	2.06	5.36	Loam	0.34
TN073	0.00	B	2.97	5.21	Loam	0.34
TN077	4.00	C	2.16	5.03	Loam	0.34

Table 4-34. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000306. *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)
Hickman	16,754	19,926	22,295	9.30	1,559	1,854	2,074	33.0
Lawrence	35,303	39,095	39,926	0.24	86	95	97	12.8
Lewis	9,247	10,789	11,367	33.71	3,118	3,637	3,832	22.9
Maury	54,812	68,268	69,498	0.09	52	65	66	26.9
Totals	**116,116**	**138,078**	**143,086**		**4,815**	**5,651**	**6,089**	**26.0**

Table 4-35. Population Estimates in Subwatershed 0604000306.

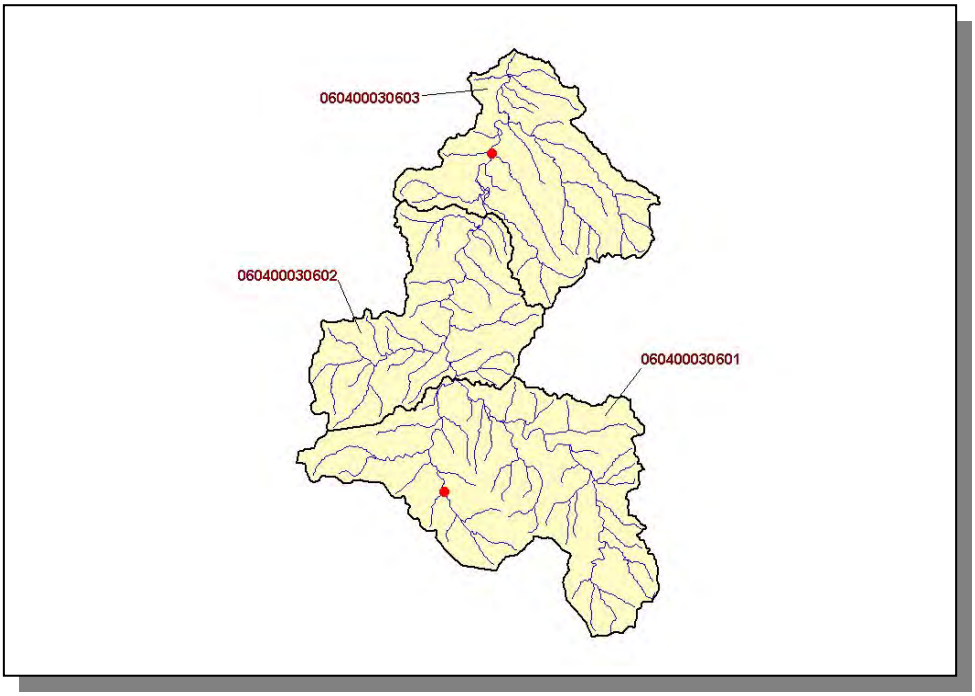


Figure 4-65. Location of STORET Monitoring Sites in Subwatershed 0604000306. *Subwatershed 060400030601, 060400030602, and 060400030603 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.F.ii. Point Source Contributions.

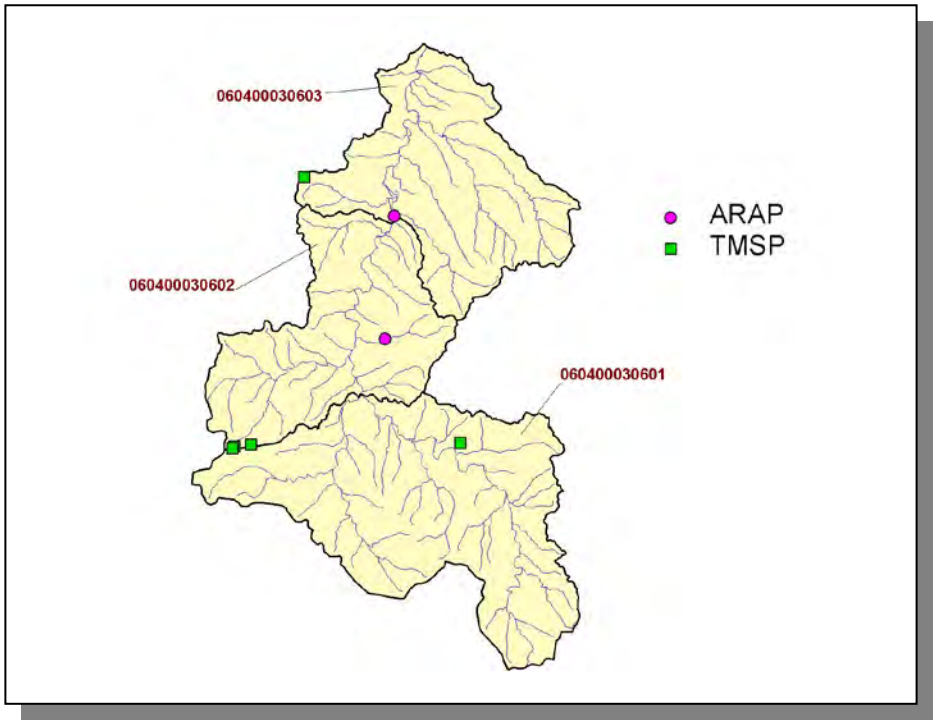


Figure 4-66. Location of Active Point Source Facilities in Subwatershed 0604000306. *Subwatershed 060400030601, 060400030602 and 060400030603 boundaries are shown for reference. More information is provided in Appendix IV.*

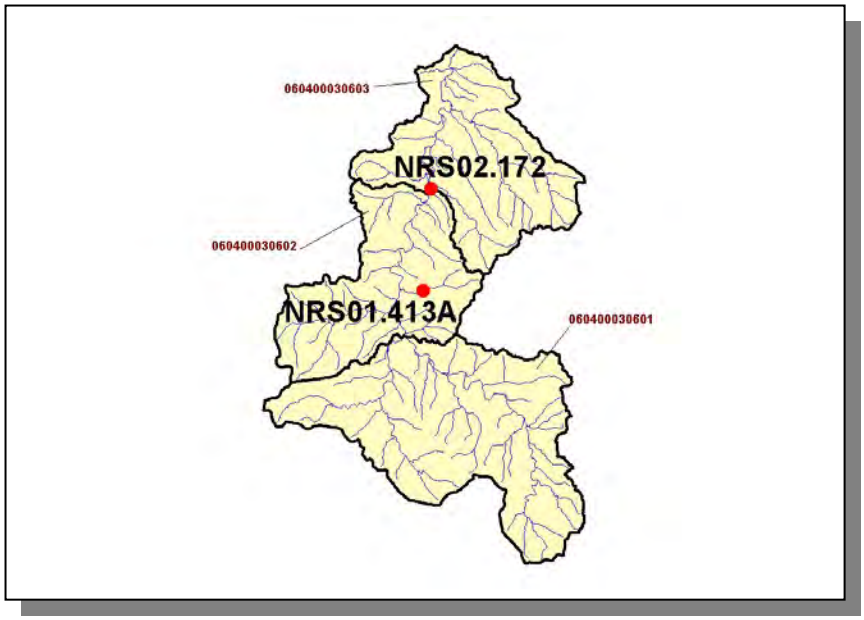


Figure 4-67. Location of ARAP Sites (Individual Permits) in Subwatershed 0604000306. *Subwatershed 060400030601, 060400030602 and 060400030603 boundaries are shown for reference. More information is provided in Appendix IV.*

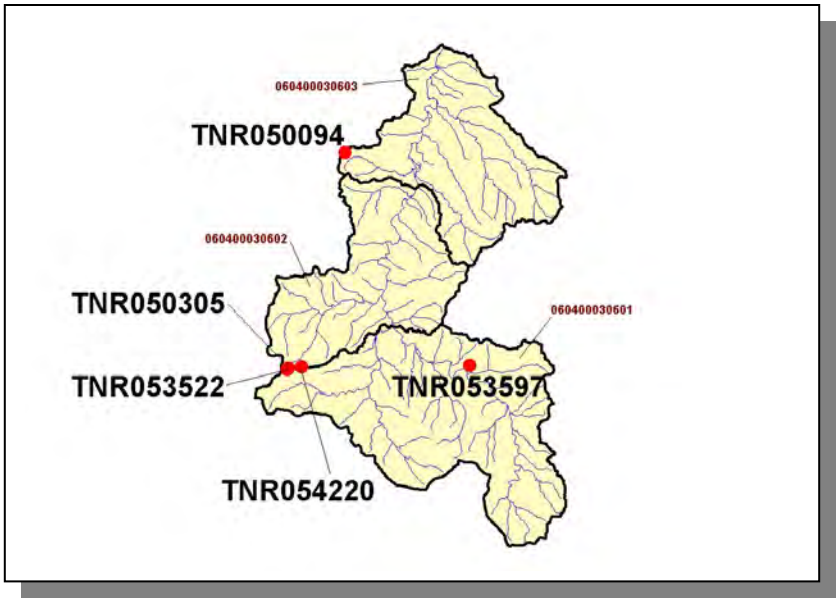


Figure 4-68. Location of TMSP Facilities in Subwatershed 0604000306. *Subwatershed 060400030601, 060400030602 and 060400030603 boundaries are shown for reference. More information is provided in Appendix IV.*

4.2.F.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Milk Cow	Cattle	Chickens (Layers)	Chickens Sold	Hogs	Sheep
1,774	24	3,240	6	<5	653	18

Table 4-36. Summary of Livestock Count Estimates in Subwatershed 0604000306. *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)
Hickman	297.2	297.2	5.8	23.0
Lawrence	199.8	199.8	6.6	27.1
Lewis	158.0	158.0	4.0	10.2
Total	**655.0**	**655.0**	**16.4**	**60.3**

Table 4-37. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 0604000306.

CROPS	TONS/ACRE/YEAR
Legume (Pastureland)	0.68
Grass (Pastureland)	1.45
Grass (Hayland)	0.21
Legumes (Hayland)	1.05
Legumes, Grass (Hayland)	0.31
Grass, Forbs, Legumes (Mixed Pasture)	0.53
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	5.21
Cotton (Row Crops)	8.07
Soybeans (Row Crops)	5.98
Tobacco (Row Crops)	7.68
All Other Row Crops	11.45
Wheat (Close-Grown Cropland)	14.15
All Other Close-Grown Cropland	1.80
Other Cropland not Planted	0.88
Conservation Reserve Program Lands	0.47
Non-Agricultural Land Use	0.00
Farmsteads and Ranch Headquarters	0.19

Table 4-38. Annual Estimated Total Soil Loss in Subwatershed 0604000306.

4.2.G. 0604000307 (Piney River).

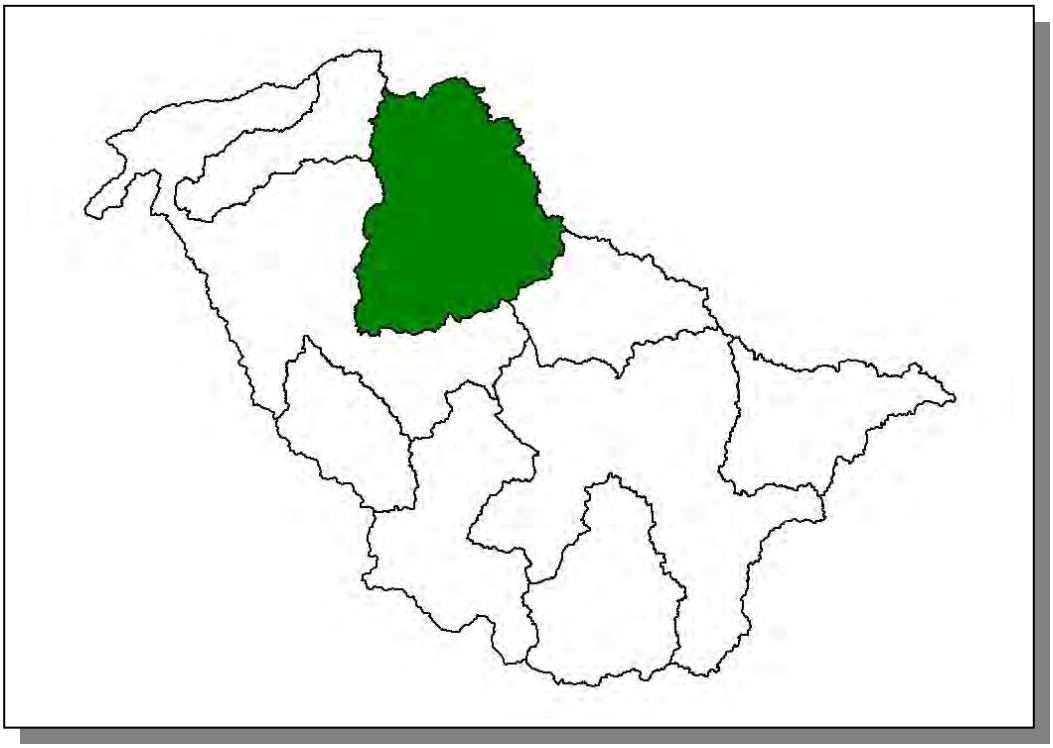


Figure 4-69. Location of Subwatershed 0604000307. *All Lower Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.G.i. General Description.

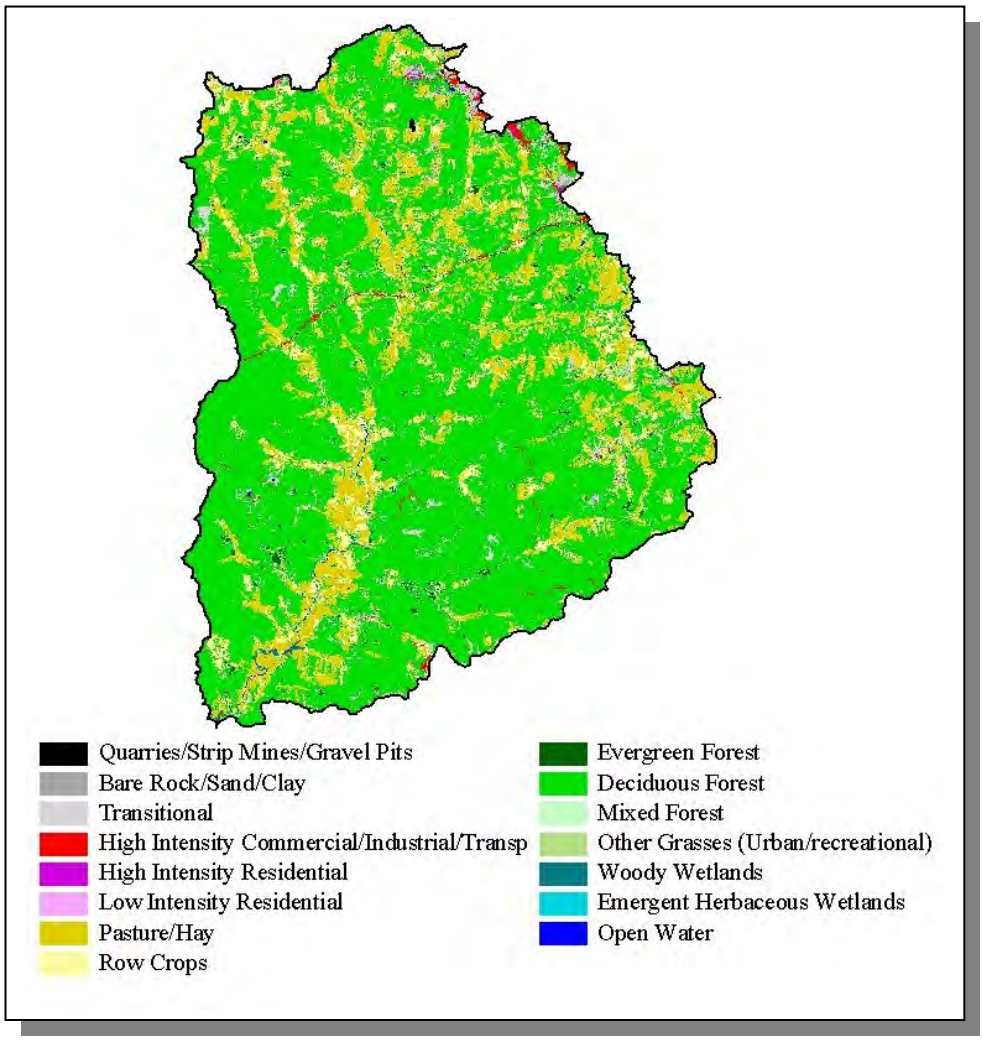


Figure 4-70. Illustration of Land Use Distribution in Subwatershed 0604000307.

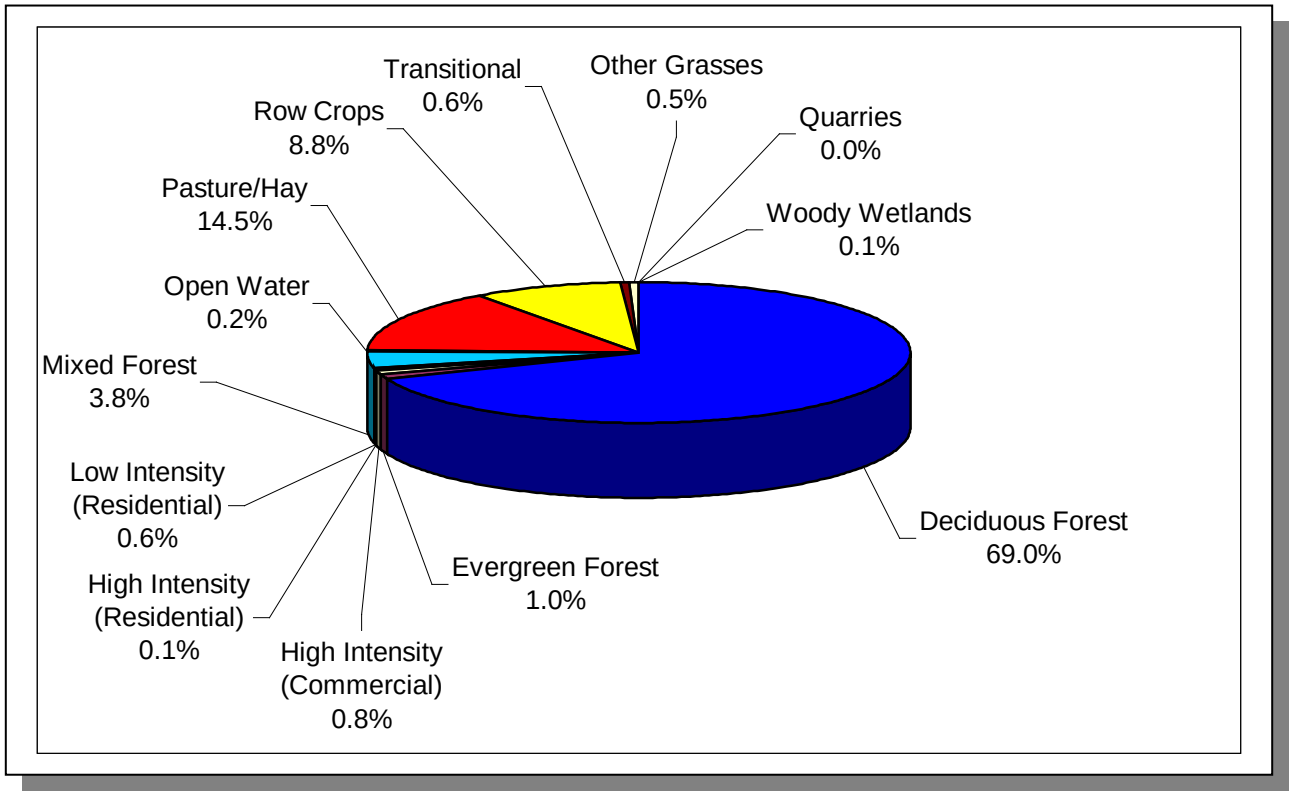


Figure 4-71. Land Use Distribution in Subwatershed 0604000307. *More information is provided in Appendix IV.*

