



CHAPTER 6

Water Resources

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The Tennessee River watershed encompasses parts of seven states in the Southeast totaling nearly 40,000 square miles. TVA has been actively involved with water resources and river system integration since 1933, when Congress charged the agency with managing and serving as the steward of the Tennessee River and its watershed. Many of TVA's programs to date have been associated with construction and improvement of new dams and reservoirs and their operation as well as the broader stewardship mission of TVA. Specific activities include (but are not limited to):

- Address erosion and suspended sediment in the Tennessee River watershed
- Study TVA reservoir limnology (i.e., freshwater ecosystems)
- Monitor and improve water quality in reservoirs, rivers and tailwaters
- Maintain and enhance reservoir aquatic habitats for fisheries
- Document and track stream biology
- Study hydrology and water quality impacts of different land uses
- Work in partnership with other stakeholders to reduce impacts of land practices in the Tennessee River watershed and sub-watersheds
- Collect and utilize water resource information to plan, site, construct and operate TVA fossil and nuclear electric generation stations



As decades have passed, TVA's unique role and value to the region has evolved, and its programs have evolved to address the demands placed on the river system. In the early 1980s, TVA began a systematic effort to improve conditions downstream from its dams where issues were known to exist. TVA's capital investment of \$44 million between 1991 and 1996 and current multimillion-dollar annual operational expenses have created significant benefits. For example, these investments have helped to increase dissolved oxygen levels as well as improve flow rates in rivers downstream from TVA dams. As a result, the number and diversity of fish and insects have increased in these sections of river, and there has been a significant growth in tailwater fishing. In addition, capital investments have been made to upgrade or expand aeration systems in tailwaters as well as develop "put-and-take" cold-water trout fisheries in coordination with state wildlife resource agencies in the region.

Today, TVA continues to operate the Tennessee River and its tributaries as an integrated system to provide a wide range of public benefits, such as year-round navigation, flood-damage reduction, affordable electricity, improved water quality, water supply, land use, and recreation. TVA's water resource responsibilities are geographically bound by the Tennessee River watershed and not politically bound by state borders. Thus, TVA can focus on water resources in a watershed setting, enabling it to more holistically manage resources for today and for the use of future generations.

As part of this effort, TVA works in concert with state and other federal agencies to protect and improve water quality while maintaining an in-depth knowledge of changing conditions in the river system. TVA helps to build and catalyze partnerships, promote public outreach efforts, and provide

technical support to implement key water resource initiatives throughout the Tennessee River watershed. Also, TVA has historically played a national role as a test case for the development of tools and best management practices that can be used for maintaining and improving water quality on a national level.

These TVA water resources management programs support the objective of the federal Clean Water Act to "restore and maintain the chemical, physical and biological integrity of the nation's waters." A part of the Environmental Protection Agency's strategy to meet this objective is its Healthy Watersheds Initiative. This initiative augments the watershed approach with proactive, holistic aquatic ecosystem conservation and protection. The Healthy Watersheds Initiative includes both assessment and management approaches that encourage states, local governments, watershed organizations, and others to take a strategic, systematic approach to conserve healthy components of watersheds. In this way, the organizations avoid additional water quality impairments in the future. TVA's experience in holistic watershed resource management aligns with and benefits the Environmental Protection Agency's strategy.

TVA's stewardship responsibilities do not include regulation of water pollution. The U.S. Environmental Protection Agency and each of the states that share the Tennessee River develop pollution regulations and grant permits for discharges to the river and its tributaries. TVA facilities that have the potential to discharge pollutants into river water, such as hydroelectric or fossil-fueled generating plants, obtain the appropriate permits for routine facility discharges in accordance with these regulations. Pursuant to Section 26(a) of the TVA Act, however, TVA does have authority to issue 26(a) permits for water withdrawals and for the construction

and maintenance of discharge and other structures or obstructions affecting navigation, flood control, or public lands or reservations along, across, or in the Tennessee River or any of its tributaries. Through associated National Environmental Protection Act reviews, TVA considers environmental effects of its permitting actions under Section 26(a) of the TVA Act.

The NRP focuses exclusively on programs and activities to maintain and improve water resource conditions not associated with reservoir operations. Activities associated with the operation of the TVA reservoir system are presented in the Reservoir Operations Study (2004). As a result of the Reservoir Operations Study, the TVA board established a policy that continues to govern reservoir operations and is not reevaluated in this planning effort. See www.tva.com/environment/reports/ros_eis/ for additional information on reservoir operations.



6.1 Goal

TVA will promote water quality and aquatic habitat improvements across the Tennessee River watershed through collaborative partnerships by providing water quality data and technical support to conduct water resource stewardship efforts within the watershed, including on TVA-managed lands and at TVA facilities.