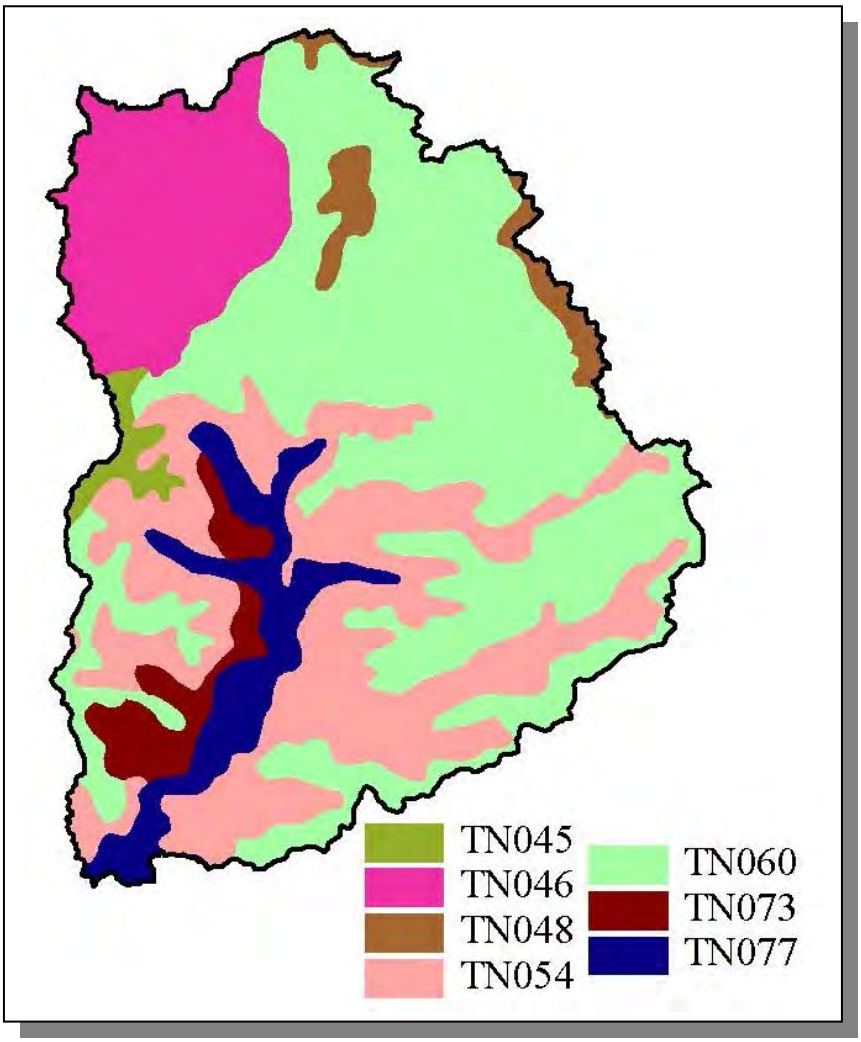


Figure 4-72. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000307.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hr)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN045	0.00	B	1.95	5.45	Loam	0.35
TN046	0.00	B	1.98	5.09	Silty Loam	0.38
TN048	8.00	C	1.38	5.06	Silty Loam	0.42
TN054	0.00	C	3.04	4.84	Loam	0.32
TN060	5.00	B	1.30	5.32	Silty Loam	0.39
TN073	0.00	B	2.97	5.21	Loam	0.34
TN077	4.00	C	2.16	5.03	Loam	0.34

Table 4-39. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000307. *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)
Dickson	35,061	40,937	43,156	15.79	5,536	6,464	6,814	23.1
Hickman	16,754	19,926	22,295	23.6	3,954	4,702	5,261	33.1
Humphreys	15,795	16,839	17,929	0.16	25	26	28	12.0
Totals	**67,610**	**77,702**	**83,380**		**9,515**	**11,192**	**12,103**	**27.2**

Table 4-40. Population Estimates in Subwatershed 0604000307.

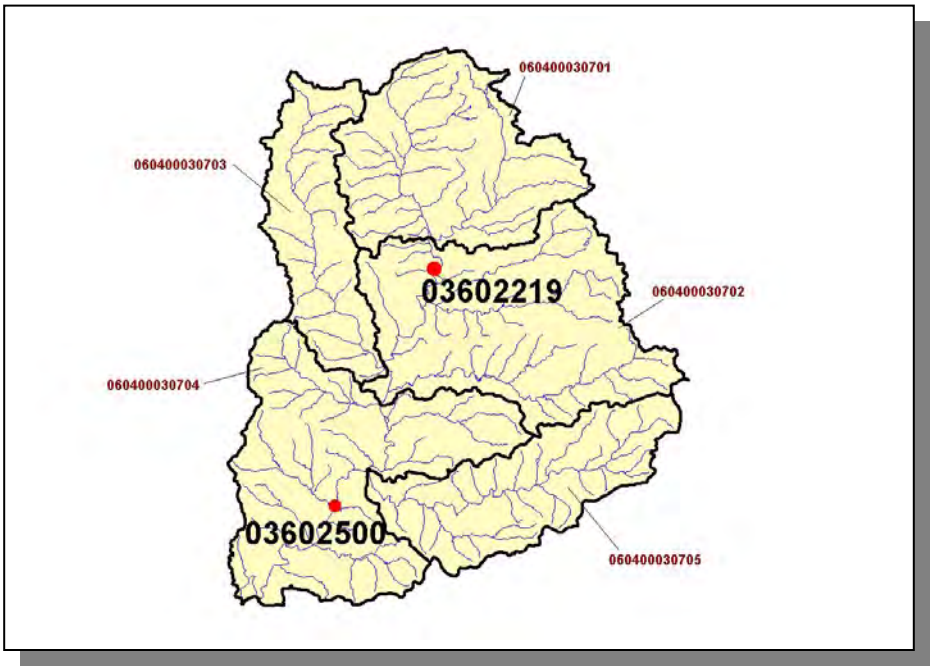


Figure 4-73. Location of Historical Streamflow Data Collection Sites in Subwatershed 0604000307. *Subwatershed 060400030701, 060400030702, 060400030703, 060400030704, and 060400030705 boundaries are shown for reference. More information is provided in Appendix IV.*

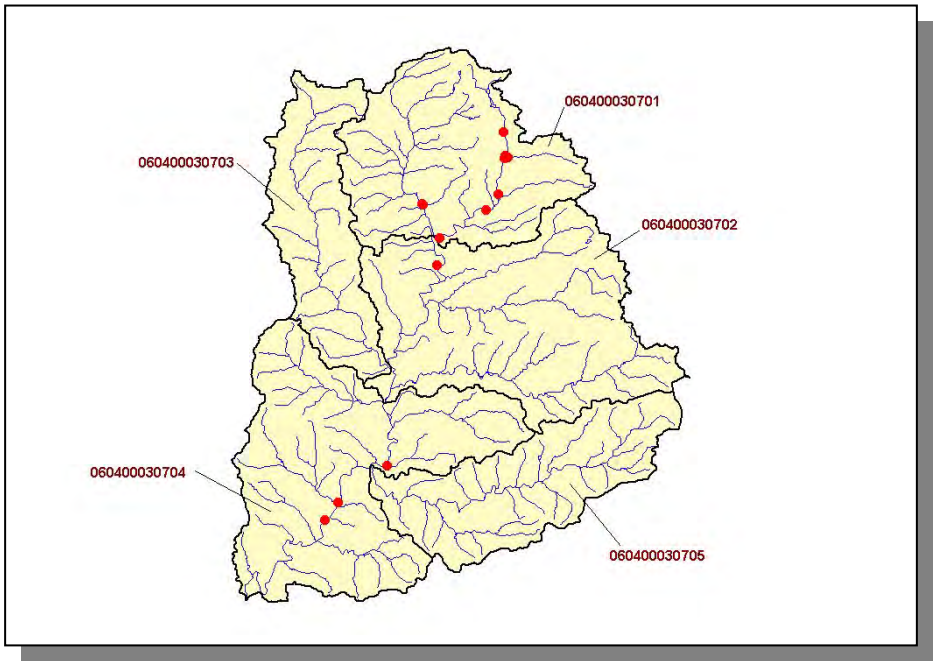


Figure 4-74. Location of STORET Monitoring Sites in Subwatershed 0604000307. *Subwatershed 060400030701, 060400030702, 060400030703, 060400030704, and 060400030705 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.G.ii. Point Source Contributions.

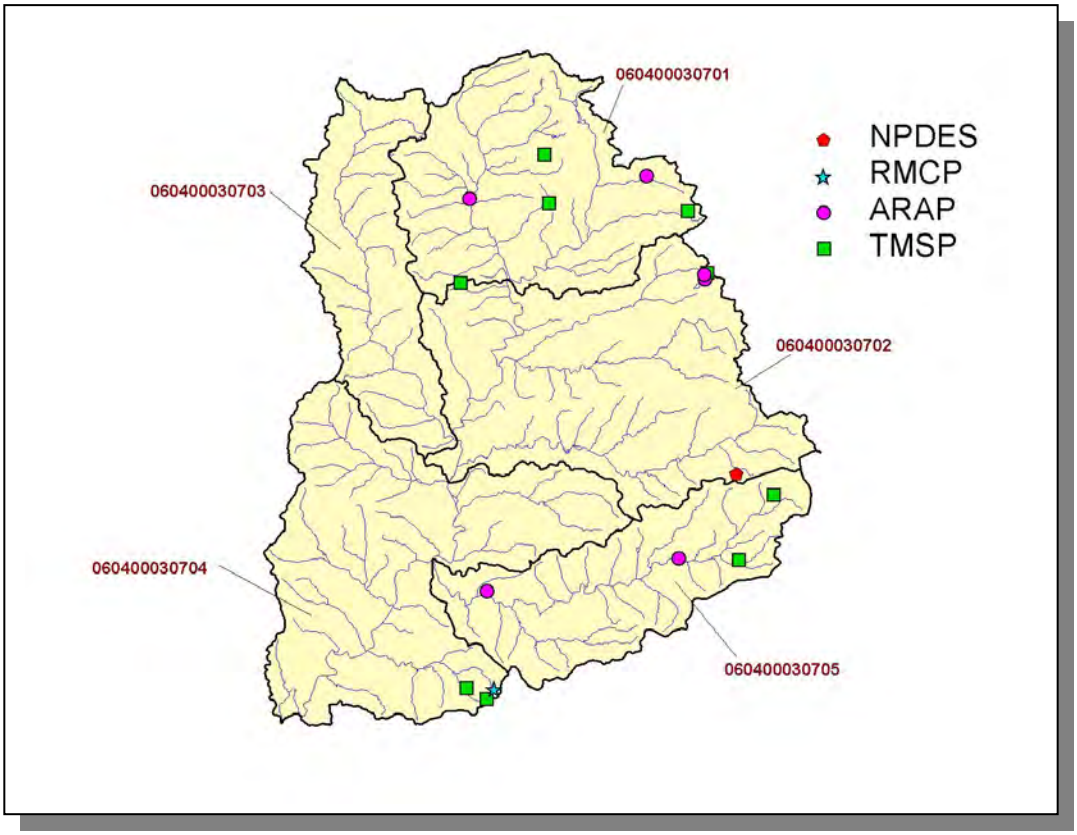


Figure 4-75. Location of Active Point Source Facilities in Subwatershed 0604000307. *Subwatershed 0604000307, 0604000307, 0604000307, 0604000307, and 0604000307 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

Figure 4-76. Location of NPDES Facilities in Subwatershed 0604000307. *Subwatershed 0604000307, 0604000307, 0604000307, 0604000307, and 0604000307 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

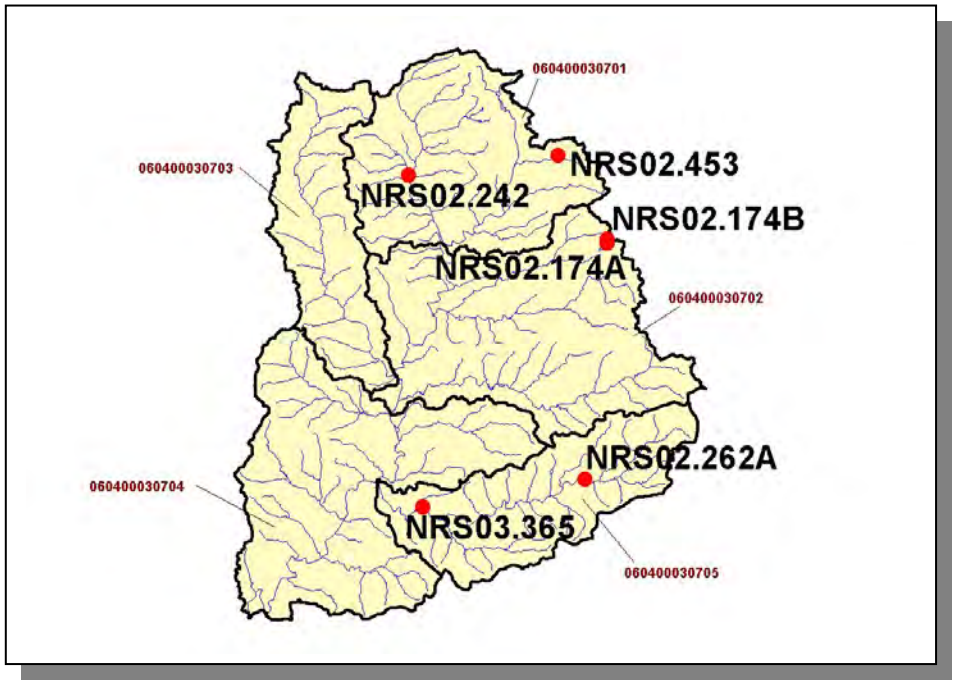


Figure 4-77. Location of Ready Mix Concrete Plants in Subwatershed 0604000307. *Subwatershed 0604000307, 0604000307, 0604000307, 0604000307, and 0604000307 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

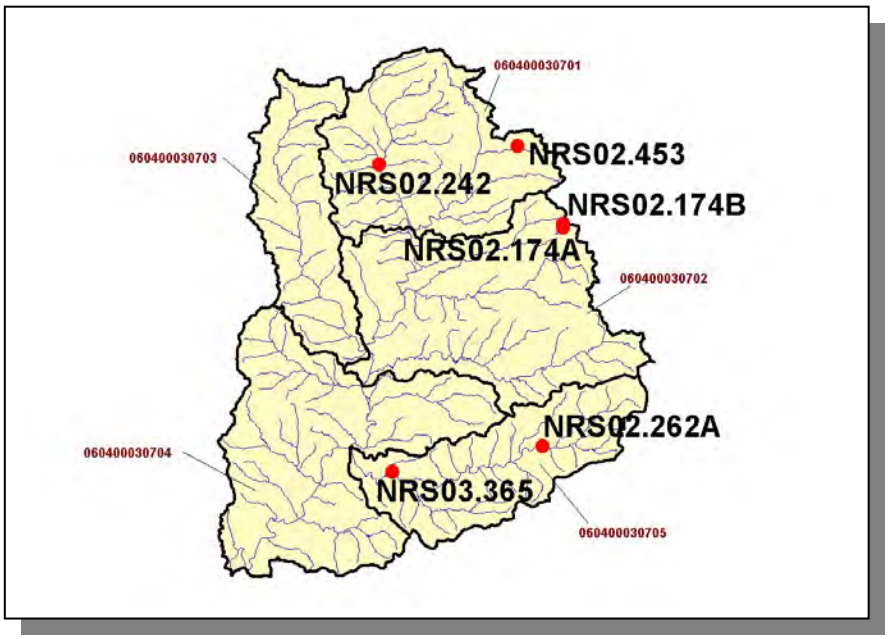


Figure 4-78. Location of ARAP Sites (Individual Permits) in Subwatershed 0604000307. *Subwatershed 0604000307, 0604000307, 0604000307, 0604000307, and 0604000307 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

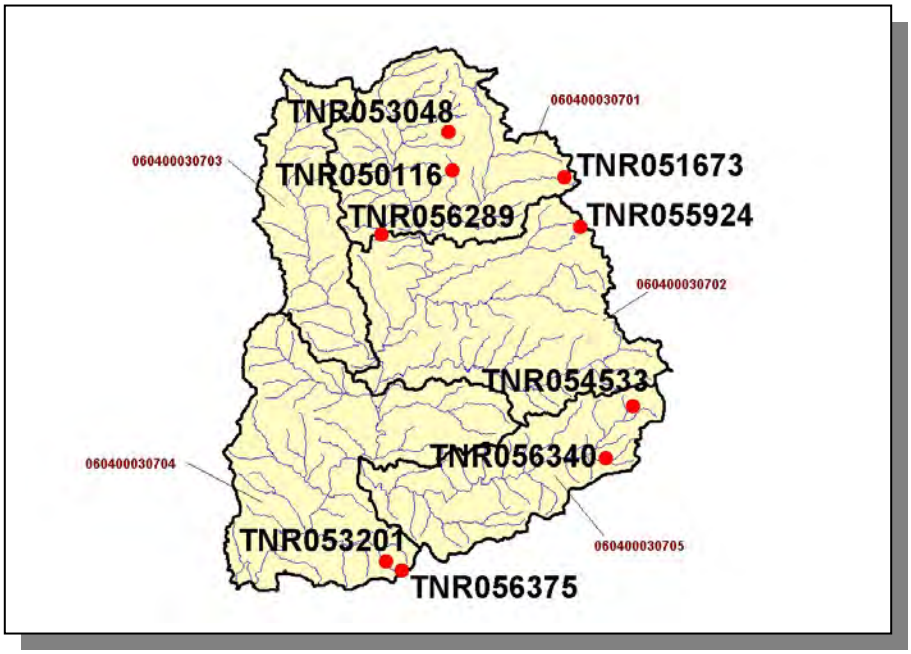


Figure 4-79. Location of TMSP Facilities in Subwatershed 0604000307. *Subwatershed 0604000307, 0604000307, 0604000307, 0604000307, and 0604000307 boundaries are shown for reference. More information, including the names of facilities, is provided in Appendix IV.*

4.2.G.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens (Layers)	Chickens (Broilers Sold)	Hogs	Sheep
3,458	12,964	18	26	75	1,534	21

Table 4-41. Summary of Livestock Count Estimates in Subwatershed 0604000307. *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)
Dickson	174.3	174.3	1.8	7.7
Hickman	297.2	297.2	5.8	23.0
Humphreys	241.2	241.2	3.7	14.4
Totals	**712.7**	**712.7**	**11.3**	**45.1**

Table 4-42. Forest Acreage and Average Removal Rates (1987-1994) in Subwatershed 0604000307.

CROPS	TONS/ACRE/YEAR
Legume (Pastureland)	0.68
Grass (Pastureland)	1.00
Grass (Hayland)	0.25
Legumes (Hayland)	1.06
Legumes, Grass (Hayland)	0.40
Grass, Forbs, Legumes (Mixed Pasture)	0.81
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	3.16
Sorgham (Row Crops)	5.80
Soybeans (Row Crops)	5.46
Tobacco (Row Crops)	7.68
Vineyard (Horticulture)	1.05
Other Vegetable and Truck Crop	7.71
Conservation Reserve Program Lands	0.51
Non-Agricultural Land Use	0.00
Other Land in Farms	0.03
Farmsteads and Ranch Headquarters	1.38

Table 4-43. Annual Estimated Total Soil Loss in Subwatershed 0604000307.

4.2.H. 0604000308 (Beaverdam Creek).

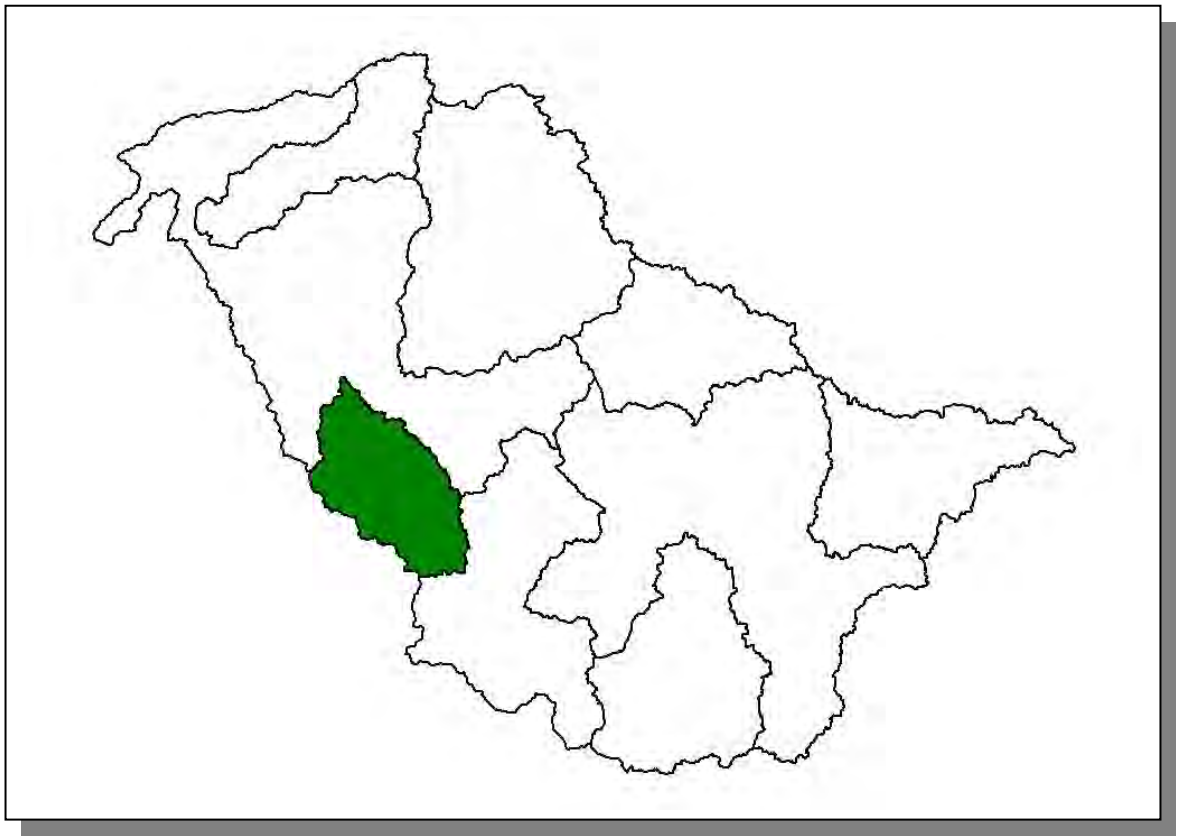


Figure 4-80. Location of Subwatershed 0604000308. *All Lower Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.H.i. General Description.

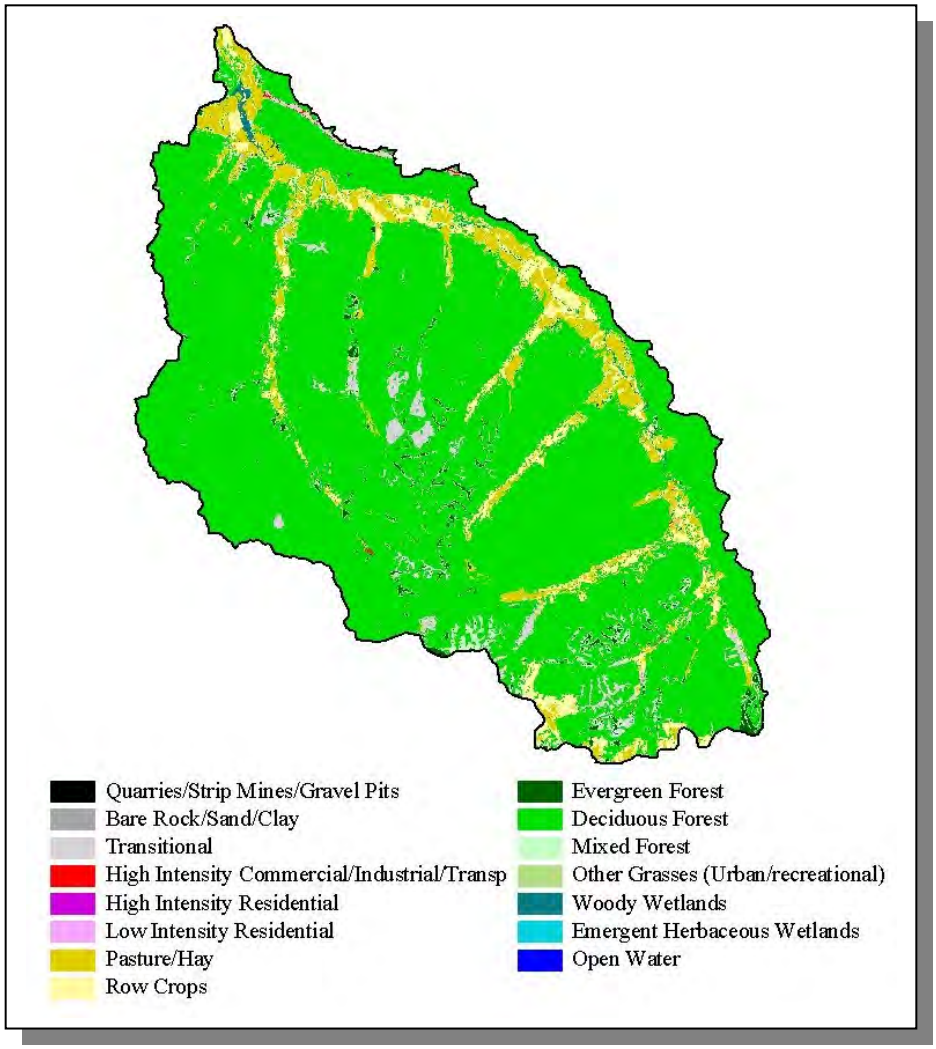


Figure 4-81. Illustration of Land Use Distribution in Subwatershed 0604000308.

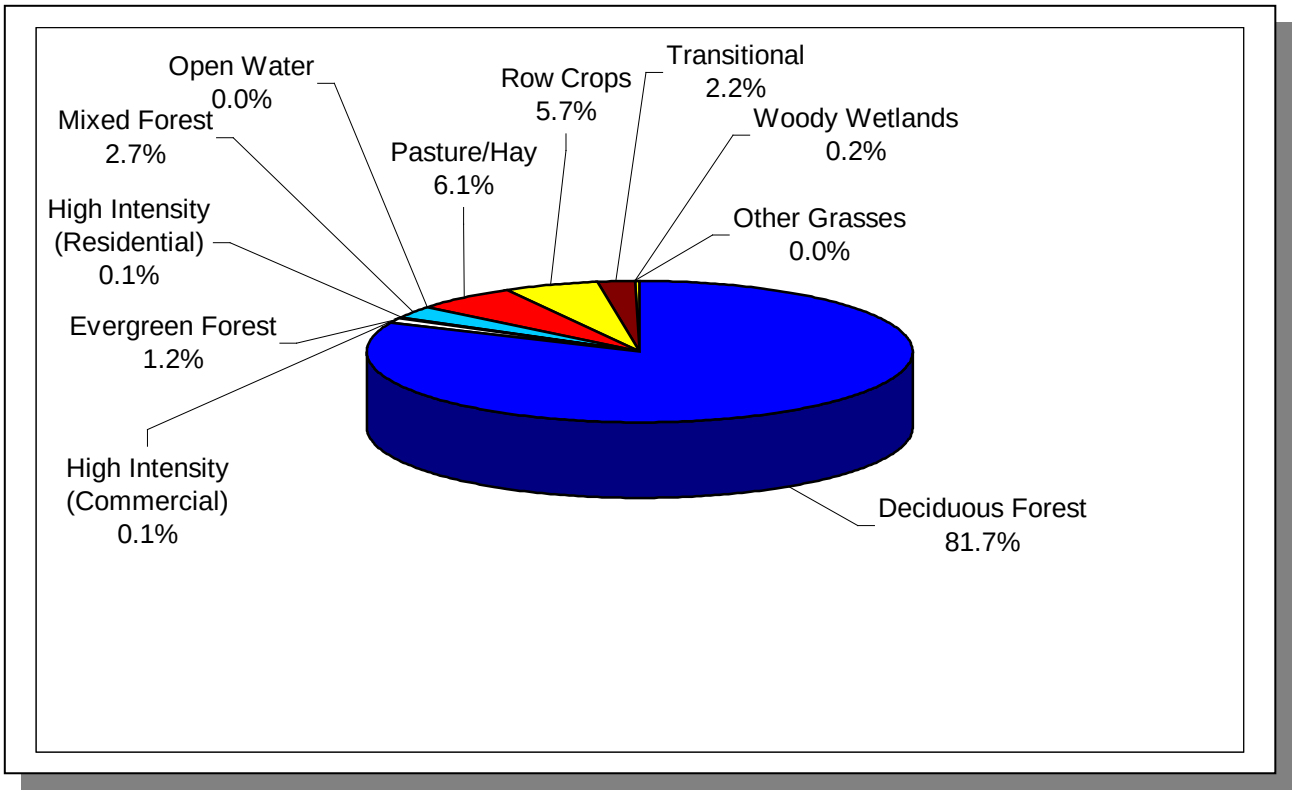


Figure 4-82. Land Use Distribution in Subwatershed 0604000308. *More information is provided in Appendix IV.*

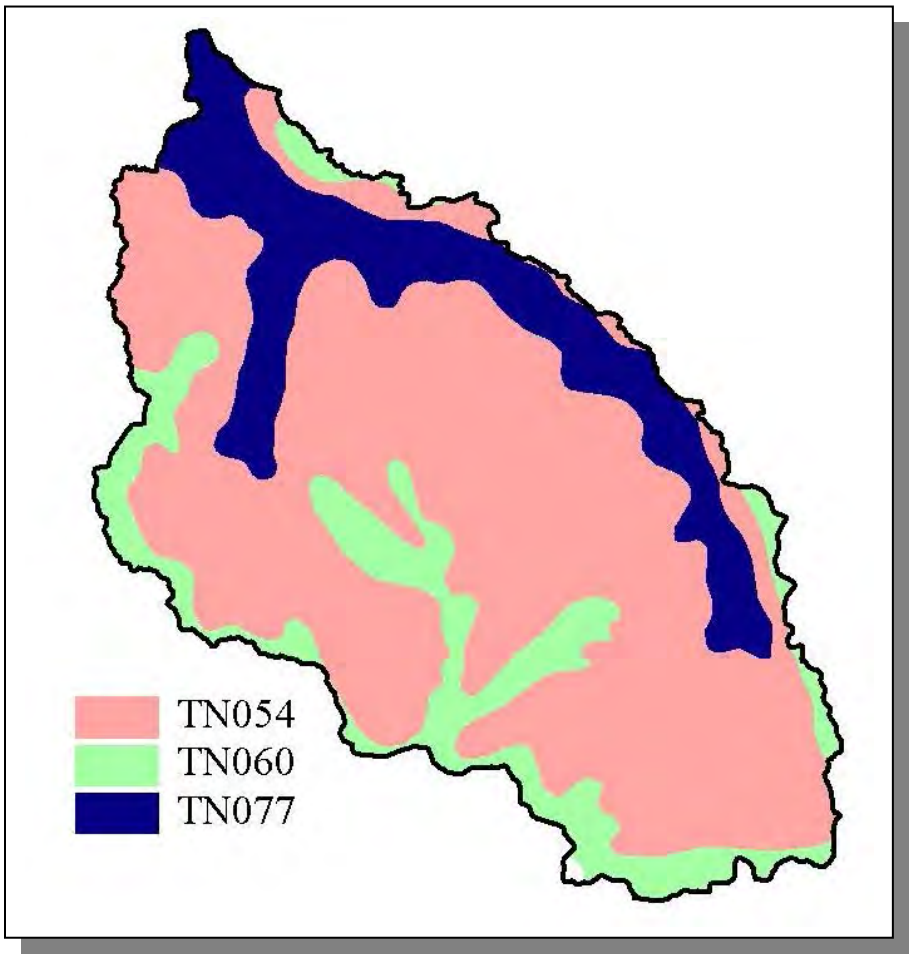


Figure 4-83. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000308.

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
TN060	5.00	B	1.30	5.32	Silty Loam	0.39
TN077	4.00	C	2.16	5.03	Loam	0.34

Table 4-44. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000308. *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)
Hickman	16,754	19,926	22,295	12.42	2,081	2,475	2,770	33.1
Lewis	9,247	10,789	11,367	1.75	162	189	199	22.8
Totals	**26,001**	**30,715**	**33,662**		**2,243**	**2,664**	**2.969**	**32.4**

Table 4-45. Population Estimates in Subwatershed 0604000308.

4.2.H.ii. Point Source Contributions.

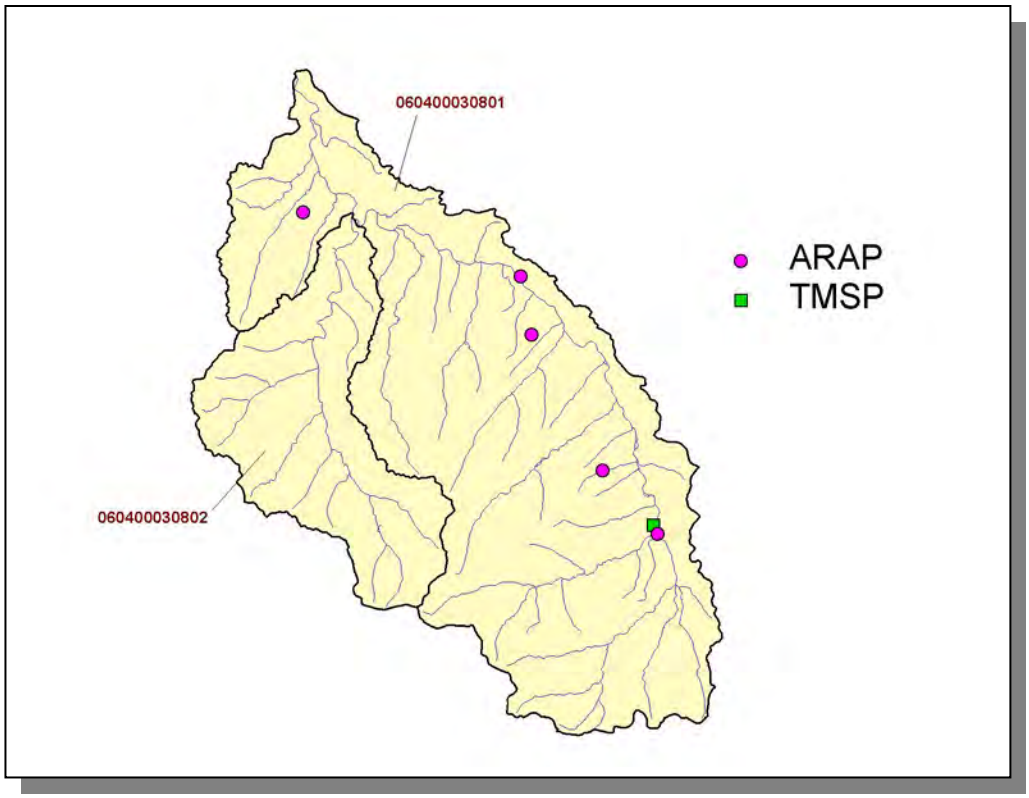


Figure 4-84. Location of Active Point Source Facilities in Subwatershed 0604000308. *Subwatershed 060400030801 and 060400030802 boundaries are shown for reference. More information is provided in Appendix IV.*

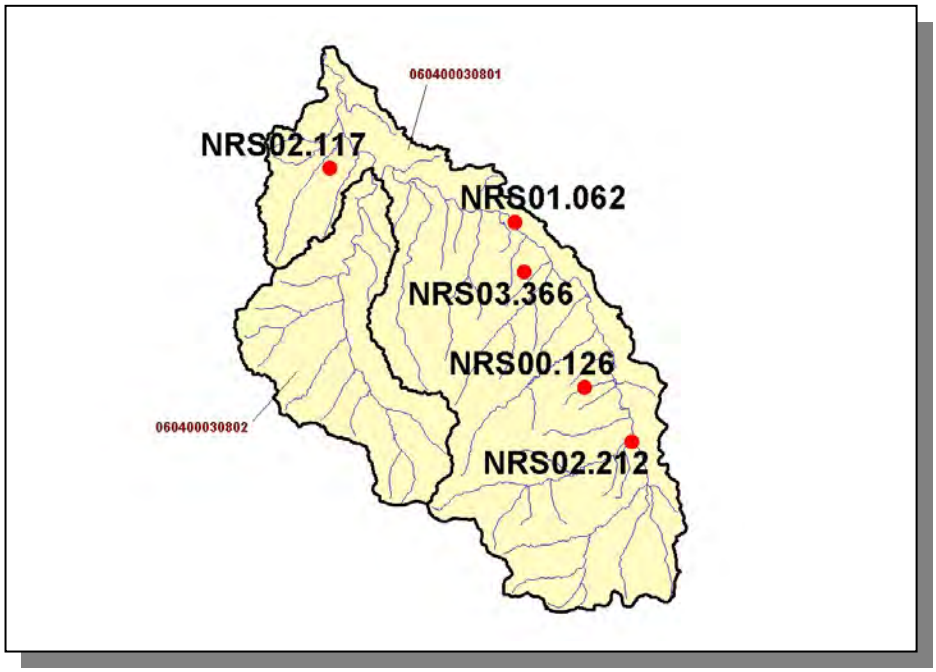


Figure 4-85. Location of ARAP Sites (Individual Permits) in Subwatershed 0604000308. *Subwatershed 060400030801 and 060400030802 boundaries are shown for reference. More information is provided in Appendix IV.*

Figure 4-86. Location of TMSP Facilities in Subwatershed 0604000308. *Subwatershed 060400030801 and 060400030802 boundaries are shown for reference. More information is provided in Appendix IV.*

4.2.H.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens (Layers)	Chickens Sold	Hogs	Sheep
967	1,804	5	3	<5	308	5

Table 4-46. Summary of Livestock Count Estimates in Subwatershed 0604000308. *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)
Hickman	297.2	297.2	5.8	23.0
Lewis	158.0	158.0	4,0	10.2
Totals	**455.2**	**455.2**	**9.8**	**33.2**

Table 4-47. Forest Acreage and Average Removal Rates (1987-1994) in Subwatershed 0604000308.

CROPS	TONS/ACRE/YEAR
Legume (Pastureland)	0.68
Grass (Pastureland)	1.23
Grass (Hayland)	0.13
Legumes (Hayland)	1.05
Legumes, Grass (Hayland)	0.30
Grass, Forbs, Legumes (Mixed Pasture)	0.82
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Soybeans (Row Crops)	5.35
Tobacco (Row Crops)	7.68
Other Cropland not Planted	0.65
Conservation Reserve Program Lands	0.71
Non-Agricultural Land Use	0.00
Farmsteads and Ranch Headquarters	0.12

Table 4-48. Annual Estimated Total Soil Loss in Subwatershed 0604000308.

4.2.I. 0604000309 (Hurricane Creek).

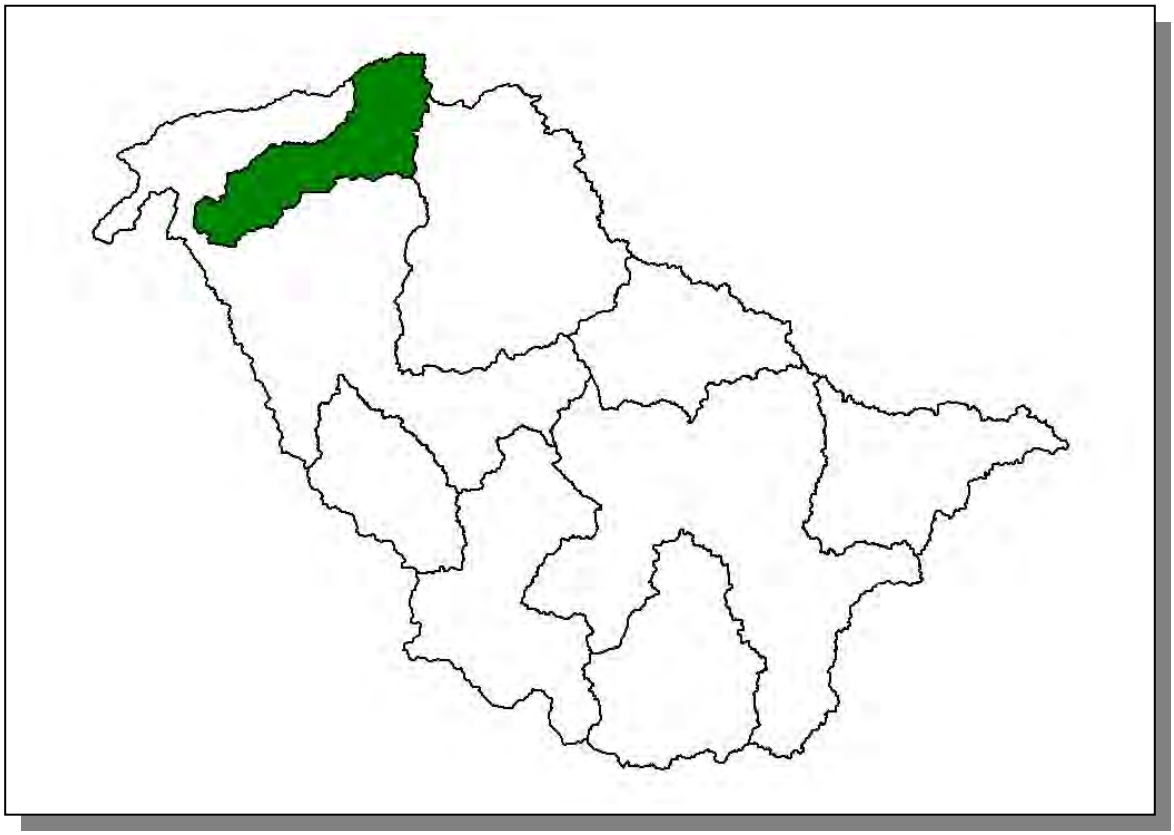


Figure 4-87. Location of Subwatershed 0604000309. *All Lower Duck HUC-10 subwatershed boundaries are shown for reference.*

4.2.I.i. General Description.