6.2 Benefits

Through management efforts in this resource area, TVA expects to realize the following benefits:

- Improved protection and enhancement of aquatic habitats and biological communities
- Greater public awareness of land use impacts and the potential for invasive species (e.g., foreign species transported into habitats)
- Expanded collaborative efforts (funding and resources) to better evaluate and protect exceptional biodiversity within the Tennessee River watershed
- A more comprehensive understanding of stream, reservoir and tailwater conditions to help inform future water resource initiatives
- Increased participation in meeting the objectives of the Clean Water Act

6.3 Implementation Strategy

TVA's objective is to manage water resources by conducting water resource improvement efforts on TVA-managed lands and facilities and promoting voluntary programs that will reduce both point and nonpoint source water pollution within the Tennessee River watershed, resulting in cleaner water in which to swim, fish and play. The NRP helps TVA to focus its water resources management efforts in an integrated manner, supporting both resource area and external stakeholder needs.

Federal, state and local stakeholders play separate, but complementary roles in water resource management. Successful and sustainable projects can only be accomplished through collaboration and cooperation of multiple organizations and agencies. One agency or organization cannot accomplish this alone. Below is an overview of some roles key stakeholders play in maintaining and enhancing the waters in the Tennessee River watershed:

- The U.S. Environmental Protection Agency and Tennessee Valley states' water pollution control agencies develop protective water quality standards and pollution regulations that ensure states' waterways meet the requirements set forth by the 1972 amendments to the federal Water Pollution Control Act, known as the Clean Water Act.
- The U.S. Fish and Wildlife Service bears the responsibility for identifying, listing, protecting and recovering aquatic species that are threatened or endangered.
- Other federal and state agencies, such as the U.S. Geological Service, the U.S. Army Corps of Engineers, and states' fish and wildlife agencies, collect, maintain and implement efforts to manage and improve aquatic resources. States maintain lists and accountabilities for protecting threatened and endangered aquatic species.
- Nongovernmental organizations, including public watershed organizations and also private citizens, work with federal, state and local organizations to identify water quality issues, develop implementation plans, and implement improvements projects.
- TVA's role in water resource management includes:
 - Complying with federal and state water pollution control regulations at its power facilities and by managing river flows and improving quality (dissolved oxygen) of releases from its hydro structures (dams)
 - Working with stakeholders to implement stewardship efforts in the Tennessee River watershed. This includes collecting, managing and sharing water quality and aquatic resource (biological) information with stakeholders, making improvements to TVA public lands and shorelines, and working in concert with state and other federal agencies, nongovernmental organizations, and private citizens to improve water resource conditions.
 - Providing public outreach information and assistance to its stakeholders in carrying out its water resource management accountabilities under the TVA Act
 - Supporting a sustainable effort in protecting and improving water resources for current and future generations

Within water resources, TVA has structured its implementation strategy based on the following characteristics:

- Water quality management
- Data management
- Strategic partnerships
- Public outreach and awareness

Water Quality Management

To support regional and national water quality initiatives, TVA will implement a variety of water resource improvement programs to:

- Lessen adverse impacts on water quality by TVA-managed properties
- Protect healthy waters that contain exceptionally diverse aquatic biological communities
- Identify sources of high nutrient loading and support initiatives to mitigate those impacts

Part of TVA's water resources management implementation strategy will be to identify methods to directly reduce nutrients, sediment loads, and other contaminants that are within TVA's control. TVA will focus on nutrient source identification and improvement opportunities within the TVA

system of reservoirs. Consequences of not proactively addressing nutrients as a regional and national issue will be significant from both a future regulatory and current needs perspective. TVA's implementation strategy will involve TVA initially in partnership efforts to demonstrate nutrient load reduction opportunities, techniques and successes within the Tennessee Valley. These efforts will be expected to favorably impact a number of water bodies identified on states' 303(d) lists of impaired waters.

Recently, there has been an increased focus on reducing nutrient loading as a national priority. Efforts associated with this focus will result in reduced impacts of nutrients both in TVA reservoirs and downstream waters as well as reduced public water-supply and wastewater treatment costs. An example of an emerging priority issue is nutrient loading (particularly of nitrogen) and its effect on



hypoxia in the northern Gulf of Mexico. Hypoxia is a condition in which natural waters have a low concentration of dissolved oxygen, resulting in unsustainable aquatic environments for most game, commercial, and other fish and shellfish species. An expanding area of depleted oxygen concentrations, referred to as the “dead zone” in the Gulf, is having a tremendous ecological and economic impact. Although impacts of nutrient yields from the Tennessee River delivered to the Gulf may not be completely understood, TVA’s strategy will implement a proactive program to demonstrate nutrient load identification and reduction opportunities that will target the major sources of nutrient loading. The ultimate goal is to reduce nonpoint and point source inputs delivered to the northern Gulf of Mexico.

Potential partners in water quality management will include states’ water pollution control agencies, the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, Ohio River Valley Sanitation Commission, Electric Power Research Institute, Natural Resources Conservation Service, Environmental Protection Agency, U.S. Army Corps of Engineers, and other interested stakeholders.