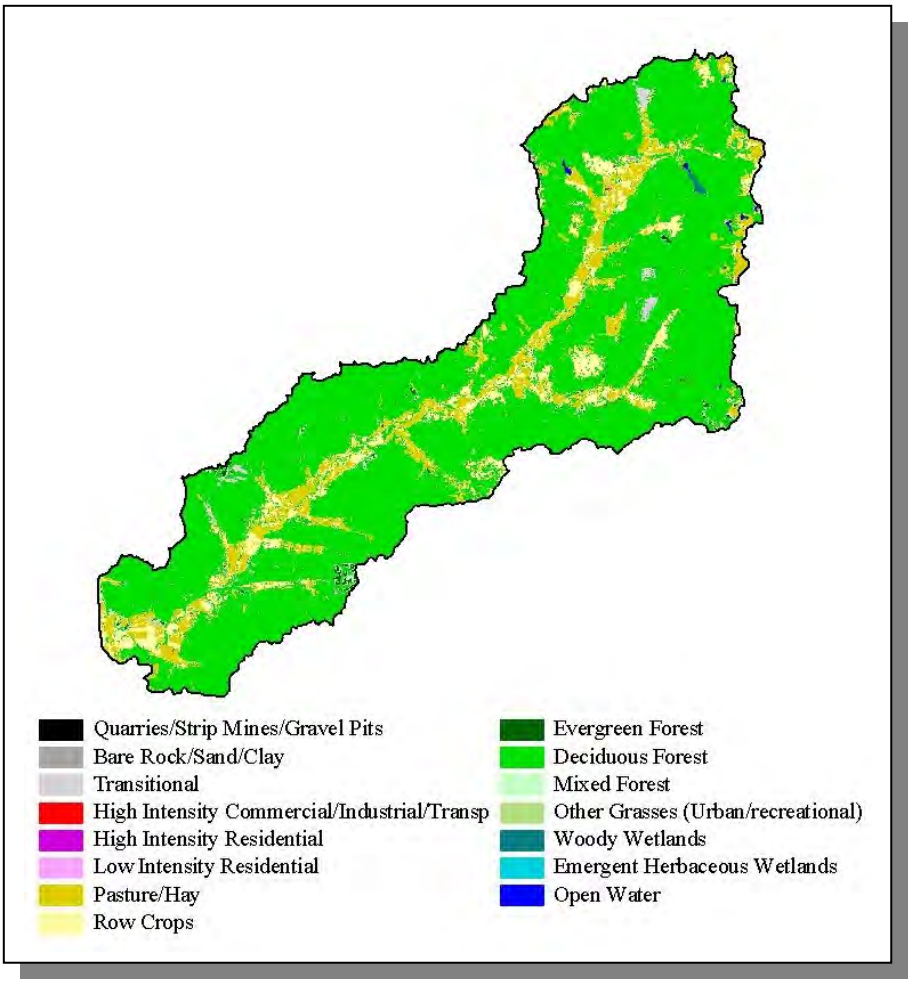


Figure 4-88. Illustration of Land Use Distribution in Subwatershed 0604000309.

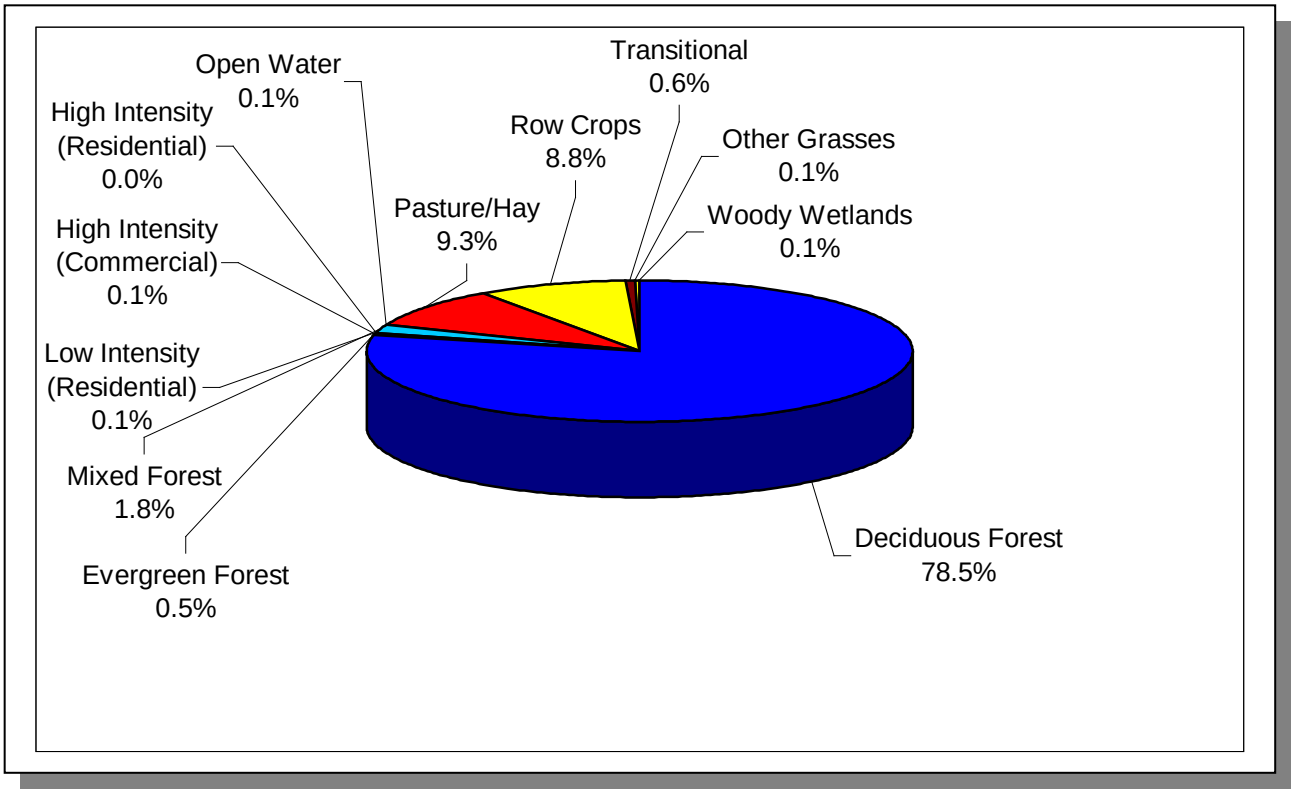


Figure 4-89. Land Use Distribution in Subwatershed 0604000309. *More information is provided in Appendix IV.*

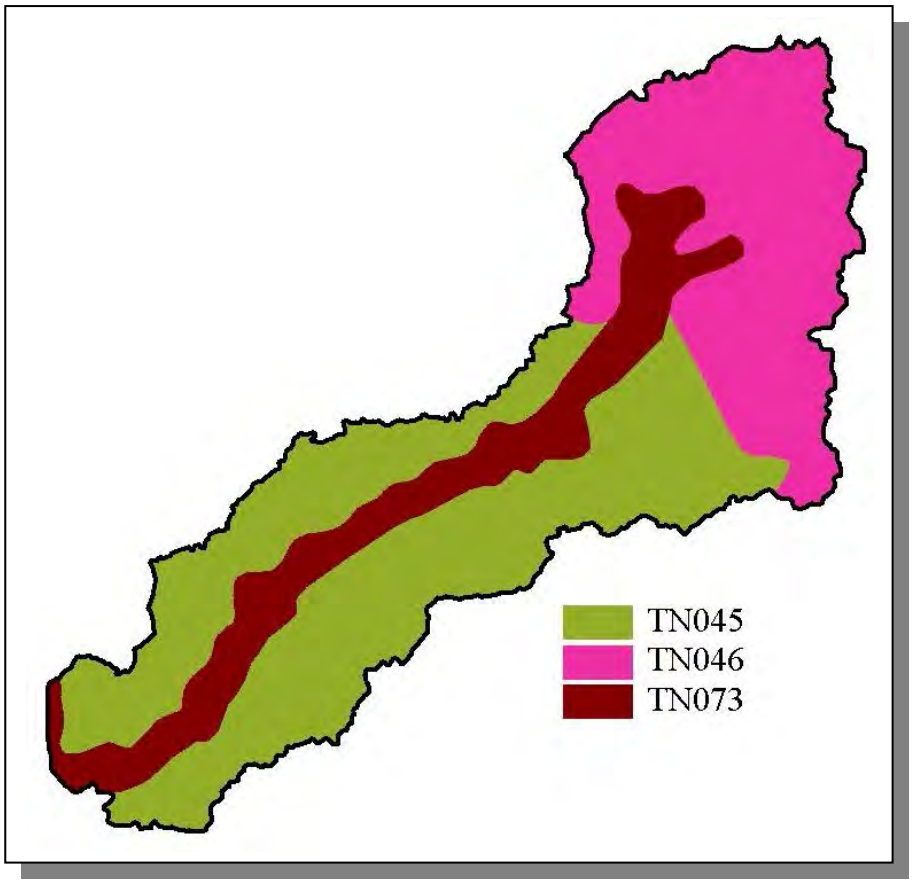


Figure 4-90. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000309.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hr)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN045	0.00	B	1.95	5.45	Loam	0.35
TN046	0.00	B	1.98	5.09	Silty Loam	0.38
TN073	0.00	B	2.97	5.21	Loam	0.34

Table 4-49. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0604000309. *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)
Dickson	35,061	40,937	43,156	0.55	193	225	237	22.8
Humphreys	15,795	16,839	17,929	14.1	2,227	2,374	2,528	13.5
Totals	**50,856**	**57,776**	**61,085**		**2,420**	**2,599**	**2,765**	**14.3**

Table 4-50. Population Estimates in Subwatershed 0604000309.

Figure 4-91. Location of Historical Streamflow Data Collection Sites in Subwatershed 0604000309. *Subwatershed 060400030901 and 060400030902 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

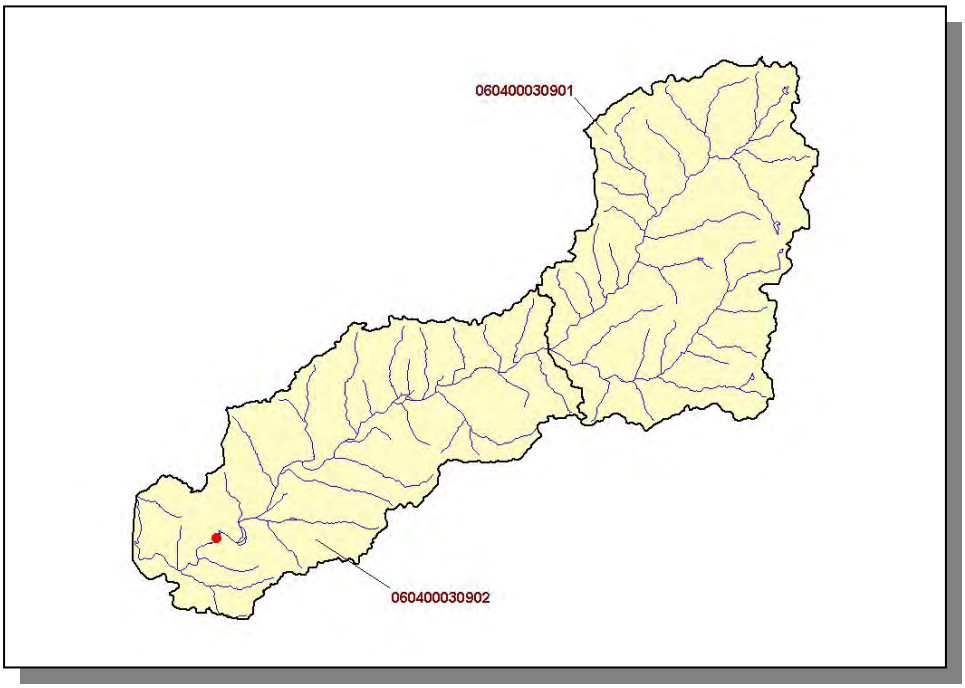


Figure 4-92. Location of STORET Monitoring Sites in Subwatershed 0604000309. *Subwatershed 060400030901 and 060400030902 boundaries are shown for reference. More information, including site names and locations, is provided in Appendix IV.*

4.2.I.ii. Point Source Contributions.

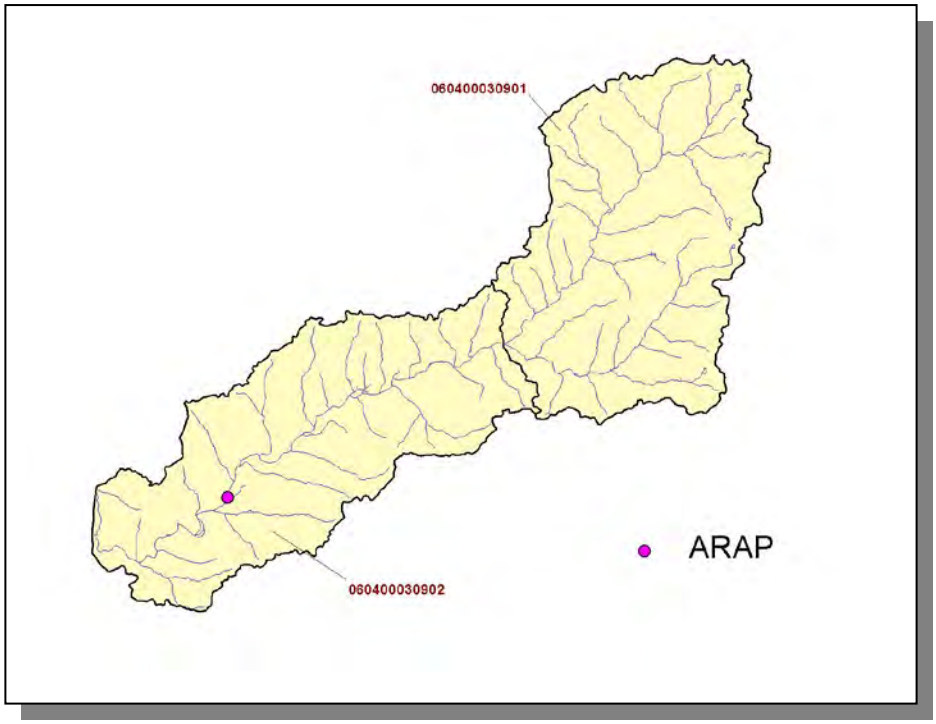


Figure 4-93. Location of Active Point Source Facilities in Subwatershed 0604000309. *Subwatershed 060400030901 and 060400030902 boundaries are shown for reference. More information is provided in Appendix IV.*

Figure 4-94. Location of ARAP Sites (Individual Permits) in Subwatershed 0604000309. *Subwatershed 060400030901 and 060400030902 boundaries are shown for reference. More information is provided in Appendix IV.*

4.2.I.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens (Layers)	Chickens (Broilers Sold)	Hogs	Sheep
1,370	3,145	51	5	<5	171	<5

Table 4-51. Summary of Livestock Count Estimates in Subwatershed 0604000309. *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)
Dickson	174.3	174.3	1.8	7.7
Humphreys	241.2	241.2	3.7	14.4
Totals	**415.5**	**415.5**	**5.5**	**23.1**

Table 4-52. Forest Acreage and Average Removal Rates (1987-1994) in Subwatershed 0604000309.

CROPS	TONS/ACRE/YEAR
Legume (Pastureland)	
Grass (Pastureland)	1.34
Grass (Hayland)	0.25
Legumes (Hayland)	2.01
Legumes, Grass (Hayland)	0.08
Grass, Forbs, Legumes (Mixed Pasture)	1.30
Forest Land (Not Grazed)	0.00
Forest Land (Grazed)	0.00
Corn (Row Crops)	24.68
Sorghum (Row Crops)	5.80
Soybeans (Row Crops)	23.49
Other Vegetable and Truck Crop	7.71
Conservation Reserve Program Lands	0.10
Non-Agricultural Land Use	0.00
Other Land in Farms	0.03
Farmsteads and Ranch Headquarters	0.63

Table 4-53. Annual Estimated Total Soil Loss in Subwatershed 0604000309.

CHAPTER 5

WATER QUALITY PARTNERSHIPS IN THE LOWER 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 Lower 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
Comprehensive Nutrient Management Plans		2,113
Streambank and Shoreline Protection	1,930	
Pest Management		2,297
Land Treatment: Buffers	15,470	72
Grazing/Forages Practices	67,171	2,591

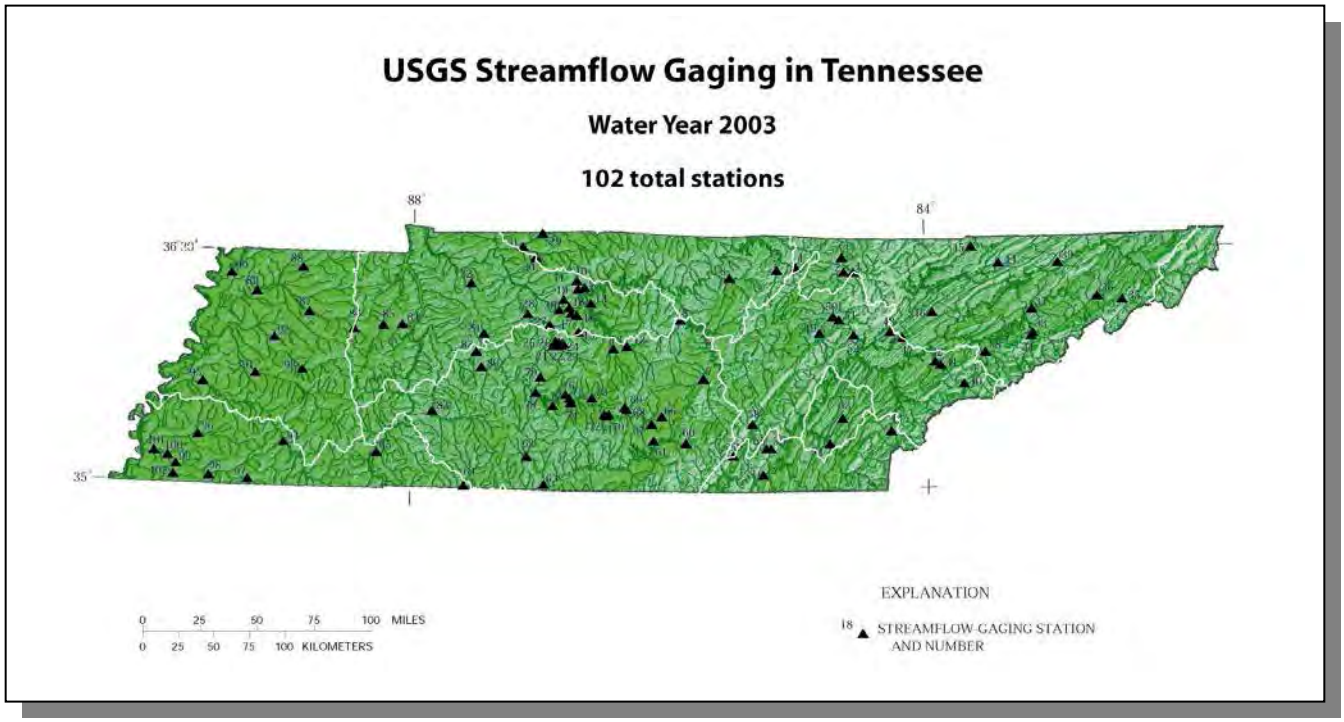
Table 5-1. Landowner Conservation Practices in Partnership with NRCS in the Lower Duck River Watershed. *Data are from PRMS for October 1, 2003 through September 30, 2004 reporting period. More information is provided in Appendix V.*

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*), pygmy madtom (*Noturus stanauli*), Eggert's sunflower (*Helianthus eggertii*), Price's potato-bean (*Apios priceana*), and Tennessee yellow-eyed grass (*Xyris tennesseensis*). 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 Lower Duck River watershed.

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 are 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. TVA began monitoring the ecological health of the Lower Duck River in 1990. In 1999, a monitoring plan was implemented for the Duck River watershed with 47 sites selected for routine assessment. These sites are typically sampled every five years to keep a current picture of watershed condition.