In addition, wetlands restoration plays an important role in water resources management. Primary wetland functions that affect water resources include:

- Shoreline protection
- Erosion reduction
- Trapping and removing sediment particulates (suspended solids)
- Retaining (recycling) excess nutrients
- Groundwater recharge and stream flow maintenance
- Flood protection—by retaining excess runoff after a storm, and then releasing it slowly and with lower concentrations of storm water pollutants
- Providing habitat for fish and wildlife, including organisms that they feed upon
- Providing spawning areas for fish and other aquatic organisms (lake margin and riverine wetlands)



TVA includes wetlands restoration, creation, and enhancement as one of several water resource management improvement methodologies. Program activities associated with wetlands management are located in the biological resources management chapter.



Data Management

Currently, TVA assesses stream conditions in 611 hydrologic units in the Tennessee River watershed tracked by 11-digit identification numbers on a five-year cycle (approximately 110 sites monitored annually). Data are provided to state water pollution control agencies and stakeholders as requested.

As part of the NRP, TVA will refocus aquatic monitoring and management programs to measure and assess conditions in the Tennessee River and reservoir system that will provide the information needed to identify opportunities for making improvements, detect significant changes, and document successes. Part of TVA's data management effort is to work with its partners to establish a compatible and comprehensive database of water resource related information to help support and inform the various programs

and activities being performed across the Tennessee Valley. This data sharing effort is not unique to water resources and will, in the long-term, be coordinated with other databases both internal and external to TVA. See the stream and tailwater monitoring program discussed below for examples of how TVA will monitor, capture and share water resource-related information throughout the Tennessee River watershed.

In addition, TVA's data management and collection efforts will focus on addressing the effects of climate change on water resources, which have the potential for influencing the unique biodiversity within the Tennessee Valley. The Council of Environmental Quality implementing instructions have been issued for federal agencies to evaluate climate change risks and vulnerabilities and to manage both the short- and long-term effects of climate change on the agency's mission and operations through adaptation planning. TVA's Environmental Policy states that "TVA will be proactive in addressing environmental concerns, including those related to global climate change." TVA will join in collaborative partnerships with other agencies and stakeholders to conduct long-term climate change sentinel monitoring, helping to provide early warning that climate change effects are beginning to occur. This proactive approach will support the planning of actions to lessen or mitigate future effects should they begin to develop. Partnerships will be sought with states to detect climate change effects on streams and on wildlife. The Tennessee Wildlife Resource Agency has indicated that long-term monitoring systems that are strategically designed to evaluate climate change effects and wildlife responses are a high priority for that agency. Other potential partners will include the U.S. Geological Survey, the U.S. Fish and Wildlife Service, the National Parks Service, and the U.S. Forest Service.

Strategic Partnerships

TVA will focus efforts to develop and maintain strong strategic partnerships with state, regional and national organizations to address mutually important water resources stewardship opportunities that will deliver measurable improvements to the water quality in the Tennessee Valley watershed. To support and expand implementation efforts, TVA will work to maintain existing partnerships and explore the potential for new partnerships to address mutually important water resources stewardship opportunities.

TVA is in a unique position to help integrate and focus proactive state and federal water quality improvement programs. TVA will pursue the establishment of regional working

groups to catalyze the collaboration of state, federal and other stakeholders. As a strategic priority, TVA will establish and support a Tennessee River watershed improvement team to develop and implement a comprehensive watershed improvement plan and drive implementation efforts moving forward. This team will include various internal organizations (e.g., River Operations) as well as external agencies and nongovernmental organizations. With stakeholder input, this team and its plan will help ensure a coordinated approach to identify water quality stressors that could be addressed to achieve measurable results with stewardship activities. Focus areas will include those activities and land use practices in the watershed that have the potential to directly or indirectly have a negative impact on the water quality of the Tennessee River and its tributaries.



Public Outreach and Awareness

TVA's current water resources efforts in public outreach and awareness are reactive and usually independent of other resource areas. Each NRP program contains a component of public outreach, which can vary from direct interactions or campaigns with the public to supplying information for other programs to utilize in outreach efforts. Educating the public also plays an integral role in day-to-day management. It is essential to create public awareness of issues that focus on preventable

and proactive measures to improve and protect natural resources throughout the Tennessee Valley. Through the NRP, TVA will conduct proactive, integrated efforts with state and other federal agencies and nongovernmental organizations to educate the public about the importance of water resources and their effect on the quality of life in the Tennessee Valley. In addition to, or as part of these programs, TVA will voluntarily seek out opportunities and write grant proposals for partners and share technology and expertise with stakeholders.



6.4 Measures of Success

Implementation efforts in this resource area will be regularly evaluated to track progress using the following measures of success:

Resource Area	Measures of Success	Time Frame
Water	Certify 110-130 clean marinas	20 years
	Reassess the water quality and aquatic life of all streams and reservoirs and share data	3-5 years
	Reduce 20,000-25,000 tons of nutrients and sediment in partnership with others	20 years

6.5 Resource Area Programs

When developing the NRP, TVA identified programs and activities to support the goals of each resource area. The following

sections discuss each program in more detail, highlighting current activities, NRP activities, and expected implementation benefits. In addition, relationships between resource areas and other programs are discussed to help show linkages throughout the NRP.