Contacts. Details about stream bioassessment sampling sites and scores in the Lower Duck River watershed can be obtained by contacting Amy Wales at (423)876-6748 or akwales@tva.gov or http://www.tva.gov.

Watershed Assistance

At present, TVA is not involved in any large-scale watershed protection or restoration projects in the Lower Duck River watershed. However, TVA has worked with and maintains a relationship with the local NRCS offices and Soil Conservation Districts in the Lower Duck River watershed.

Protection and Restoration Activities

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 http://www.tva.com/river/landandshore/index.htm.

Further information on TVA's involvement in the Lower Duck River watershed can be obtained by writing: Tennessee Valley Authority, PO Box 280, Paris, TN 38242 or calling the Kentucky Watershed Team at (731)-641-2026. 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.

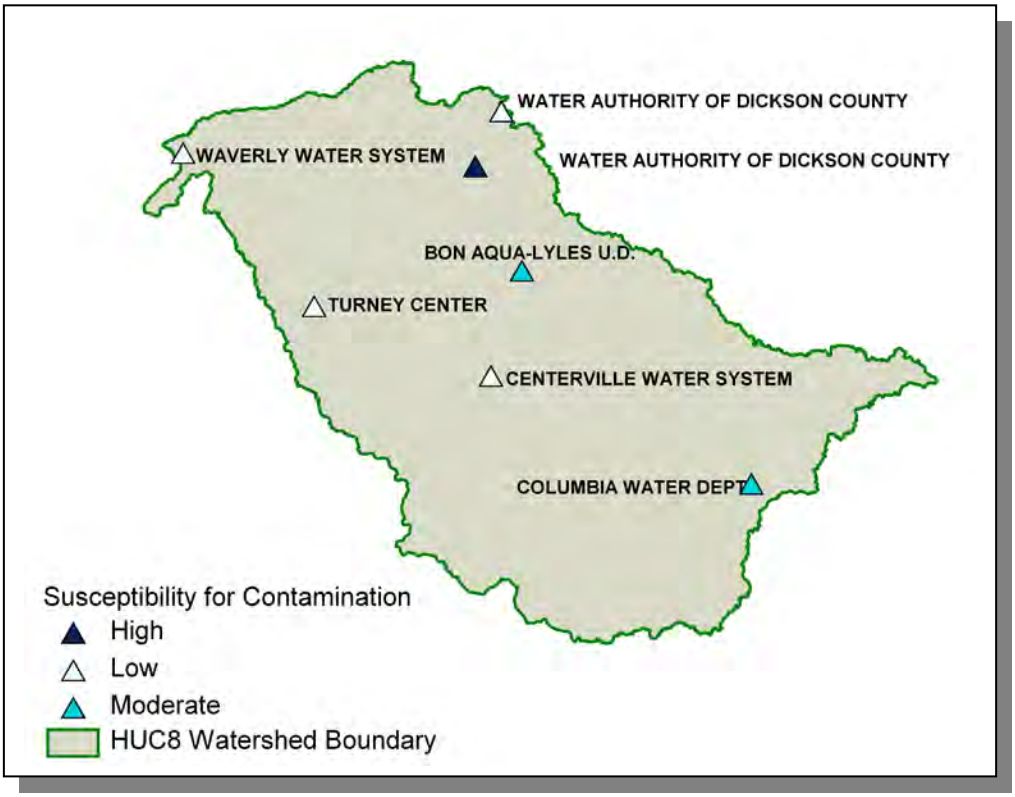


Figure 5-1. Susceptibility for Contamination in the Lower Duck River Watershed.

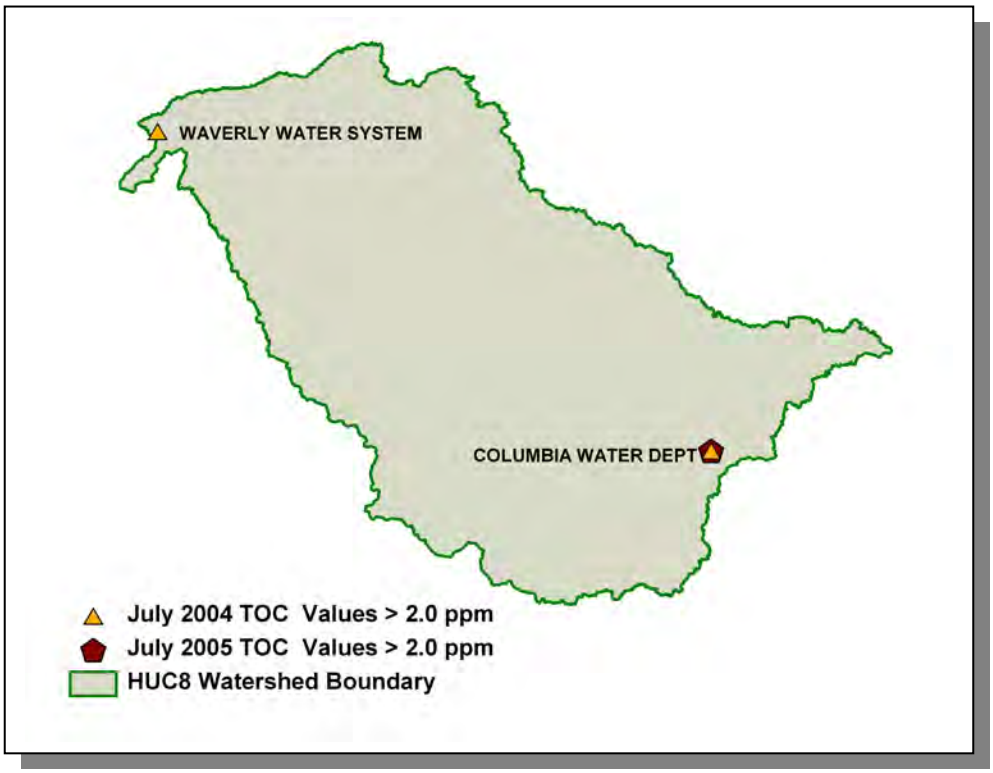


Figure 5-2. July 2004 and 2005 Raw Water Total Organic Carbon (TOC) Analysis in the Lower Duck River Watershed.

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.

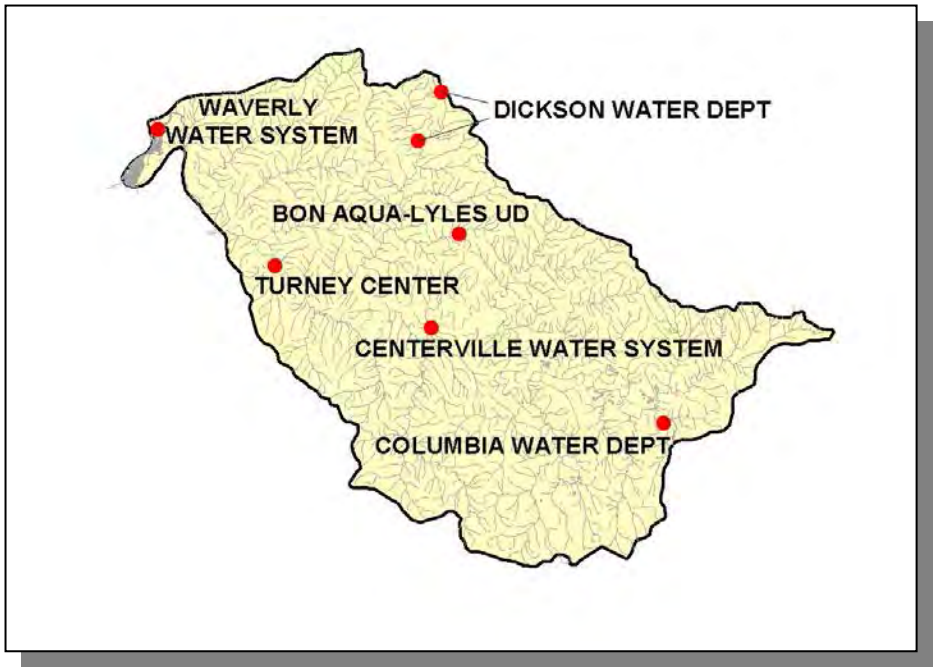


Figure 5-3. Locations of Community and Non-Community Public Water Supply Intakes in the Lower Duck River Watershed.

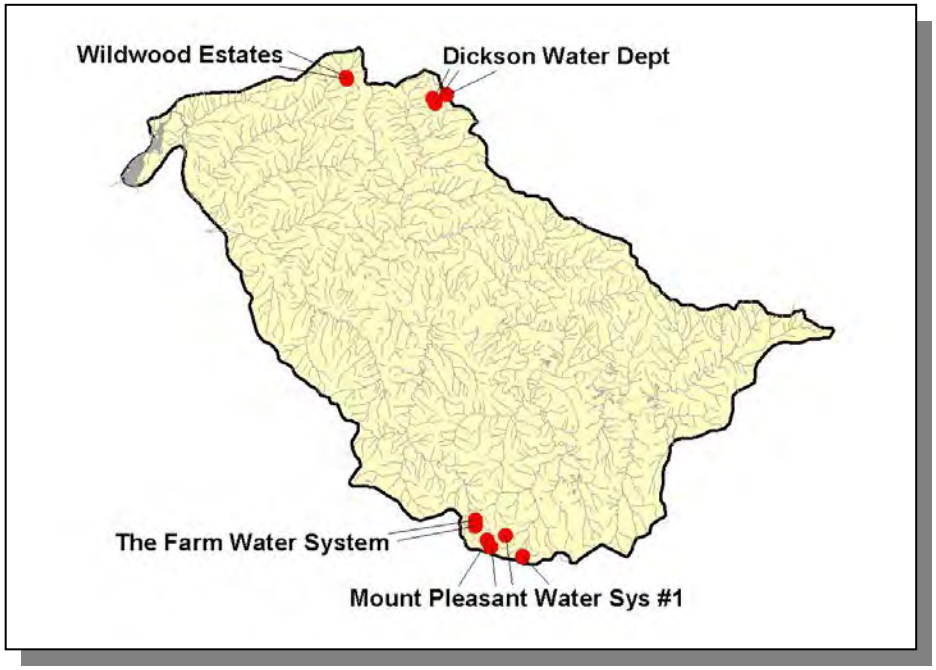


Figure 5-4. Locations of Community and Public Groundwater Supply Intakes in the Lower Duck River Watershed.

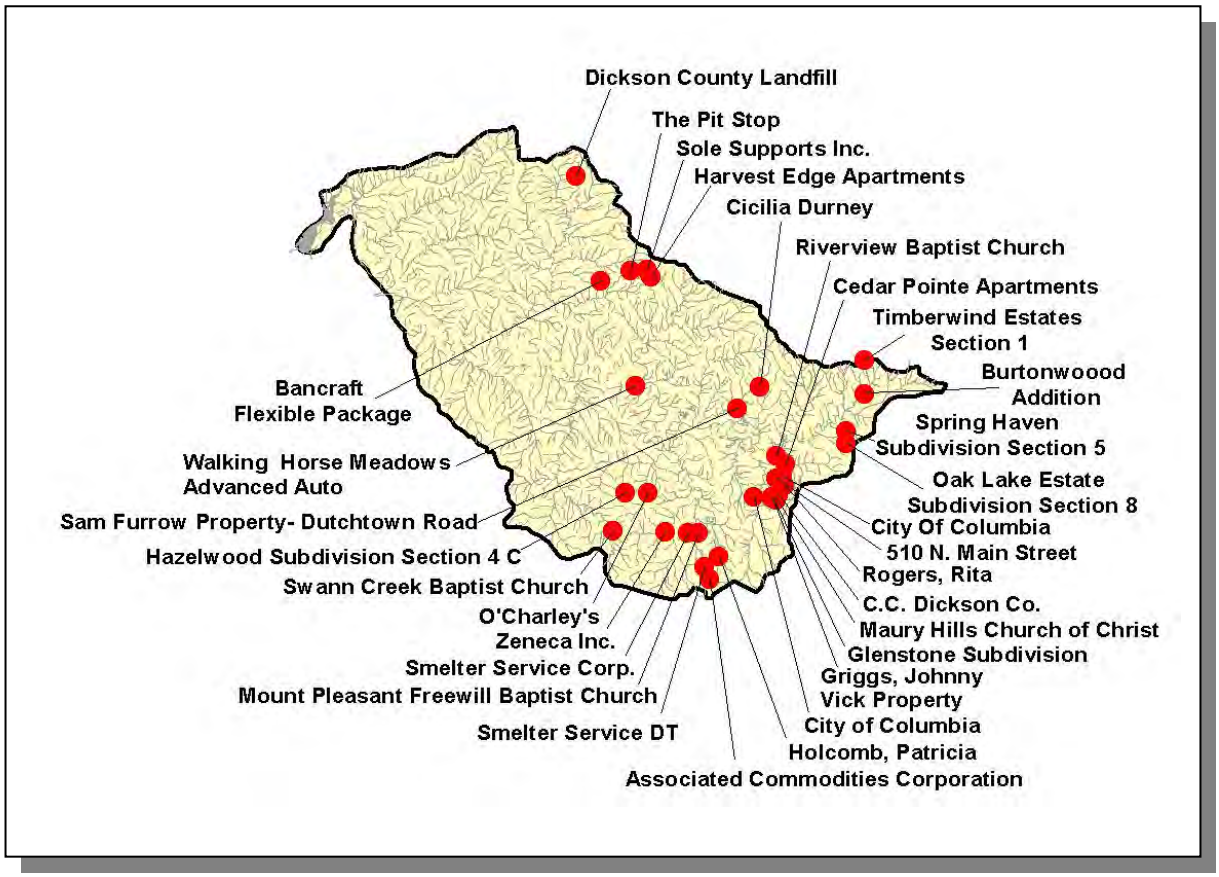


Figure 5-5. Locations of UIC (Underground Injection Control) Sites in the Lower Duck River Watershed. *Injection wells include stormwater sinkholes modified for drainage, commercial/industrial septic tanks, and large capacity septic tanks.*

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.

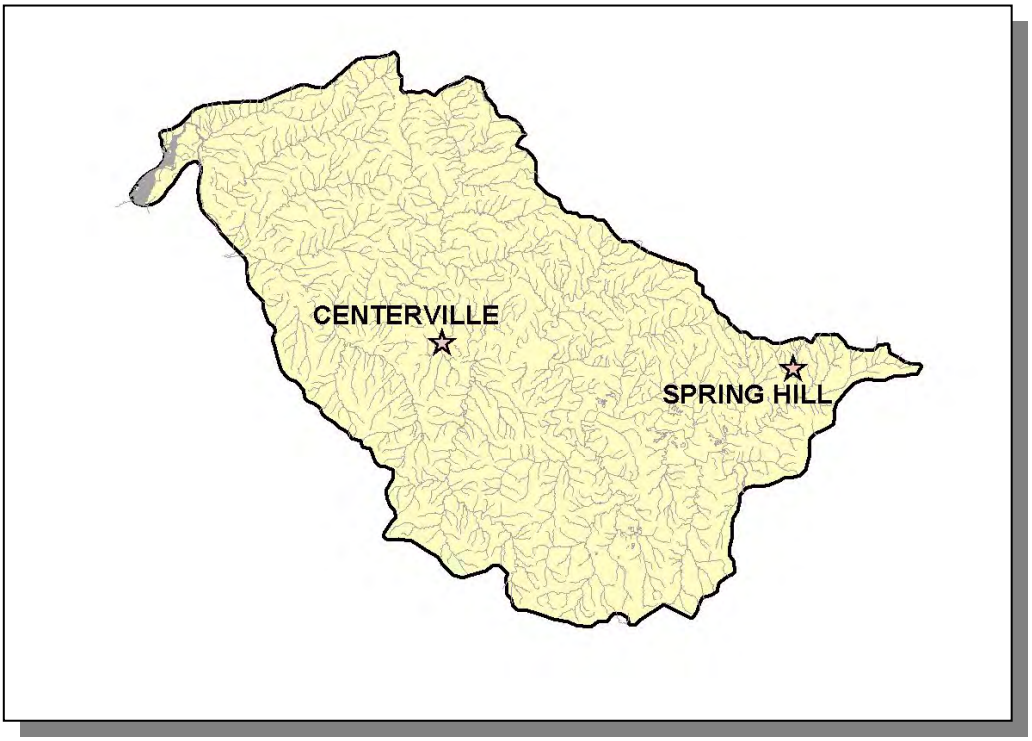


Figure 5-6. Location of Communities Receiving SRF Loans or Grants in the Lower Duck River Watershed. *More information is provided in Appendix V.*

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 Lower 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.

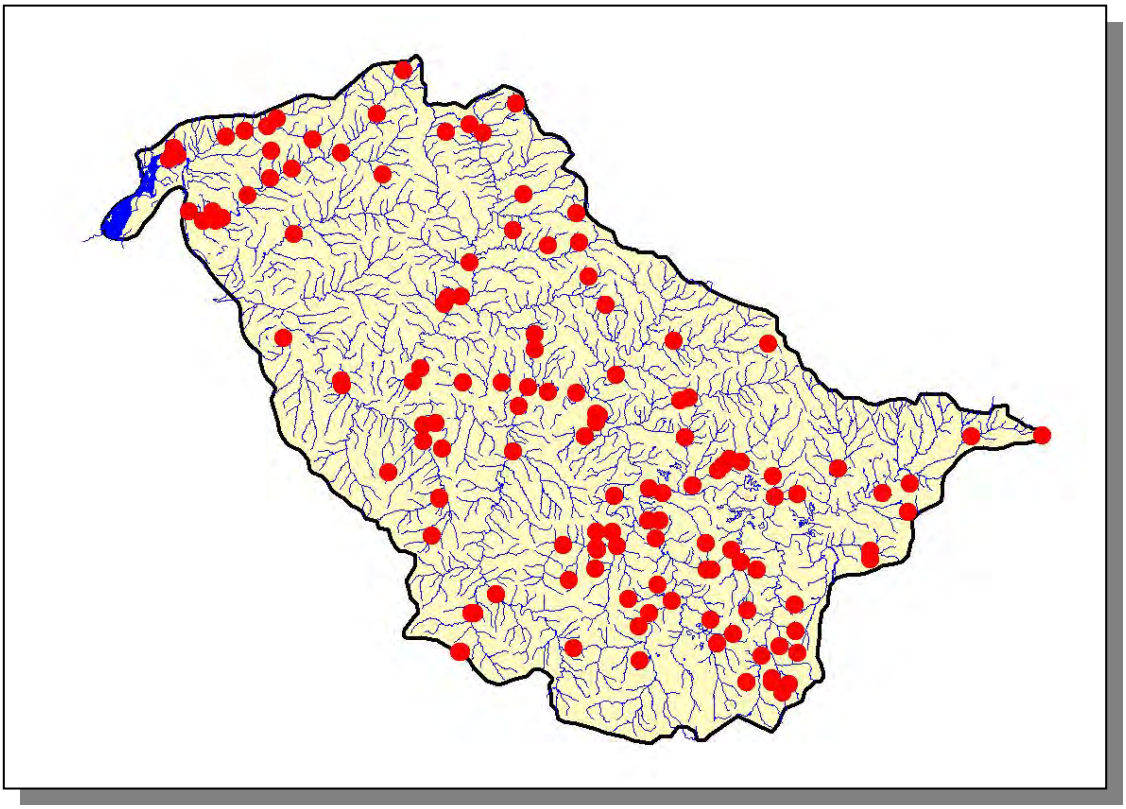


Figure 5-7. Location of BMPs installed from 1999 through 2003 in the Lower Duck River Watershed with Financial Assistance from the Tennessee Department of Agriculture's Nonpoint Source and Agricultural Resources Conservation Fund Grant Programs. *More information is provided in Appendix V.*

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
jmcfadden62@earthlink.net

5.4.C. Five Rivers RC&D Council. The Mission of the Five Rivers RC&D Council is to promote activities that will enhance the quality of life, conserve natural resources, and promote economic development in the council area.

The Five Rivers RC&D Council covers seven counties in Middle Tennessee. Named for the 5 major rivers flowing through the area, the council serves Cheatham, Dickson, Houston, Humphreys, Montgomery, Robertson, and Stewart Counties. With the natural resources and community activities being diverse in geography, the Council responds to the needs of their local communities, both for conservation issues and for economic and rural development. The collaboration of its numerous partners makes the Five Rivers RC & D Council Area distinctive.

The Five Rivers RC & D Council assists in administering the Resource Conservation and Development Program, which is a unique combination of private enterprise and federal assistance that encourages economic growth through development, conservation and planned utilization of natural resources across the Council Area and Tennessee. Just a few services the RC&D program is providing in our community are Conservation Education, Farmland Protection, providing Technical Assistance, ensuring Community Services, establishing Sustainable Development, encouraging Natural Resources Protection, and Communicating Local Issues.