6.5.1 Aquatic Ecology Management

The aquatic ecology management program will focus on enhancement of aquatic biological communities in TVA streams, reservoirs and tailwaters. This may include activities such as habitat improvements, biological monitoring, and pollution reduction. In addition, TVA will identify and develop public outreach information and opportunities to raise public awareness of land use practices that degrade aquatic communities and of exotic and invasive aquatic species. In addition, this program will include a focus on protection of aquatic biodiversity by identifying and actively protecting exceptionally diverse aquatic biological communities, such as the Clinch, Powell and Duck watersheds. These efforts include:

- Identifying protection needs through biological monitoring and habitat assessment activities
- Fostering the coordination efforts among stakeholders to make better management decisions
- Participating in public outreach efforts to raise public awareness of exceptional biological diversity
- Proactively implementing protection measures

Within the NRP, this program aligns with the following resource area and program:

- Threatened and endangered species program (Biological)

Scope: Tennessee River watershed

TVA Span of Control: No control over external impacts to the resource

Current Activities

TVA has worked in the past to enhance aquatic biologic communities through, for example, introduction of lake sturgeon into the Tennessee River as well as habitat enhancement to recover fish and mussels in the tailwaters below Tims Ford Dam. This program is intended to advance these efforts in a systematic manner moving forward.

NRP Activities

- Partner and actively participate in maintaining and enhancing aquatic biological communities
- Join and support collaborative partnerships to identify and implement protection needs, foster partnerships, and conduct outreach efforts in up to three healthy watersheds (Clinch, Powell and Duck watersheds)

Expected Benefits

Key benefits of this program are:

- A stronger understanding of factors affecting aquatic habitats and biological communities
- Protection and improvement of aquatic habitats and biological communities
- Increased knowledge and protection of threatened and endangered species
- Improved public awareness of land use impacts and a potential for invasive species (e.g., foreign species transported into habitats)
- Strengthened relationships with existing and new partners
- Expanded collaborative efforts (funding and resources) to better evaluate and protect exceptional biodiversity within the Tennessee River watershed
- Increased recognition of exceptional “hot spots” of biological diversity within the Tennessee River watershed and TVA’s commitment to partnering on improvement and protection efforts

6.5.2 Stream and Tailwater Monitoring Program

The stream and tailwater monitoring program uses biological monitoring to evaluate biological conditions and diversity that reflect watershed conditions. This information is used for decision making by water resource managers throughout the Tennessee River Valley (e.g., states, TVA, etc.) to target and track improvements. Also, it helps create public awareness about water resource conditions, increasing the opportunity for water resource managers to become involved in monitoring and data collection activities. Data gathered through stream and tailwater monitoring are used to measure certain effects below dams and to track operational changes resulting from the Reservoir Operations Policy (2004). The primary biological monitoring tool is the Index of Biological Integrity for fish communities. This methodology is used to identify both healthy and unhealthy streams and also to target and track success of stream improvement projects.

Within the NRP, this program aligns with the following resource area and program:

- Threatened and endangered species program (Biological)

Scope: Tennessee River watershed

TVA Span of Control: Partial control as TVA manages stream and tailwater monitoring efforts in coordination with state agencies in the Tennessee Valley

Current Activities

TVA assesses stream conditions in 611 hydrologic units in the Tennessee River watershed tracked by 11-digit identification numbers. Currently, 110 sites are assessed annually, allowing TVA to assess all hydrologic units on a five-year cycle.

Data are provided to state water pollution control agencies and stakeholders as requested.

NRP Activities

- Conduct between 110 to 125 stream assessments per year
- Share stream and reservoir data (online – TBD)

Expected Benefits

Key benefits of this program are:

- A proficient understanding of stream and tailwater conditions
- Ability to make more informed watershed management decisions
- Targeted and tracked watershed and tailwater improvement efforts
- Additional support for state and TVA programs separate from the NRP (e.g., state 305(b) reports, environmental reviews, river operations, tailwater monitoring across the watershed, permitting and relicensing of power facilities)
- One of the most comprehensive aquatic biological data sets in the nation



6.5.3 Climate Change Sentinel Monitoring

The climate change sentinel monitoring program will focus on collecting biological, chemical, and physical data in each of the five predominant ecoregions (Level III)¹ in the Tennessee Valley: Blue Ridge, Ridge and Valley, Southwestern and Central Appalachians, Interior Plateau, and Southern Plains. The location and timing of potential climate change effects on the unique biodiversity within the Tennessee River watershed are uncertain and currently not being assessed. Therefore, TVA will use historical data and information gathered as part of this sentinel monitoring program to provide early warning if adverse climate change effects need to be taken into consideration during future business planning efforts. This will be a collaborative effort, aligning with other initiatives to determine the vulnerability of aquatic ecosystems and water quality to climate change.