Since 1999, the Five Rivers RC&D Council has worked with local landowners along the Buffalo and Duck Rivers in Humphreys County to demonstrate solutions to sedimentation and non-point source pollution loading by installing Best Management Practices. The U S Fish & Wildlife Service awarded $20,000 to the Council to assist the enhancements of this watershed. The problems were mostly caused by severe streambank erosion, livestock accessibility to these streams, a lack of buffer or riparian zones, and improper farming techniques that have impaired the river systems.

This project has installed 10,613 linear feet of fencing for livestock use exclusion, and over 1000 linear feet of bioengineering to restore the streambanks and to provide protection against river swells. Landowners have improved their pasture lands by providing intensive rotational grazing systems to adequately feed forages and maintain

healthy open lands. Many included alternatives to watering animals from the streams with new solar ram watering troughs.

The project installations totaled over $47,000 in addition to improving water quality along the Buffalo and Duck Rivers. The knowledge by these landowners will carry on ensuring the rest of the farming community grasped the conservation concepts for generations to come and to expand to others areas in the region.

For more information on the Five Rivers RC&D Council and its programs, contact Chandra Berry, RC&D Coordinator at (931)-368-0252 ext. 5 or visit the web site at: http://www.fiveriversrcd.org.

5.4.D. Swan Conservation Trust. Swan Conservation Trust is an all-volunteer 501c(3) land trust organization, founded in 1992, with the mission of protecting forests, streams, and biodiversity on the Western Highland Rim of Tennessee. Native hardwood forests are critical for maintaining clean groundwater and surface waters for municipal water supplies and wells. Healthy streams provide habitat for aquatic species and recreational opportunities for citizens. Riparian areas are home to many of our state's rare plant species and provide rich foraging and nesting areas for wildlife.

Swan Trust's initial focus is on the forests in the headwaters area of Big Swan and Big Bigby Creeks (southeastern Lewis County and southwestern Maury County). Nearly 20,000 acres of forestland in this area was slated to become Maury State Forest in the 1930's under the Fulmer Act. Although protection by the State of Tennessee never came to fruition, about 10,000 acres still remains in large forested tracts with pristine headwater streams, rare plants, and wildlife habitat for aquatic and terrestrial creatures. The public has long enjoyed the area for hunting, recreation, wildlife viewing, and scientific study. Swan Trust's vision is to preserve and protect this large forest from subdivision and development. Protection will be accomplished through ownership, conservation easements, partnerships, or cooperative management agreements.

To this end, Swan Trust has been successful in protecting several tracts in the 10,000-acre region. Through a series of contiguous purchases, roughly 1500 acres, now known as Big Swan Headwaters Nature Preserve, has been set aside in perpetuity for the benefit of wildlife and enjoyment by the public. This headwaters region is known for its abundant seeps, springs, and streams that contribute clean water to Big Swan Creek, which serves as the water supply for the City of Centerville, downstream in Hickman County. Another 100-acre tract in the headwaters of Big Bigby Creek has been purchased and protected as the Highland Woods Preserve. The pristine forest and streams in the Highland Woods help maintain clean groundwater for three area springs used by the Mt. Pleasant water system. Nearby is Stillhouse Hollow Falls, a 92-acre scenic tract under contract for purchase with Tennessee Parks and Greenways Foundation. Swan Trust laid the groundwork for the purchase by working with the former landowner to protect this natural treasure from development. In addition, the Tennessee Nature Conservancy recently donated the Langford Branch State Natural Area to Swan Trust. This 23-acre preserve is one of several sites in Lewis County that are home to the federally endangered Tennessee Yellow-Eyed Grass. The Trust is cooperatively managing the site with the Division of Natural Heritage.

Swan Trust has been successful in receiving substantial grants for land purchases from the Tennessee Environmental Endowment / Duck River Fund, the North American Wetlands Conservation Act Small Grant Fund, the Norcross Foundation, and the Community Foundation of Middle Tennessee. Generous donations from members and successful fundraising events, such as the annual silent auction, have been essential components of the land purchase effort.

Landowner interest in conservation easements has grown, as development pressure is taking its toll on formerly rural areas. Swan Trust holds and monitors several conservation easements in Perry, Hickman, and Lewis Counties that protect deciduous forests and streams in perpetuity.

A rare opportunity was taken in 2002 when a road-widening project in Lewis County made mitigation funds available for a large bank stabilization project. Swan Trust assisted a landowner, who was losing banks during frequent floods, with his property on Little Swan Creek and Piney Branch. The mitigation funds paid for rock jetties along 943 feet of stream and bio-engineering, designed by the Natural Resources Conservation Service. Follow-up work has consisted of several tree-planting days to re-establish the riparian buffers along the two streams. Tennessee Scenic River Association's Duck River Project donated 500 trees, and local school students and Swan Trust volunteers supplied the labor. Swan Trust is under contract with TDEC to monitor the site for five years.

A concerted public education effort is helping Swan Trust accomplish its mission. Local schools are involved in volunteer monitoring of streams in the Big Swan and Big Bigby headwaters. Monthly outings for the general public feature hikes to scenic sites, threatened habitats, rare plant communities, and protected lands on the Western Highland Rim. In 2004, Swan Trust partnered with the Tennessee Native Plant Society and the Division of Natural Heritage, with funds from an environmental education grant from the EPA, to raise awareness of the importance of deciduous hardwood forests to protect water quality as well as habitat for native flora and fauna. Dinners with noted guest speakers have provided a forum for networking and educational presentations to benefit members, teachers, students, and the general public.

Swan Trust's lands are open to the public for low-impact recreation, enjoyment of nature, and scientific study. Contact us at:

Swan Conservation Trust
PO Box 162
Summertown, TN 38483
931-964-4402
http://www.swantrust.org

CHAPTER 6

RESTORATION PRIORITIES IN THE LOWER 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 Lower 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 Lower 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

- Development along Swan Creek
- 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
- Impact of I-840 construction and resulting development
- Lack of public awareness of water quality standards the public should expect

6.2.B. Year 3 Public Meeting. The second Lower Duck River Watershed public meeting was held March 13, 2001 at Columbia State Community College. 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.

Major Concerns/Comments

- Water Withdrawals
- Water Quality and Quantity effects on the local economy
- Sediment from construction problems
- Effects of new development on existing STP capacity
- Clear cutting near small streams
- Building in Lower Duck River floodplain
- Lack of environmental education by TDEC via mass media
- Protection of Swan Creek

6.2.C. Year 5 Public Meeting. The third scheduled Lower Duck River Watershed public meeting was held November 3, 2005 at Columbia State Community College. The meeting was held jointly with the Buffalo River Watershed and featured ten 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
- Duck River Opportunity Project display
- Swan Creek Trust display

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

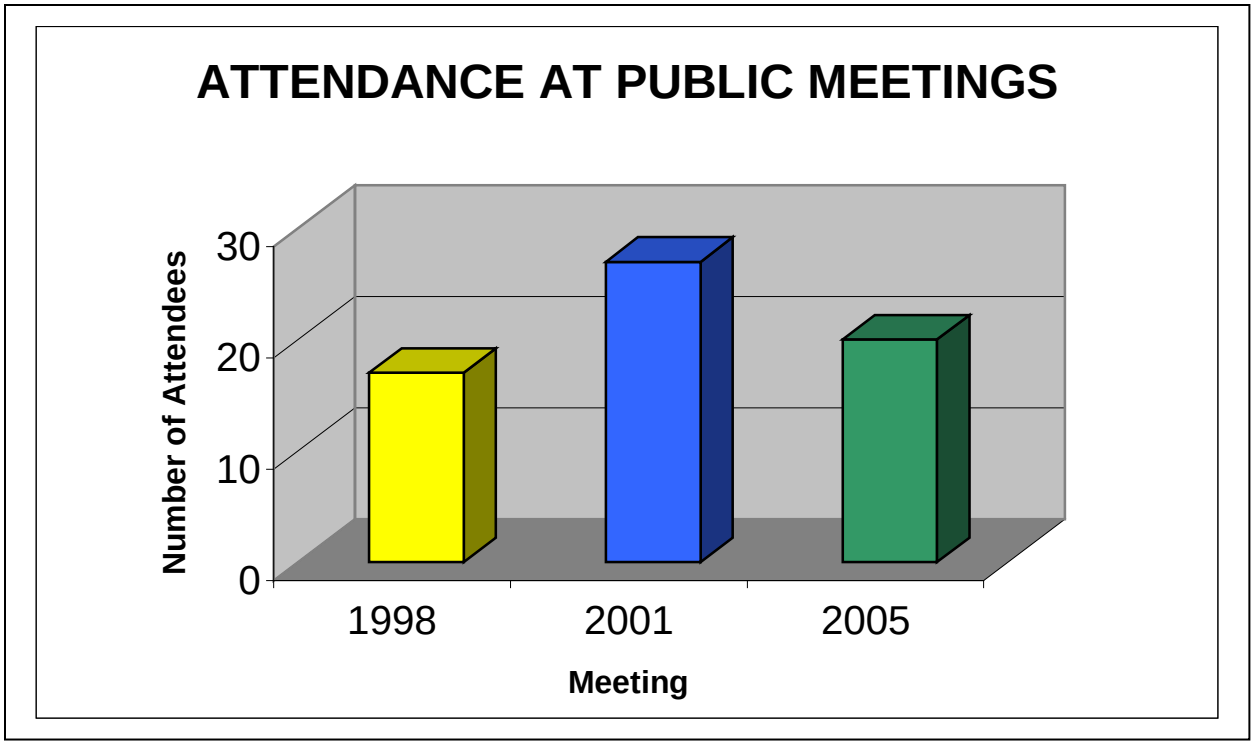


Figure 6-1. Attendance at Public Meetings in the Lower Duck River Watershed. *1998 meeting attendance number represents Buffalo River, Upper Duck River and Lower Duck River Watersheds joint meeting; 2001 and 2005 meeting attendance numbers represent Buffalo River and Lower Duck River Watersheds joint meeting. Attendance numbers do not include TDEC personnel.*

Figure 6-2. Watershed Meetings are an Effective Way to Facilitate Networking Among Consultants, Local Officials, Non-Government Organizations, Government Agencies, and Staff.

Figure 6-3. The SmartBoard™ is an Effective Interactive Tool to Teach Citizens About the Power of GIS.

Figure 6-4. Watershed Meetings Begin With A Short Presentation To Review The Watershed Water Quality Management Plans With Interested Citizens.

Figure 6-5. 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 TMDLs:

Big Bigby Creek, Sugar Fork, Potts Branch, Lunnis Branch, Dog Creek, and Blue Creek. TMDL for pathogens in the Lower Duck River Watershed. Approved March 1, 2005.
http://www.state.tn.us/environment/wpc/tmdl/approvedtmdl/LowDuckRF2.pdf

Quality Creek, Sugar Creek, Unnamed Tributary to Little Bigby Creek, Unnamed Tributary to Lytle Creek, McCutcheon Creek, Crooked Creek, Rutherford Creek, and Grab Branch. TMDL for station and habitat alteration in the Lower Duck River Watershed. Approved March 1, 2005.
http://www.state.tn.us/environment/wpc/tmdl/approvedtmdl/LowDuckSed_final.pdf

TMDLs are prioritized for development based on many factors.

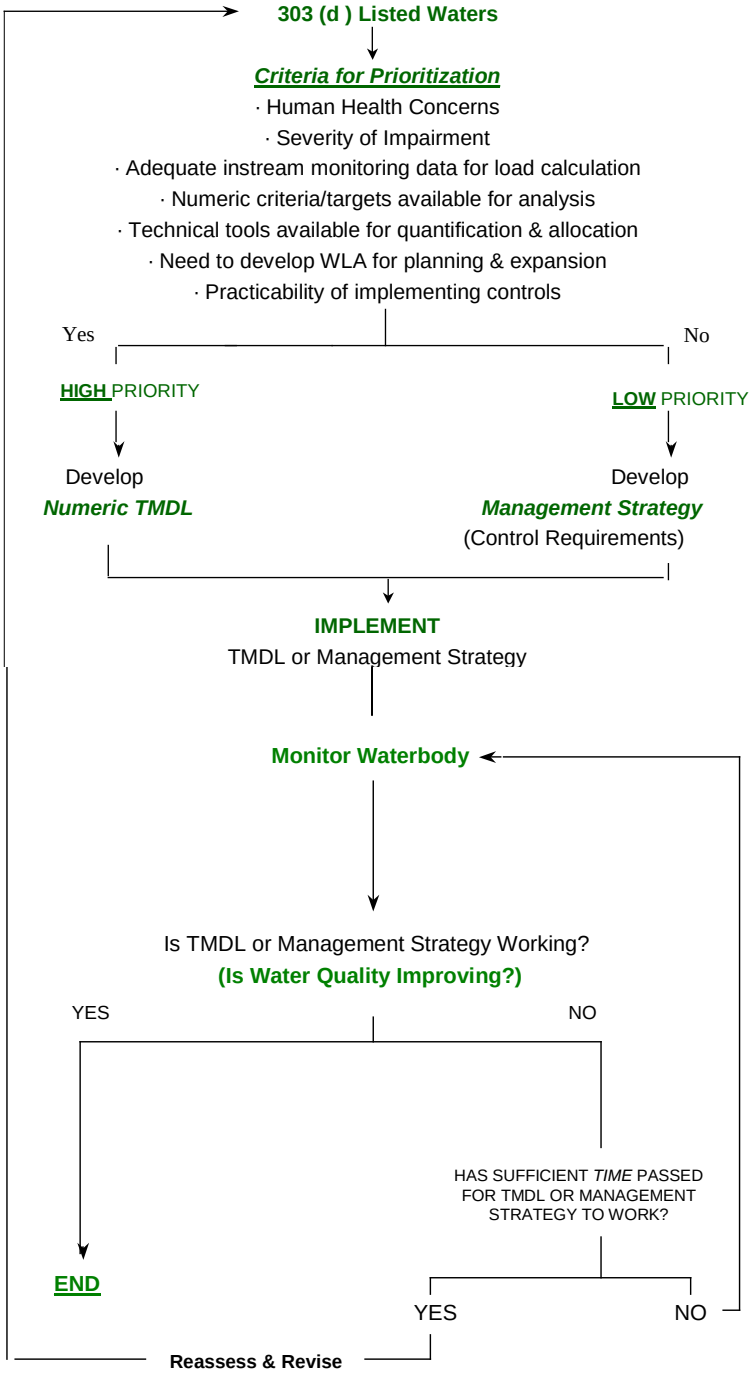


Figure 6.6. Prioritization Scheme for TMDL Development.

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 Lower 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 in the Lower Duck River Watershed are McCutcheon Creek and Rutherford Creek. Regardless of the size, no construction site is allowed to cause a condition of pollution.

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.

The same requirements apply to sites that drain into high quality waters. Wolf Creek and Little Swan Creek are examples of high quality streams in the Lower Duck River Watershed.

6.3.B.i.b. From Channel and/or Bank Erosion. Many streams within the Lower 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 Smith Fork, 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 (example: Lytle Creek).
- Establish off-channel watering areas for livestock by moving watering troughs and feeders back from stream banks (example: Crooked Creek).
- Limit cattle access to streams and bank vegetation (example: Crooked 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: Lytle Creek, Little Bigby Creek, and Grab Branch).
- Limit livestock access to streams and bank vegetation (example: Beaver Creek).
- Require post-construction run-off rates to be no greater than pre-construction rates in order to avoid in-channel erosion (examples: Grab Branch, Lytle Creek).
- Implement additional restrictions on logging in streamside management zones.
- Limit clearing of stream and ditch banks (examples: Little Bigby Creek, Lytle 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. Agriculturally impacted streams which could benefit from the establishment of riparian buffer zones include Crooked 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 and Nashville Field Offices 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, six stream systems in the Lower Duck River Watershed are known to have excessive pathogen contamination. Big Bigby Creek (Columbia), Sugar Fork Creek (Mount Pleasant), and Blue Creek (McEwen) are impacted by urban areas, with contributions of bacterial contamination coming from storm water runoff, sewage collection system leaks, and treatment plant operation failures. Lunns Branch, Potts Branch, and Dog Branch in Maury County are 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 (examples: Crooked Creek and Grab Branch).
- Limit livestock access to streams (examples: Crooked Creek and Grab Branch).
- Improve and educate on the proper management of animal waste from feeding operations (examples: Lunns Branch, Potts Branch, and Dog Branch).

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 (example: Sugar Fork Creek).

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 McCutcheon Creek and Rutherford Creek, and along stream channels.
- 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 Sugar Fork Creek and Rutherford Creek).
- Timely and appropriate enforcement for noncomplying sewage treatment plants, large and small, and their collection system.
- Identify Concentrated Animal Feeding Operations not currently permitted.

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 Lower Duck River Watershed, a relatively small number of streams are damaged by storm water runoff from industrial facilities or urban areas. More stringent inspection and regulation of permitted industrial facilities, and local strormawter 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 Quality Creek, Sugar Creek, Little Bigby Creek, Lytle Creek, and Grab Branch.

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. (This would benefit Lytle Creek and Little Bigby Creek).
- Sponsor community clean-up days (This has already benefited Bear Creek and Rutherford Creek).
- 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.

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 (Bear Creek has benefited from such cleanup efforts).
- 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 (The Tennessee Scenic River Association’s Duck River Project has mobilized several riparian restoration projects).
- 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		ID	NAME	HAZARD
227001	City Lake	1		607037	Rattle and Snap #21	2
227003	Craig	S		947006	Poplar Grove #1	L
227009	Upper Lake Dam	1		947011	Thompson Lake	L
227016	Sawmill Branch	3		947013	McCall	L
417002	Wilder	2		417008	Littleot Washer Plant #1	3
417003	Cedar Crest	2		417009	Littleot Washer Plant #2	3
417004	Huckaby Lake	S		417010	Spring Lake	3
437001	Simmons	S		417011	Crystal Lake	2
437002	Burch	L		437009	Hurrican Creek #3A	2
437005	Big Springs Lake #2	2		607011	Ingram	2
607001	Lost Acres	H		607041	Old Columbia	2
607002	Arrow	1		437010	Hurricane Creek #8	1
607003	Campbell Lake	L		417001	Boon-Dok	H
607004	Miller	2		607043	Whippoorwill Lake	1
607005	U.T. Experiment Station	3		227018	Simmons #2	S
607008	Big Oak	H		417012	Big Piney Lake	2
607013	Bob's #1	1		417007	Kirk Lake	3
607014	Bob's #2	1		437011	Buckhaven #1	3
517007	Hughes	H		567005	Red Boiling Springs #4	1
607016	Occidental Chem #10	2		227019	Woodland Hills	2
607019	Goldeneye Lake	2		437015	Indian Creek	L
607020	Shellcracker	2		437014	Hurricane Creek #9	1
607022	Bluecat Lake	1		607046	Tomlin Lake	H
607024	Solutia #2	3		417016	Johnson Lake	S
607025	Solutia #11	3		607047	Rattle and Snap #18	2
607027	Solutia #8	2		607015	Rattle and Snap #19	2
607033	Solutia #15	3				

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

LAND COVER/LAND USE	ACRES	% OF WATERSHED
Open Water	6,784	0.69
Other Grasses	2,749	0.28
Pasture/Hay	190,343	19.23
Row Crops	73,860	7.46
Woody Wetlands	6,853	0.69
Emergent Herbaceous Wetlands	224	0.02
Deciduous Forest	614,480	62.07
Mixed Forest	61,224	6.18
Evergreen Forest	15,627	1.58
High Intensity: Commercial/Industrial	5,091	0.51
High Intensity: Residential	809	0.08
Low Intensity: Residential	5,751	0.58
Quarries/Strip Mines/Gravel Pits	810	0.08
Bare Rock/Sand/Clay	10	0.00
Transitional	5,333	0.54
Total	**989,948**	**100.00**

Table A2-2. Land Use Distribution in Lower 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)	
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)	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 (71I16)	Stones River	05130203
Loess Plains (74b)	Terrapin Creek (74B01)	Obion River	08010202