Within the NRP, this program aligns with the following resource area and program:



- Threatened and endangered species program (Biological)

Scope: Tennessee River watershed

TVA Span of Control: Partial control as TVA and partners oversee the monitoring of sentinel stations but do not have control over the onset of climate change

Current Activities

Currently, TVA collects various stream and tailwater data in its river systems. However, these efforts are not specifically aligned with climate change monitoring, which is being proposed as a new program in the NRP.

NRP Activities

- Monitor one or two watersheds per year in each of the five predominant ecoregions (i.e., five to 10 watersheds) in the Tennessee Valley for long-term trending analysis
- Monitor two sentinel locations per prioritized watershed (i.e., up to 20 monitoring sites)
- Manage data, conduct trending analysis, and report findings on a five-year cycle

Expected Benefits

Key benefits of this program are:

- Enhanced data collection and understanding of potential climate change effects on streams and their biodiversity
- Improved planning efforts due to early identification of climate change mitigation needs and strategies for aquatic species protection
- Improved knowledge and information sharing with agencies and other stakeholders for assessment and planning activities
- Consistency with Executive Order 13514 (Federal Leadership in Environmental, Energy and Economic Performance, 2009) and Council of Environmental Quality implementing instructions to evaluate climate change risks and vulnerabilities

¹ Designation of ecoregions is based on the premise that distinct ecological regions can be identified through the analysis of the patterns and the composition of biotic and abiotic phenomena that affect or reflect differences in ecosystem quality and integrity. Level III ecoregions subdivide the North American continent into 182 distinct ecoregions. Of these, 104 lie partly or wholly within the United States.

6.5.4 Strategic Partnership Planning

The strategic partnership planning program will focus on building strong partnerships with state, other federal, and regional nongovernmental organizations to address stewardship issues of mutual importance to drive measurable improvement of the region's waters. Also, this program will explore market-based opportunities (e.g., water pollution banking or trading) for improving water quality. This program will facilitate regional working groups to:

- Develop regional, collaborative projects to improve water quality in the Tennessee River watershed
- Provide technical assistance through enhanced data collection and sharing opportunities
- Build relationships with key contacts at agencies and organizations throughout the Tennessee Valley
- Network with current and prospective financial contributors to enhance TVA's ability to secure external funding

Scope: Tennessee River watershed

TVA Span of Control: Not applicable

Current Activities

Currently, TVA actively partners with state, other federal, and local organizations to address various water resource improvement initiatives. Example partnership activities include identifying water quality concerns, coordinating and implementing improvement efforts, developing new and existing partnerships, and creating consistent public awareness and education materials. However, as part of the NRP, TVA is proposing a new program to help focus its water resource partnership efforts to be more comprehensive and integrated throughout the Tennessee Valley.



NRP Activities

- Maintain existing relationships and partnerships for water quality protection and improvement efforts
- Develop new or enhance existing strategic relationships and partnerships focused on regional water resource planning efforts

Expected Benefits

Key benefits of this program are:

- A clear understanding of Valleywide water resource concerns and mutual agreement on paths forward with partners (e.g., strategy or priorities, funding, resource requirements, etc.)
- Effective best management practices for protecting and improving water resources
- Improved working relationships with state and national partners
- Re-established focus on partnerships at a regional level

6.5.5 Tennessee Valley Clean Marina Program

The Tennessee Valley Clean Marina Program promotes environmentally responsible marina and boating practices and will directly link to recreation and to TVA's permitting authority under Section 26(a) of the TVA Act. The Tennessee Valley Clean Marina program is designed to reduce water pollution and erosion in the Tennessee River watershed. (Note: All new marinas will be required to be certified as part of this program.) The program encourages boater education, improves coordination among state agencies, and helps communicate marina best-management practices. Also, the program offers incentives for environmentally innovative and proactive marina operations. This program also supports the National Clean Boating Campaign.²

Within the NRP, this program aligns with the following resource area and program:

- Recreation management's public outreach and engagement efforts

Scope: Tennessee River watershed

TVA Span of Control: Partial control because TVA manages the certification program in coordination with marina owners and operators

Current Activities

TVA is working with marina owners and operators to maintain 80 certified clean marinas throughout the Tennessee Valley.

NRP Activities

- Collaborate with marina owners to maintain their clean marina certifications
- Develop and provide marina owners/operators with outreach materials and training on existing obligations and best management practices to protect water quality
- Certify one new marina per year

Expected Benefits

Key benefits of this program are:

- Increased awareness with existing marina owners and customers about environmentally protective requirements and best boating practices
- Improved water resources conditions in TVA-managed reservoirs as a result of the implementation of best management practices
- Enhanced public perception of TVA stewardship efforts
- Strengthened compliance with federal and state regulations (e.g., waste water management, fuel management, solid waste management, etc.)



² The National Clean Boating Campaign is a year-round program to promote good stewardship of water resources by boating families, marina operators, boat dealers and manufacturers.