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

CODE	NAME	AGENCY	AGENCY ID
34	TDEC/DNH Brush Creek Swamp Site	TDEC/DNH	
138	TDEC/DNH Little Swan Creek State Natural Area Site	TDEC/DNH	M.USTNHP 1460
156	TDEC/DNH Sandy Mitchell Hollow Site	TDEC/DNH	S.USSER01 1049
190	TDEC/DNH Langford Branch-Parnassia Seep Site	TDEC/DNH	
206	USACOE-Nashville Client Site	USACOE-Nashville	
242	USACOE-Nashville Client Site	USACOE-Nashville	
244	USACOE-Nashville Client Site	USACOE-Nashville	
312	TDOT SR 50 Mitigation Site	TDOT	
365	TDOT Happy Hollow Creek Mitigation/Permit Site	TDOT	
366	TDOT Happy Hollow Creek Mitigation/Permit Site	TDOT	
367	TDOT Happy Hollow Creek Mitigation/Permit Site	TDOT	
368	TDOT Happy Hollow Creek Mitigation/Permit Site	TDOT	
369	TDOT Happy Hollow Creek Mitigation/Permit Site	TDOT	
370	TDOT Happy Hollow Creek Mitigation/Permit Site	TDOT	
396	TDOT SR 50 Permit Site	TDOT	
532	TDOT East Fork Greenlick Creek Permit/Mitigation Site	TDOT	
2363	TWRA Occidental Site	TWRA	
2364	TWRA Occidental Site	TWRA	
2365	TWRA Occidental Site	TWRA	
2366	TWRA Occidental Site	TWRA	
2367	TWRA Occidental Site	TWRA	
2368	TWRA Occidental Site	TWRA	
2702	TDEC/DNH Auntney Hollow Site	TDEC/DNH	S.USTNHP 445
2722	USACOE Kendron Road and Rutherford Creek Site	USACOE-Nashville	960048536

Table A2-4. Wetland Sites in Lower Duck River Watershed in TDEC Database. *TDEC, Tennessee Department of Environment and Conservation; USACOE-Nashville, United States Army Corps of Engineers-Nashville District; TDOT, Tennessee Department of Transportation; 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)
Barren Fork	TN06040003041_0400	13.3
Bear Creek	TN06040003033_1000	17.5
Bear Creek	TN06040003050_0700	20.6
Beard Branch	TN06040003019_0100	9.8
Beaver Creek	TN06040003050_0200	18.6
Beaverdam Creek	TN06040003007_1000	14.3
Beaverdam Creek	TN06040003007_2000	6.7
Big Bigby Creek	TN06040003019_1000	5.1
Big Bigby Creek	TN06040003019_3000	16.4
Big Spring Creek	TN06040003050_0800	36.2
Big Swan Creek	TN06040003010_1000	20.7
Big Swan Creek	TN06040003010_2000	16.7
Blue Buck Creek	TN06040003010_0100	27.7
Blue Creek	TN06040003062_1000	19.6
Blue Creek	TN06040003062_2000	10.4
Brushy Fork Creek	TN06040003007_0200	14.4
Buck Branch	TN06040003016_0500	7.6
Carters Creek	TN06040003034_0200	12.9
Catheys Creek	TN06040003017_1000	5.6
Catheys Creek	TN06040003017_2000	5.1
Curry Branch	TN06040003017_0110	7.4
Defeated Creek	TN06040003009_0100	9.0
Dog Branch	TN06040003019_0600	9.4
Dog Creek	TN06040003041_1100	11.8
Dry Creek	TN06040003009_0400	11.4
Dry Creek	TN06040003019_0300	8.2
Duck River	TN06040003005_1000	28.1
Duck River	TN06040003009_1000	36.0
Duck River	TN06040003016_1000	22.5
Duck River	TN06040003024_1000	17.3
Duck River	TN06040003026_1000	14.8
Duck River	TN06040003065_1000	10.0
Dunlap Branch	TN06040003016_0400	9.9
East Fork Little Bigby Creek	TN06040003027_0200	13.4
East Piney River	TN06040003050_0600	15.8
Falls Branch	TN06040003010_0300	8.4
Garner Creek	TN06040003050_0300	37.4
Greenlick Creek	TN06040003024_0100	35.9
Haley Creek	TN06040003009_0200	9.2
Hampshire Creek	TN06040003017_0100	16.3
Hassell Creek	TN06040003041_0100	12.7
Hurricane Creek	TN06040003061_1000	15.0

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Hurricane Creek	TN06040003061_2000	12.7
Indian Creek	TN06040003009_0700	15.5
Indian Creek	TN06040003010_0900	25.8
Knob Creek	TN06040003039_1000	23.5
Leatherwood Creek	TN06040003016_0100	24.4
Leipers Creek	TN06040003040_1000	24.5
Leipers Creek	TN06040003040_2000	42.3
Lick Creek	TN06040003041_1000	11.4
Lick Creek	TN06040003041_2000	7.0
Little Bigby Creek	TN06040003027_1000	47.7
Little Blue Creek	TN06040003062_0300	9.7
Little Hurricane Creek	TN06040003061_0300	25.3
Little Swan Creek	TN06040003010_0800	27.1
Lunns Branch	TN06040003041_0900	0.9
Lytle Creek	TN06040003030_1000	2.4
Lytle Creek	TN06040003030_2000	10.0
Mill Creek	TN06040003050_1200	49.5
Morgan Creek	TN06040003009_0500	6.6
North Fork Lick Creek	TN06040003041_0600	13.5
Piney River	TN06040003050_1000	10.9
Piney River	TN06040003050_2000	6.1
Piney River	TN06040003050_3000	7.6
Rutherford Creek	TN06040003034_1000	20.0
Smith Branch	TN06040003041_0610	1.8
Snow Creek	TN06040003082_1000	28.3
South Fork Lick Creek	TN06040003041_0700	10.3
Sugar Creek	TN06040003059_1000	32.7
Sugar Fork	TN06040003023_2000	0.9
Sulphur Fork	TN06040003007_0700	29.1
Tanyard Branch	TN06040003060_0500	9.8
Tatum Creek	TN06040003041_0200	20.6
Tumbling Creek	TN06040003060_1000	43.8
Turkey Creek	TN06040003082_0100	13.5
UT to Carters Creek	TN06040003034_0250	5.3
West Fork Big Bigby Creek	TN06040003019_0500	24.7
West Piney River	TN06040003050_0500	47.2
Wolf Creek	TN06040003005_0500	22.5

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

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Big Bigby Creek	TN06040003019_2000	4.6
Crooked Creek	TN06040003034_0700	2.5
Grab Branch	TN06040003050_0610	3.9
McCutcheon Creek	TN06040003034_0300	21.8
Potts Branch	TN06040003041_0800	2.9
Quality Creek	TN06040003023_0100	7.1
Rutherford Creek	TN06040003034_2000	12.5
Sugar Creek	TN06040003023_0200	13.6
UT to Little Bigby Creek	TN06040003027_0100	2.0

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

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Blue Creek	TN06040003062_3000	5.1
Dog Creek	TN06040003041_1150	2.0
Lunns Branch	TN06040003041_0950	2.4
Sugar Fork	TN06040003023_1000	2.0
UT to Lytle Creek	TN06040003030_0100	1.6

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

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Aenon Creek	TN06040003034_0400	25.2
Alexander Branch	TN06040003034_0600	2.7
Baptist Creek	TN06040003060_0200	9.6
Bassham Branch	TN06040003034_0210	5.7
Beech Creek	TN06040003082_0200	4.8
Bell Branch	TN06040003050_1210	10.2
Bird Creek	TN06040003050_1300	11.2
Bluewater Creek	TN06040003007_0600	6.3
Boat Branch	TN06040003016_0600	3.8
Brady Branch	TN06040003062_0100	7.2
Bucket Branch	TN06040003065_0100	6.6
Copperas Spring Branch	TN06040003010_1100	6.5
Double Branch	TN06040003034_0800	8.1
Dry Branch	TN06040003010_0400	5.0
Dry Fork	TN06040003017_0200	5.0
Falls Creek	TN06040003019_0400	10.1
Fattybread Branch	TN06040003016_0200	4.4
Gin Branch	TN06040003041_0300	4.6
Grassy Branch	TN06040003065_0400	4.1
Happy Hollow Creek	TN06040003005_0100	5.5

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Indian Creek	TN06040003060_0300	7.2
Isbell Branch	TN06040003023_0110	5.2
Joe Branch	TN06040003007_0500	5.3
Kettle Branch	TN06040003016_0300	4.3
Keys Branch	TN06040003050_1100	4.2
Langford Branch	TN06040003010_0500	5.1
Little Carters Creek	TN06040003034_0230	6.9
Little Grinders Creek	TN06040003010_0700	11.3
Little Piney Creek	TN06040003005_0200	8.7
Little Piney Creek	TN06040003009_0800	3.9
Little Spring Creek	TN06040003050_0900	9.5
Locust Branch	TN06040003041_0410	28.3
Loves Creek	TN06040003017_0300	3.4
Luten Branch	TN06040003065_0200	5.3
Marker Branch	TN06040003061_0400	4.9
Matthews Branch	TN06040003062_0200	3.9
Middle Fork Sugar Creek	TN06040003059_0100	5.2
Milam Branch	TN06040003007_0400	7.2
Misc tribs to Big Bigby Creek	TN06040003019_0999	34.3
Misc tribs to Big Swan Creek	TN06040003010_0999	74.1
Misc. Tribs to Catheys Creek	TN06040003017_0999	28.3
Misc. tribs to Duck River	TN06040003005_0999	49.5
Misc. tribs to Duck River	TN06040003009_0999	48.8
Misc. Tribs to Duck River	TN06040003016_0999	15.2
Misc. Tribs to Duck River	TN06040003024_0999	14.0
Misc. tribs to Duck River	TN06040003026_0999	2.6
Misc. tribs to Lick Creek	TN06040003041_0999	15.8
Misc. tribs to Piney River	TN06040003050_0999	27.9
Misc. Tribs to Sugar Creek	TN06040003023_0999	2.6
Misc. tribs. To Duck River	TN06040003065_0999	23.6
Mud Creek	TN06040003034_0500	6.6
Panther Branch	TN06040003005_0400	3.0
Patterson Creek	TN06040003019_0200	5.8
Pemberton Branch	TN06040003060_0400	4.4
Persimmon Creek	TN06040003009_0300	4.6
Piney Branch	TN06040003010_0810	7.6
Piney Fork	TN06040003007_0100	9.6
Plunders Creek	TN06040003050_0400	3.1
Poplar Creek	TN06040003024_0200	7.7
Pretty Creek	TN06040003050_0100	12.9
Pumpkin Creek	TN06040003062_0400	8.4
Ranel Branch	TN06040003034_0100	3.2
Romantown Branch	TN06040003039_0100	3.2
Scotts Creek	TN06040003023_0120	18.1
Shoal Branch	TN06040003041_0500	7.4
Short Branch	TN06040003010_0200	5.3

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Simmons Branch	TN06040003010_1200	5.3
South Fork Sugar Creek	TN06040003059_0200	10.7
Stewarts Branch	TN06040003061_0500	4.7
Taylor Creek	TN06040003005_0300	11.5
Terrell Creek	TN06040003034_0220	9.2
Trace Creek	TN06040003009_0900	6.8
Tribs to Beaverdam Creek	TN06040003007_0999	36.9
Tribs to Carters Creek	TN06040003034_0299	13.7
Tribs to Hurricane Creek	TN06040003061_0999	63.2
Tribs to Rutherford Creek	TN06040003034_0999	25.7
Trotters Branch	TN06040003010_0600	6.7
Turkey Creek	TN06040003050_0710	10.6
Unnamed trib to Duck River	TN06040003026_0100	1.4
UT to Duck River	TN06040003005_0600	17.3
UT to Duck River	TN06040003065_0300	11.5
Wades Branch	TN06040003007_0300	7.0
Walden Branch	TN06040003034_0240	5.7
Wallace Branch	TN06040003060_0100	10.0
Wiley Branch	TN06040003050_0620	5.4
Willie Branch	TN06040003009_0600	7.1
Woodward Branch	TN06040003061_0100	3.7
Yellow Bank Branch	TN06040003061_0200	5.7

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

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (ACRES)
Dickson Lake	TN06040003DICKSONLK_1000	8
Upper Dickson Lake	TN06040003UPPERLAKE_1000	5

Table A3-1e. Lakes Not Assessed in the Lower Duck River Watershed

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)	SUPPORT DESCRIPTION
Crooked Creek	TN06040003034_0700	2.5	Partial
Grab Branch	TN06040003050_0610	3.9	Partial
McCutcheon Creek	TN06040003034_0300	21.8	Partial
Quality Creek	TN06040003023_0100	7.1	Partial
Rutherford Creek	TN06040003034_2000	12.5	Partial
Sugar Creek	TN06040003023_0200	13.6	Partial
UT to Lytle Creek	TN06040003030_0100	1.6	Not supporting

Table A3-2a. Stream Impairment Due to Siltation in the Lower Duck River Watershed.

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)	SUPPORT DESCRIPTION
Blue Creek	TN06040003062_3000	5.1	Not supporting
Dog Creek	TN06040003041_1150	2.0	Not supporting
Lunns Branch	TN06040003041_0950	2.4	Not supporting
Potts Branch	TN06040003041_0800	2.9	Partial
Rutherford Creek	TN06040003034_2000	12.5	Partial
Sugar Creek	TN06040003023_0200	13.6	Partial
Sugar Fork	TN06040003023_1000	2.0	Not supporting

Table A3-2b. Stream Impairment due to Organic Enrichment / Low Dissolved Oxygen in the Lower Duck River Watershed.

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)	SUPPORT DESCRIPTION
Crooked Creek	TN06040003034_0700	2.5	Partial
Quality Creek	TN06040003023_0100	7.1	Partial
Sugar Creek	TN06040003023_0200	13.6	Partial
UT to Lytle Creek	TN06040003030_0100	1.6	Not supporting
UT to Little Bigby Creek	TN06040003027_0100	2.0	Partial

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

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)	SUPPORT DESCRIPTION
Quality Creek	TN06040003023_0100	7.1	Partial
Sugar Creek	TN06040003023_0200	13.6	Partial

Table A3-2d. Stream Impairment due to Unionized Ammonia in the Lower Duck River Watershed.

APPENDIX IV

LAND USE/LAND COVER	AREAS IN HUC-10 SUBWATERSHEDS (ACRES)				
	01	02	03	04	05
Bare Rock/Sand/Clay		1	1		7
Deciduous Forest	8,756	16,297	35,063	46,175	163,123
Emergent Herbaceous Wetlands	41	34	15		130
Evergreen Forest	5,374	1,734	2,594	762	1,730
High Intensity: Commercial/Industrial/Transportation	1,833	463	327	180	727
High Intensity: Residential	488	30	57	2	68
Low Intensity: Residential	2,895	551	586	69	512
Mixed Forest	25,246	8,548	9,446	2,266	5,231
Open Water	1,995	190	616	6	3,594
Other Grasses: Urban/Recreational	609	448	405	67	379
Pasture/Hay	66,625	34,384	25,097	10,507	19,841
Row Crops	15,560	9,867	6,826	4,273	13,671
Transitional	551	206	102	95	882
Woody Wetlands	1,803	948	1,209		2,010
Quarries/Strip Mines	176	256	163	43	10
Total	**210,772**	**73,957**	**82.508**	**64,447**	**211,917**

LAND USE/LAND COVER	AREAS IN HUC-10 SUBWATERSHEDS (ACRES)			
	06	07	08	09
Deciduous Forest	84,134	98,650	42,747	40,715
Emergent Herbaceous Wetlands	3			
Evergreen Forest	1,078	1,461	628	265
High Intensity: Commercial/Industrial/Transportation	278	1,164	60	58
High Intensity: Residential	36	127		1
Low Intensity: Residential	133	895	50	60
Mixed Forest	2,675	5,429	1,433	950
Open Water	89	225	2	67
Other Grasses: Urban/Recreational	88	673	8	71
Pasture/Hay	5,148	20,724	3,176	4,840
Row Crops	3,493	12,616	2,972	4,581
Transitional	1,187	867	1,145	297
Woody Wetlands	567	145	122	48
Quarries/Strip Mines	98	65		
Total	**99,008**	**143,041**	**52,344**	**51,954**

Table A4-1. Land Use Distribution in Lower 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
03599500	0604000301	USGS	Duck River	1,208	103	117	97.9
03600258	0604000301	USGS	Little Bigby Creek	42.6			
03600000	0604000302	USGS	Rutherford Creek	68.8	0	0	0
03600088	0604000302	USGS	Carters Creek	20.1			
03600100	0604000302	USGS	Rutherford Creek				
03600500	0604000303	USGS	Big Bigby Creek	17.5	2.1	2.3	1.6
03601000	0604000303	USGS	Big Bigby Creek	25.8			
03601100	0604000303	USGS	Big Bigby Creek	48.3	3.9	4.3	3.2
03601990	0604000305	USGS	Duck River				
03602000	0604000305	USGS	Duck River	2,048	121	135	107
03602100	0604000305	USGS	Moss Spring Hollow				
03603000	0604000305	USGS	Duck River	2,557	456	477	422
03604600	0604000305	USGS	Blue Creek	24.8	6.3	6.5	5.8
03602219	0604000307	USGS	Piney River	46.6			
03602500	0604000307	USGS	Piney River	193	50.5	51.9	46.5
03603500	0604000309	USGS	Hurricane Creek	75.1	20.5	21.0	19.0

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

AGENCY	STATION	ALIAS	LOCATION	HUC-10
TDEC	CATHE001.8MY		Catheys Creek @ RM 1.8	0604000301
TDEC	001050		Duck River	0604000301
TDEC	001070		Duck River	0604000301
TDEC	DUCK127.2MY	DUCK127.2	Duck River @ RM 127.2	0604000301
TDEC	001065	DUCK113.9MY	Duck River @ RM 113.9	0604000301
TDEC	001060		Duck River @ RM 126.0	0604000301
TDEC	001054		Duck River @ RM 133.5	0604000301
TDEC	DUCK113.9MY	1065	Duck River @ RM 113.9	0604000301
TDEC	BIGBYSUR12		Duck River @ RM 109.3	0604000301
TDEC	BIGBYSUR13		Duck River @ RM 104.4	0604000301
TDEC	GREEN002.1MY		Green River @ RM 2.1	0604000301
TDEC	LBIGB004.1MY		Little Bigby Creek @ RM 4.1	0604000301
TDEC	LYTLE002.1MY		Lytle Creek @ RM 2.1	0604000301
TDEC	LYTLE002.3MY		Lytle Creek @ RM 2.3	0604000301
TVA	476813		Duck River @ RM 104.44	0604000301
TVA	476812		Duck River @ RM 109.31	0604000301
TVA	475039		Duck River @ RM 113.9	0604000301
TVA	476484		Duck River @ RM 116.2	0604000301
TVA	475308		Duck River @ RM 116.4	0604000301
TVA	476483		Duck River @ RM 118.3	0604000301
TVA	476482		Duck River @ RM 120.4	0604000301
TVA	475040		Duck River @ RM 122.3	0604000301
TVA	476481		Duck River @ RM 123.8	0604000301
TVA	476480		Duck River @ RM 124.80	0604000301
TVA	476479		Duck River @ RM 126.0	0604000301
TVA	476478		Duck River @ RM 126.8	0604000301
TVA	476477		Duck River @ RM 127.1	0604000301
TVA	476492		Duck River @ RM 127.15	0604000301
TVA	476476		Duck River @ RM 128.1	0604000301
TVA	475068		Duck River @ RM 128.2	0604000301
TVA	476475		Duck River @ RM 128.9	0604000301
TVA	476474		Duck River @ RM 129.2	0604000301
TVA	476473		Duck River @ RM 129.7	0604000301
TVA	475067		Duck River @ RM 129.9	0604000301
TVA	476259		Duck River @ RM 130.4	0604000301
TVA	476472		Duck River @ RM 131.2	0604000301
TVA	476303		Duck River @ RM 132.0	0604000301
TVA	476302		Duck River @ RM 132.5	0604000301
TVA	475066		Duck River @ RM 132.8	0604000301
TVA	476471		Duck River @ RM 133.5	0604000301
TVA	475763		Duck River @ RM 133.92	0604000301
TVA	475746		Duck River @ RM 136.6	0604000301
TVA	476133		Duck River @ RM 82.5	0604000301
TVA	475309		Duck River @ RM 98.02	0604000301