6.5.6 Water Resource Outreach Campaign

The water resource outreach campaign program will increase public awareness and involvement through the promotion of water resource protection and improvement best practices. Campaigns will include focused efforts to:

- Protect and improve reservoir shoreline
- Address storm water management issues and sustainable land use practices
- Address other emerging resource concerns (e.g., nutrient and sediment reductions, climate change, Gulf hypoxia, etc.)

Within the NRP, this program aligns with the following resource areas and programs:

- Environmental education program (Public Engagement)
- Other resource-area specific public outreach efforts

Scope: Tennessee River watershed

TVA Span of Control: Partial control as TVA will collaborate with regional and national partners to implement this program

Current Activities

TVA has historically completed public outreach campaigns through other activities that were included in the quality growth program, the water efficiency program, and targeted watershed initiatives. Also, TVA has an existing three-year commitment with the Tennessee Department of Agriculture to deliver quality growth workshops and demonstration projects. However, as part of the NRP, TVA is proposing to create a formal program that helps focus its water outreach campaigns in a coordinated and integrated fashion.

NRP Activities

- Evaluate, develop and execute public outreach activities to raise awareness of water resource protection and improvement efforts (includes addressing other resource area concerns)

Expected Benefits

Key benefits of this program are:

- Increased public awareness of the importance and value of protecting water resources within the Tennessee River basin
- Enhanced sense of public ownership in the day-to-day management of the basin's water resources
- Enhanced perception of TVA as a leader in water resource stewardship

6.5.7 Reservoir Shoreline Stabilization/Riparian Management Program

TVA is charged with management and stewardship of some 11,000 miles of reservoir shoreline. A number of these reservoir shoreline areas are classified as sensitive resource areas, as they contain cultural and archaeological resources. These are resources that TVA is mandated by federal law to protect. There are also sites being impacted by soil erosion that have other resource values, such as recreational areas that have been extensively developed and are heavily used by the public.

The reservoir shoreline stabilization/riparian management program will help control critical shoreline erosion. The program includes protecting significant cultural and other sensitive resources, maintaining or improving water quality, and enhancing aquatic and wildlife habitat. Treatment of these sites will include innovative techniques for stabilization (e.g., soil bioengineering) as well as the improvement of traditional methods (e.g., use of geotextiles in the application of rock riprap).

Within the NRP, this program aligns with the following resource areas and programs:

- Archaeological monitoring and protection program (Cultural)
- Wildlife habitat enhancement partnerships (Biological)
- Land conditions assessment and land stewardship maintenance (Biological)
- Dispersed recreation management (Biological)

Scope: TVA reservoir lands and managed shoreline

TVA Span of Control: Direct control over TVA-managed lands and shoreline

Current Activities

TVA has historically managed its shoreline stabilization efforts on a project-by-project basis as needs and funding allow. TVA, with the support of its partners, has successfully protected almost 100 miles of critically eroding reservoir shoreline on about 500 sites across the multi-state reservoir system. Also, TVA established criteria for determining the health of TVA-managed reservoir shorelines as described in the Shoreline Management Initiative (1998).

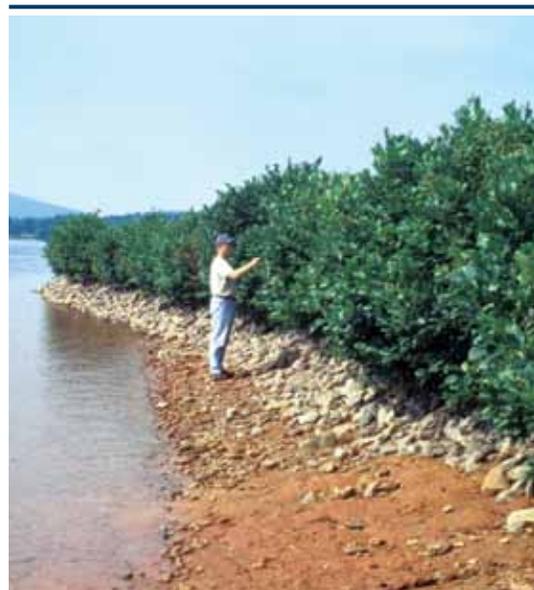
NRP Activities

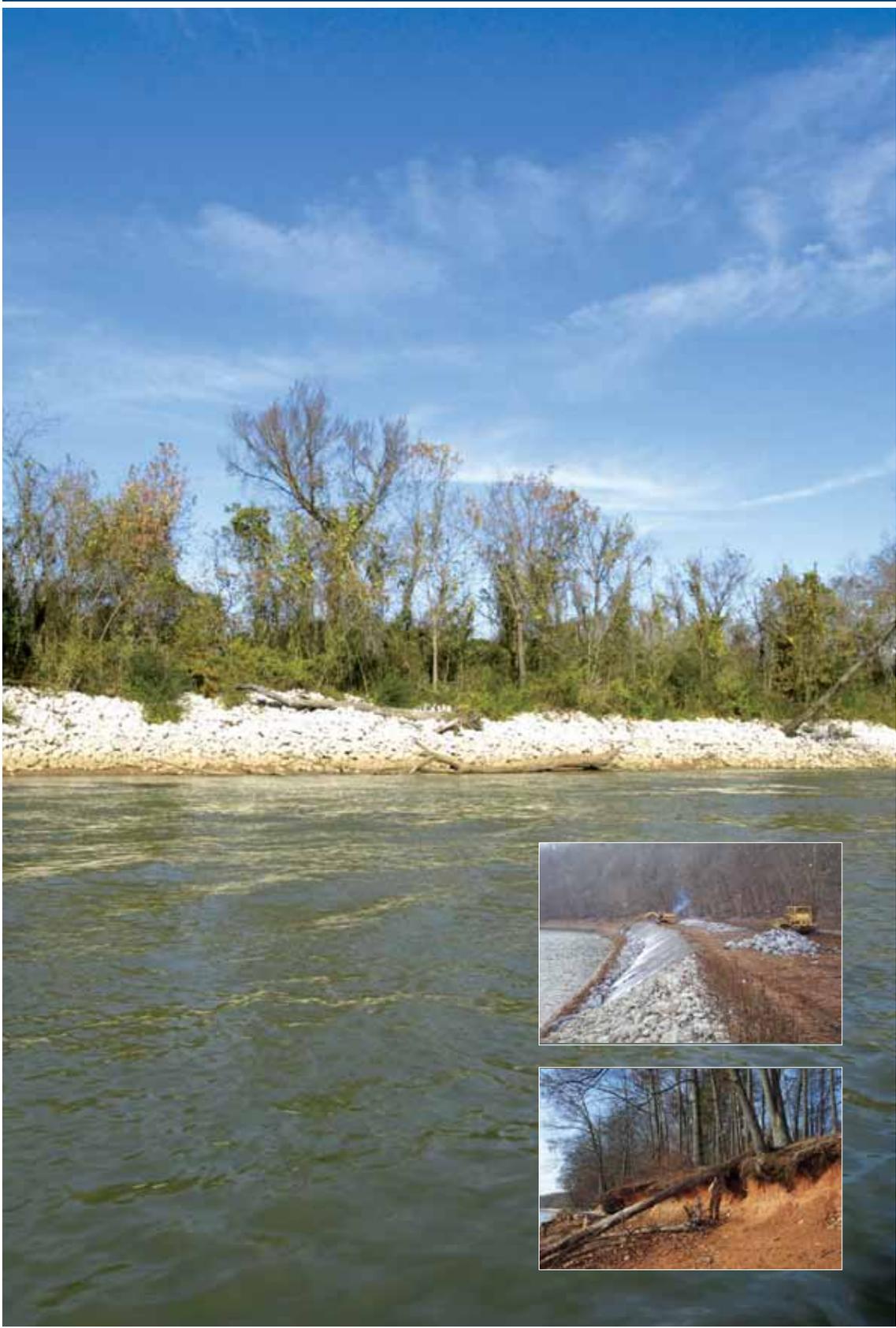
- Stabilize up to three miles of critically eroding shoreline per year

Expected Benefits

Key benefits of this program are:

- Stabilization of critically eroding TVA reservoir shoreline and public land
- Protection and improvement of water resources; preservation of public land from erosion; recreational opportunities; preservation of significant cultural and biological resources, wildlife habitat, and scenic beauty





6.5.8 Nutrient Source-Watershed Identification and Improvement Program

The nutrient source-watershed identification and improvement program will establish goals or targets to reduce nutrients (phosphorus), sediment, or both in TVA-managed reservoirs. It will use existing and monitored nutrient and flow data to assess the nutrient status of TVA reservoirs, helping to target the top

three reservoirs having greatest potential for nutrient source load reductions. This program will provide information to not only better understand and communicate resource conditions within the Tennessee Valley, but also reduce nonpoint nutrient loading from these source-watersheds and also from point sources where appropriate. Such reductions will be proactive in the view of forthcoming regulatory numeric nutrient water quality criteria and nutrient loading allocations that are being developed at the national and state



levels. By improving water quality, potential increases in wastewater treatment costs related to emerging reduction requirements may be mitigated, providing a key economic benefit to the region. This program will link with TVA's national water resource recovery programs category (described on page 128) for the northern Gulf of Mexico/Mississippi River basin nutrient load reductions program.

Within the NRP, this program aligns with the following resource area and program:

- Wetlands management (Biological)

Scope: Tennessee River watershed

TVA Span of Control: Partial control as TVA will work with partners in nutrient and sediment reduction efforts but has no control over external impacts

Current Activities

Currently, TVA participates in various nutrient and sediment reduction efforts across the Tennessee River watershed. However, these efforts are performed in a “one-off” fashion. As part of the NRP, TVA needs a more prioritized and comprehensive approach to provide the intended near- and long-term benefits associated with these activities.