AGENCY	STATION	ALIAS	LOCATION	HUC-10
TVA	476770		EF Little Bigby Creek @ RM 0.79	0604000301
TVA	476771		EF Little Bigby Creek @ RM 1.72	0604000301
TVA	476772		EF Little Bigby Creek @ RM 1.91	0604000301
TVA	476773		EF Little Bigby Creek @ RM 2.25	0604000301
TVA	476491		Greenlick Creek @ RM 0.01	0604000301
TVA	476490		Knob Creek @ RM 0.01	0604000301
TVA	476488		Little Bigby Creek @ RM 0.01	0604000301
TVA	475409		Little Bigby Creek @ RM 1.94	0604000301
TVA	476769		Little Bigby Creek @ RM 11.92	0604000301
TVA	476768		Little Bigby Creek @ RM 12.60	0604000301
TVA	476769		Little Bigby Creek 11.92	0604000301
TVA	476766		Unnamed Tributary @ RM 0.25	0604000301
TVA	476765		Unnamed Tributary @ RM 1.10	0604000301
USEPA	012ERL		Duck River	0604000301
TDEC	CARTE000.4MY		Carters Creek @ RM 0.4	0604000302
TDEC	MCCUT000.1MY		McCutcheon Creek @ RM 0.1	0604000302
TDEC	RANEB000.1MY		Ranel Branch @ RM 0.1	0604000302
TDEC	RUTHE1T0.2MY		Rutherford Creek @ RM 0.2	0604000302
TDEC	RUTHE001.6MY		Rutherford Creek @ RM 1.6	0604000302
TDEC	RUTHE019.3MY		Rutherford Creek @ RM 19.3	0604000302
TDEC	RUTHE002.9MY		Rutherford Creek @ RM 2.9	0604000302
TDEC	RUTHE006.2MY		Rutherford Creek @ RM 6.2	0604000302
TDEC	RUTHE008.7MY		Rutherford Creek @ RM 8.7	0604000302
TVA	476485		Rutherford Creek @ RM 0.05	0604000302
TVA	475408		Rutherford Creek @ RM 0.1	0604000302
TDEC	BBIGB000.3MY	BIGBYSUR09	Big Bigby Creek @ RM 0.3	0604000303
TDEC	BBIGB011.0MY	BIGBYSUR06	Big Bigby Creek @ RM 11.0	0604000303
TDEC	BBIGB014.0MY		Big Bigby Creek @ RM 14.0	0604000303
TDEC	BBIG015.2MY	BIGBYSUR03	Big Bigby Creek @ RM 15.2	0604000303
TDEC	BBIGB015.6MY	BIGBYSUR02	Big Bigby Creek @ RM 15.6	0604000303
TDEC	BBIGB016.3MY		Big Bigby Creek @ RM 16.3	0604000303
TDEC	BBIGB017.2MY	BIGBYSUR01	Big Bigby Creek @ RM 17.5	0604000303
TDEC	BBIGB007.0MY	BIGBYSUR08	Big Bigby Creek @ RM 7.0	0604000303
TDEC	BBIGB008.5MY	BIGBYSUR07	Big Bigby Creek @ RM 8.5	0604000303
TDEC	BBIGB008.5MY	BIGBYSUR07	Big Bigby Creek @ RM 8.5	0604000303
TDEC	BBIGB014.3MY	BIGBYSUR05	Big Bigby Crek @ RM 14.3	0604000303
TDEC	DOG000.1MY		Dog Branch @ RM 0.1	0604000303
TDEC	QUALI000.1MY		Quality Creek @ RM 0.1	0604000303
TDEC	QUALI001.6MY		Quality Creek @ RM 1.6	0604000303
TDEC	SUGAR000.1MY	BIGBYSUR10	Sugar Creek @ RM 0.1	0604000303
TDEC	SUGAR001.8MY		Sugar Creek @ RM 1.8	0604000303
TDEC	SUGAR002.2MY		Sugar Creek @ RM 2.2	0604000303
TDEC	SUGAR002.4MY		Sugar Creek @ RM 2.4	0604000303
TDEC	SUGAR004.4MY		Sugar Creek @ RM 4.4	0604000303

AGENCY	STATION	ALIAS	LOCATION	HUC-10
TDEC	SUGAR005.1MY		Sugar Creek @ RM 5.1	0604000303
TDEC	SUGAR006.6MY		Sugar Creek @ RM 6.6	0604000303
TDEC	SUGAR001.9MY	SUGARFK001.9	Sugar Fork @ RM 1.9	0604000303
TDEC	WFORK000.1MY	BIGBYSUR04	West Fork @ RM 0.1	0604000303
TDEC	WFORK001.3MY		West Fork Creek @ RM 1.3	0604000303
TVA	476811		Big Bigby Creek @ RM 0.3	0604000303
TVA	476810		Big Bigby Creek @ RM 11.1	0604000303
TVA	476809		Big Bigby Creek @ RM 19.14	0604000303
TVA	475045		Big Bigby Creek @ RM 4.7	0604000303
TDEC	LICK001.0HI		Lick Creek @ RM 1.0	0604000304
TDEC	LICK014.2MY		Lick Creek @ RM 14.2	0604000304
TDEC	BLUE001.4HU		Blue Creek @ RM 1.4	0604000305
TDEC	BLUE016.2HU	BLUE016.2	Blue Creek @ RM 16.2	0604000305
TDEC	1080		Duck River @ Hwy 100 Bridge	0604000305
TDEC	1090		Duck River @ Hwy 50 Bridge	0604000305
TDEC	1100		Duck River @ RR Bridge	0604000305
TDEC	1110		Duck River @ RM 64.0	0604000305
TDEC	1130		Duck River @ RM 14.0	0604000305
TDEC	DUCK015.7HU		Duck River @ RM 15.7	0604000305
TDEC	DUCK064.0HI	001110	Duck River @ RM 64.0	0604000305
TDEC	1135		Duck River @ RM 8.8	0604000305
TDEC	India001.2hi	1680	Indian Creek	0604000305
TDEC	ECO71F16		Wolf Creek	0604000305
TDEC	ECO71F16		Wolf Creek @ RM 1.0	0604000305
TVA	475981		Blue Creek @ RM 9.7	0604000305
TVA	475017		Duck River @ RM 1.0	0604000305
TVA	475841		Duck River @ RM 11.6	0604000305
TVA	475036		Duck River @ RM 11.7	0604000305
TVA	477402		Duck River @ RM 16.7	0604000305
TVA	476629		Duck River @ RM 18.5	0604000305
TVA	477318		Duck River @ RM 22.5	0604000305
TVA	475793		Duck River @ RM 26.0	0604000305
TVA	477074		Duck River @ RM 4.2	0604000305
TVA	475783		Duck River @ RM 47.9	0604000305
TVA	475037		Duck River @ RM 64.0	0604000305
TVA	476134		Duck River @ RM 71.4	0604000305
TVA	475038		Duck River @ RM 72.8	0604000305
USEPA	022ERL		Green River	0604000305
TDEC	BSWAN005.7		Big Swan Creek @ RM 5.7	0604000306
TDEC	ECO71F28		Little Swan Creek @ RM 5.6	0604000306
TDEC	EPINE000.2DI		East Piney River @ RM 0.2	0604000307
TDEC	EPINE003.0DI	PINEY05	East Piney River @ RM 3.0	0604000307
TDEC	EPINE003.9DI	PINEY04	East Piney River @ RM 3.9	0604000307
TDEC	EPINE005.3DI	PINEY03	East Piney River @ RM 5.3	0604000307

AGENCY	STATION	ALIAS	LOCATION	HUC-10
TDEC	EPINE005.4DI	PINEY02	East Piney River @ RM 5.4	0604000307
TDEC	EPINE006.5DI	PINEY01	East Piney River @ RM 6.5	0604000307
TDEC	PINEY022.0DI	PINEY08	Piney River @ RM 22.0	0604000307
TDEC	PINEY008.4HI		Piney River @ RM 8.4	0604000307
TDEC	WPINE001.2DI		West Piney River @ RM 1.2	0604000307
TDEC	WPINE001.3DI	PINEY07	West Piney River @ RM 1.3	0604000307
TDEC	WILLO000.1DI	PINEY06	Willow Branch @ RM 0.1	0604000307
TVA	475046		Piney River 11.5	0604000307
TVA	475869		Piney River 7.5	0604000307
TVA	476055		Piney River 8.4	0604000307
TDEC	HURRI004.5HU	HURRI004.5	Hurricane Creek @ RM 4.5	0604000309

Table A4-4. STORET Water Quality Monitoring Stations in the Lower Duck River Watershed*. RM, River Mile; TDEC, Tennessee Department of Environment and Conservation; USEPA, United States Environmental Protection Agency; TVA, Tennessee Valley Authority.*

FACILITY NUMBER	FACILITY NAME	SIC	SIC NAME	MADI	WATERBODY	HUC-10
TN0026441	Glenn Springs Holdings	2819	Industrial Inorganic Chemicals	Minor	Duck River @ RM 129.9 (Outfall 001) and @ RM130.4 (Outfalls 002 and 003)	0604000301
TN0001571	Spontex, Incorporated	3081	Unsupported Plastic Film or Sheet	Minor	Duck River @ RM 130.0 (Outfall 001), @ RM 129.9 ((Outfall 002), and @ RM 129.0-130.0 (SWA and SWH)	0604000301
TN0002275	UCAR Carbon, Inc.	3624	Carbon and Graphite Production	Minor	Duck River @ RM 129.4	0604000301
TN0056103	Columbia STP	4952	Sewerage System	Major	Duck River @ RM 127.2	0604000301
TN0001538	Solutia, Incorporated	2819	Industrial Inrorganic Chemicals	Minor	Duck River @ RM 122.4 (Outfall 002) and @ RM 127.7 (Outfall 011)	0604000301
TN0060291	Hampshire Coin Laundry	7215	Coin Operated Laundry and Dry Cleaning	Minor	McClannahan Branch @ RM 0.2 to Hampshire Creek @ RM 2.6	0604000301
TN0075868	Spring Hill STP	4952	Sewerage System	Major	Rutherford Creek @ RM 19.6	0604000302
TN0020800	Mount Pleasant STP	4952	Sewerage System	Minor	Sugar Fork Creek @ RM 1.9	0604000303
TN0067415	CYTEC Industries	2869	Industrial Organic Chemicals	Major	Big Bigby Creek @ RM 15.1, 15.4, and 15.6	0604000303
TN0021962	Universal Fasteners #1	3471	Electroplating, Polishing, Anodizing	Minor	Duck River @ RM 70.5	0604000305
TN0024937	Centerville STP	4952	Sewerage System	Minor	Duck River @ RM 71.5	0604000305
TN0021741	McEwen STP	4952	Sewerage System	Minor	Blue Creek @ RM 16.2	0604000305
TN0067130	East Hickman County Middle School	4952	Sewerage System	Minor	UT @ RM 1.1 to Big Spring Creek @ RM 11.0	0604000307

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

FACILITY NUMBER	PERMITEE	COUNTY	LIVESTOCK	WATERBODY	HUC-10
TNA000068	Blackjack Ridge Dairy	Maury	Dairy Cows	UT to Potts Branch	0604000304

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

FACILITY NUMBER	PERMITEE	SIC	SIC NAME	WATERBODY	HUC-10
TN0004171	Columbia Rock Products (Plant and Mine #1)	1422	Limestone-Crushed and Broken	Rutherford Creek	0604000302

Table A4-7. Active Permitted Mining Sites in the Lower Duck River Watershed. *SIC, Standard Industrial Classification.*

FACILITY NUMBER	FACILITY NAME	WATERBODY	HUC-10
TN0004375	Columbia Water System WTP	Duck River @ RM 134 and 135	0604000301
TN0077933	Spring Hill WTP	UT to Rutherford Creek	0604000302
TN0061689	Mount Pleasant WTP	Bigby Creek @ RM 19.5	0604000303

Table A4-8. Water Treatment Plants in the Lower Duck River Watershed. *RM, River Mile; UT, Unnamed Tributary.*

FACILITY NUMBER	FACILITY NAME	WATERBODY	HUC-10
TNG110120	Sequatchie Concrete Services	Lytle Creek	0604000301
TNG110241	B&B Concrete Products	Settling Pond	0604000301
TNG110067	IMI Tennessee, Inc.	Pond to Evaporation	0604000302
TNG110055	Nashville Ready Mix	Unknown	0604000302
TNG110068	IMI Tennessee	UT to Greenlick Creek	0604000303
TNG110006	Dorton Lumber Company	Ditch to Haley Creek to Duck River @ RM 75.1	0604000305
TNG110175	Centerville Concrete Prod.	UT to Dry Creek to Duck River	0604000305
TNG110221	V&W Ready Mix	WWC to UT to Duck River	0604000307

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

LOG NUMBER	COUNTY	DESCRIPTION	WATERBODY	HUC-10
NRS00.216	Lewis	Channel Relocation	UT to Little Swan Creek	0604000301
NRS02.262	Hickman	Bridge Repair	Buck Branch	0604000301
NRS02.204	Hickman	Bridge Maintenance	Duck River	0604000302
NRS02.464	Maury	Railroad Siding	Carter's Creek	0604000302
NRS04.003	Williamson	Stream Encapsulation	McCutcheon Creek	0604000302
NRS03.138	Maury	Isolated Wetland Fill	UT to Rutherford Creek	0604000302
NRS02.387	Williamson	Roadway and Utility Crossing	McCutcheon Creek	0604000302
NRS03.296	Williamson	Channel Bypass	Grassy Branch	0604000302
NRS02.087	Williamson	Wetland Alteration	Isolated Wetland	0604000302
NRS02.270	Williamson	Gravity sewer Line	Grassy Branch	0604000302
NRS02.396	Maury	Gas Pipeline Crossing	West Fork McCutcheon Creek and UTs	0604000302
NRS03.199	Maury	Earthen Dam Stream Impoundment	Big Bigby Creek	0604000303
NRS02.350N	Williamson	Stream Crossings	Locke Branch	0604000304
NRS00.008	Hickman	Bridge Replacement	Persimmon Creek	0604000305
NRS02.172	Hickman	Stream/Roadside Stabilization	Big Swan Creek	0604000306
NRS01.413A	Lewis	Rip-Rap	Dry Branch	0604000306
NRS03.365	Hickman	Gravel Removal	Mill Creek	0604000307
NRS02.453	Dickson	Culvert	Willow Branch	0604000307
NRS02.174A	Dickson	Stream Relocation	Turkey Creek	0604000307
NRS02.174B	Dickson	Road Crossing	UT to Turkey Creek	0604000307
NRS02.262A	Hickman	Bridge Repair	Mill Creek	0604000307
NRS02.242	Dickson	Bank Stabilization	Coon Creek	0604000307
NRS01.062	Hickman	Bank Stabilization	Beaverdam Creek	0604000308
NRS03.366	Hickman	Gravel Bar Removal	Beaverdam Creek	0604000308
NRS00.126	Hickman	Channel Relocation, Bank Stabilization	Wades Branch	0604000308
NRS02.212	Hickman		Brushy Creek	0604000308
NRS02.117	Hickman	Bank Stabilization	Cow Hollow Branch	0604000308
NRS02.426	Humphreys	Bank Stabilization	Hurricane Creek	0604000309

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

FACILITY NUMBER	FACILITY NAME	SECTOR	RECEIVING STREAM	AREA*	HUC-10
TNR053550	United Parcel Service	P	UT to Little Bigby Creek	1.73	0604000301
TNR053430	Federal Express-FYMA	S, P	UT to Lytle Creek	0.4	0604000301
TNR050360	Occidental Chemical Corporation	C, L	Rutherford Creek	20	0604000301
TNR056384	R&D Motor Sports	M	UT to Little Bigby Creek	0.25	0604000301
TNR054225	Columbia Machine Works	AA, AB	Little Bigby Creek	9	0604000301
TNR050188	UCAR Carbon Company	L	Duck River	185	0604000301
TNR050728	Lo-Jac	D	Not Identified	5	0604000301
TNR054099	Con-Way Southern Express-NLW	P	Little Bigby Creek	4	0604000301
TNR050012	Fedders-Columbia Specialties	AB, AC	Duck River	6.2	0604000301
TNR051786	Swarco, Inc.	Y	East Fork Creek	7.25	0604000301
TNR054514	Calcium Silicate, Corp.	E	Greenlick Creek	13	0604000301
TNR054341	Pioneer Manufacturing	Y	UT to Carter's Creek	10	0604000302
TNR050680	Saturn Corporation	AB	Titan Creek	1,265	0604000302
TNR054063	Armor Environmental Services	P	Quality Creek	8.3	0604000303
TNR054408	R&D Tire Mold Company	AB	Quality Creek	3.31	0604000303
TNR053682	Tennessee Aluminum Processors	F, P	UT to Quality Creek	28.6	0604000303
TNR053301	Smelter Services Corp.	F	Sugar Creek	9	0604000303
TNR056499	First F&M Company	C	Big Bigby Creek	23.89	0604000303
TNR051746	CYTEC Industries, Inc.	C	Big Bigby Creek	245	0604000303
TNR052013	Rhodia, Inc. Landfill	C, L	Sugar Creek	7.4	0604000303
TNR055966	Fox Hardware Lumber	A, P	Smith Branch @ RM 1.5	28	0604000304
TNR053119	Fabrication Specialists	A	UT(s) to Haley's Creek	33.5	0604000305
TNR055950	Affordable Auto Parts and Sales	N	Indian Creek	4	0604000305
TNR051768	Universal Fastners #1	Y, AA	Duck River	44	0604000305
TNR051912	Signage, Incorporated	Y	Duck River	22	0604000305
TNR051943	Universal Fastners #2	Y	Duck River	94	0604000305
TNR053856	Bucksnort Lumber and Pallet	A	Tumbling Creek	2	0604000305
TNR053597	Eubanl Asphalt Paving and Sealing	D, P	Jones Creek	25	0604000306
TNR050094	Quercus Forest Products	A	Simmons Branch	60	0604000306
TNR054220	Hohenwald Machine Works	AB	Indian Creek	0.75	0604000306
TNR050305	Hohenwald Biomass Facility	AD	Hinson Hollow Branch, Indian Creek, Swan Creek, and Duck River	6.6	0604000306
TNR053522	Eaton Aerquip	Y	Mulherin Creek	40	0604000306
TNR054533	Cowley Container Corp.	N	Quality Creek	3.81	0604000307
TNR056340	L&R Auto Salvage	M	UT to Mill Creek	4.1	0604000307
TNR055924	Shapiro Recycling Systems	N	Turkey Creek	25	0604000307
TNR051673	Wabash Alloys	F, P	Grab Creek	56.4	0604000307

FACILITY NUMBER	FACILITY NAME	SECTOR	RECEIVING STREAM	AREA*	HUC-10
TNR050116	Porcelain Industries	AA	Beaverdam Creek	3.7	0604000307
TNR053048	Dickson County Landfill	L, P	Worley Furnace Branch	90	0604000307
TNR056375	Stud Welding, Inc.	AA	Bird Creek	12	0604000307
TNR053201	Centerville Municipal Airport	S	Defeated Creek and Bird Creek	0.5	0604000307
TNR056289	Stephens Used Cars	M	Gray Branch	10	0604000307
TNR050514	Foreman Lumber Co.	A	Beaverdam Creek	5	0604000308

Table A4-11. Active Permitted TMSP Facilities in Lower Duck River Watershed. *Area, acres of property associated with industrial activity; UT, Unnamed Tributary. 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	13,540	
Filter Strips		24
Grassed Waterways		
Hedgerow Plantings		
Herbaceous Wind Barriers		
Riparian Forest Buffers		48
Streambank and Shoreline Protection	1,930	
Windbreaks and Shelterbelts		
Total Conservation Buffers	**15,470**	**72**

Table A5-1a. Conservation Buffers Conservation Practices in Partnership with NRCS in the Lower 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	2,113
Waste Utilization	0

Table A5-1b. Nutrient Management Conservation Practices in Partnership with NRCS in the Lower 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	2,297

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

CONSERVATION PRACTICE	AMOUNT	
	Feet	**Acres**
Fence	67,171	
Firebreak		
Forest Harvest Management		815
Heavy Use Area Protection		
Pasture and Hay Planting		73
Prescribed Grazing		1,699
Range Planting		
Use Exclusion		4
Pipeline		
Prescribed Burning		
Total	**67,171**	**2,591**

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

COMMUNITY	PROJECT DESCRIPTION	AWARD DATE	AWARD AMOUNT
Centerville	Inflow/Infiltration Correction/Plant Rehabilitation	02/06/1992	$250,000
Centerville	Sewer Line Extension to Residential Area	12/13/1999	$675,000
Spring Hill	New Wastewater Treatment Plant	06/11/1998	$4,523,350

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

PRACTICE	NRCS CODE	NUMBER OF BMPs
Conservation Cover	327	5
Critical Area Planting	342	3
Fence	382	12
Grade Stabilization Structure	410	3
Grassed Waterway	412	2
Heavy Use Area	561	11
Mine Reclamation	543	1
Nutrient Management	590	3
Pasture/Hay Planting	512	60
Pest Management	595	1
Pipeline	516	9
Pond	378	23
Prescribed Grazing	528	8
Riparian Forest Buffer	391	2
Spring Development	574	1
Stream Crossing	578	1
Streambank Protection	580	14
Use Exclusion	472	3
Watering Facility	614	10

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