NRP Activities

- Conduct current targeted TVA Vital Signs and Fixed Station water chemistry monitoring programs
- Use existing and new nutrient data combined with flow data to determine and quantify the top three reservoirs receiving the greatest phosphorus and nitrogen loadings
- Develop a reservoir-specific improvement plan for one or two of the top three reservoirs over the life of the NRP
- Implement plan to reduce point-source phosphorus reaching one TVA-managed reservoir by 5,000 pounds

- Implement plan to reduce 720 to 1,080 tons per reservoir of suspended sediment transported from watershed streams into one or two of the top three reservoirs
- Implement plan to reduce 1,100 to 1,650 pounds per reservoir of phosphorus transported from watershed streams into one or two of the top three reservoirs

Expected Benefits

Key benefits of this program are:

- Identification of the major phosphorus and sediment loading sources from watersheds into TVA reservoirs, helping to develop focused nutrient load reduction initiatives
- Reduced phosphorus loads into some streams that are currently included in states' lists of nutrient impaired waters (required by Section 303(d) of the Clean Water Act)
- Replicable methods and techniques for achieving measurable phosphorus and sediment load reductions and improvements in water quality
- Lower potable water treatment costs
- Proactive nutrient reductions to meet expected future regulatory requirements (increase public perception). See northern Gulf of Mexico/Mississippi River basin nutrient load reductions program (below) for additional information

6.5.9 Northern Gulf of Mexico/ Mississippi River Basin Nutrient Load Reductions Program

Similar to events that led to the federal establishment of a total maximum daily load nutrient budget to recover the Chesapeake Bay, increasing pressures and planning are underway to implement nutrient (primarily nitrogen) load reductions within the Mississippi River basin to recover an 8,000-square-mile “dead zone” (oxygen-deprived area) in the northern Gulf of Mexico. A potential source of impairment may be excessive nitrogen carried by fresh water discharged from the Mississippi River basin. The direct impact of these excessive nutrient levels is the consumption of oxygen within the water resource, creating a hypoxic zone (oxygen levels too low to support productive marine life) in the Gulf. Regulatory actions are likely to be assigned to place limitations on amounts of nitrogen loading from the major tributaries to the Mississippi River basin, including the Tennessee River. Currently, the Environmental Protection Agency has a 60,000 man-hour task order that includes determining these allocations.

The northern Gulf of Mexico/Mississippi River basin nutrient load reduction program will be a demonstration program that will conduct modeling to determine what nitrogen source-load reduction opportunities exist in a selected lower Tennessee River reservoir (Guntersville to Kentucky reservoirs). The expectation is that the key benefit of such a modeling effort will be reduced nitrogen yields delivered to the northern Gulf of Mexico hypoxic zone. The U.S. Geological Survey Sparrow model³ has indicated that approximately 90 percent of the nitrogen transported in the lower Tennessee River is delivered to the northern Gulf of Mexico. Within the NRP, this program will link to the

TVA nutrient source-watershed identification and improvement program (listed on page 125). This program also will link with the national effort to recover the northern Gulf of Mexico hypoxic zone, helping to diminish the regional ecological and economic impact this zone is imposing. Potential future activities (not presented in the NRP) will use a number of effective water resource improvement tools to implement effective strategies to realize reduced nutrient yields from the Tennessee River.

Within the NRP, this program is not aligned with other resource areas and programs because its focus is on restoring a national water resource downstream from the Tennessee River watershed.

Scope: Within and downstream from the Tennessee River watershed

TVA Span of Control: Partial control through coordinated modeling and strategic planning efforts with other agencies

Current Activities

Currently, TVA does not actively monitor nitrogen levels exiting the Tennessee River basin. However, as part of the NRP, TVA recognizes the need to evaluate nutrient loading from the Tennessee River and is proposing this new program to guide efforts to determine potential load reduction opportunities.

NRP Activities

- Obtain, consolidate, and evaluate existing data (TVA, U.S. Geological Survey, National Oceanic and Atmospheric Administration, state, Mississippi River Basin Gulf of Mexico Hypoxia Task Force, Environmental Protection Agency) from lower Tennessee River reservoirs and watersheds and select one reservoir as the focus for nutrient source loading and delivery modeling

³ The USGS Sparrow model is a modeling tool for the regional interpretation of water-quality monitoring data. See water.usgs.gov/nawqa/sparrow/ for additional information.

- Monitor the selected reservoir for one year in order to support model development
- Develop a strategy and long-term action plan with partners that supports the strategy of nutrient load reduction to the Mississippi River basin and Gulf of Mexico

Expected Benefits

Key benefits of this program are:

- A better understanding of how nitrogen reacts within a reservoir and how its yields are exported into downstream water bodies
- A coordinated demonstration effort between local, regional and national stakeholders to show how to potentially reduce nitrogen load amounts to a damaged water resource (Gulf of Mexico hypoxic zone) of national significance
- Identification of best management practices for how best to reduce nitrogen loading into and nitrogen yields delivered out of a lower Tennessee River reservoir
- Proactive management of potential future regulatory loading allocations from the Tennessee River into the Mississippi River basin and Gulf of Mexico
- Increased (positive) public perception associated with TVA's proactive stewardship efforts to address downstream impacts of nutrients

