Appendix H – Biological Assessment

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, TN 38501

May 2, 2008

Ms. Peggy W. Shute
Manager, Heritage Resources
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1499

Re: FWS #07-I-0991

Dear Ms. Shute:

Fish and Wildlife Service (Service) personnel have reviewed the biological assessment regarding the Watts Bar Reservoir Land Management Plan (Land Plan) and the Amended Draft Environmental Impact Statement for the project. The biological assessment describes the potential future effects on federally listed species and designated critical habitat present in and around Watts Bar Reservoir, in Loudoun, Meigs, Rhea, and Roane counties, Tennessee, resulting from actions facilitated by land use designations on property owned or controlled by Tennessee Valley Authority (TVA). Ten federally listed species are reported from the project area, including Virginia spiraea (*Spiraea virginiana*), Cumberland rosemary (*Conradina verticillata*), fanshell (*Cyprogenia stegaria*), rough pigtoe (*Pleurobema plenum*), pink mucket (*Lampsilis abrupta*), shiny pigtoe (*Fusconaia cor*), orangefoot pimpleback (*Plethobasus cooperianus*), snail darter (*Percina tanasi*), spotfin chub (*Cyprinella monacha*), and the gray bat (*Myotis grisescens*). Additionally, designated critical habitat for the spotfin chub occurs on the Obed and Emory rivers.

The Land Plan results in an overall increase in lands designated for resource protection (Zones 3 and 4) and the reduction in land available for industrial uses (Zones 2 and 6). We commend you for this, as it will likely provide a net benefit to federally listed species in the project area when compared to the current land plan. We understand that the highest potential for impacts to listed species occurs on lands designated as Zone 2 (Project Operations) or Zone 5 (Industrial). The majority of these parcels are either located in areas where no listed species are found (most Zone 5 parcels) or have no future actions that would occur within the planning cycle (10 years) of the Land Plan. The one exception to this is the Breeder Site on the Clinch River. Because it is retaining this parcel as Zone 2, TVA has much more control over potential future activities on the Breeder Site. You indicate in the biological assessment that any future action potentially affecting a threatened or endangered species would be the subject of consultation with the

Service, and project specific avoidance or mitigation measures would be developed as a part of that consultation.

You have determined that there would be no effect on the Virginia spirea, Cumberland rosemary, fanshell, rough pigtoe, shiny pigtoe, orangefoot pimpleback, snail darter, spotfin chub, and the gray bat. Additionally, you determined that this project would have no effect on designated critical habitat for the spotfin chub in the Obed or Emory rivers.

You have determined the proposed Land Plan is not likely to adversely affect the pink mucket, based on implementation of specific measures if TVA were to develop industrial facilities at the former Clinch River Breeder Reactor site. These measures include:

1. TVA would consult with the Service in order to determine if the proposed action could affect listed mussels present in the area.
2. Pre-construction mussel surveys would be conducted in all areas of the Clinch River (Watts Bar Reservoir) that would be affected by construction and use of the terminal associated infrastructure (e.g. barge terminal, water intakes or water outfalls).
3. Any listed mussels found during these surveys would be dealt with according to terms and conditions imposed as a result of the consultation process. These could consist of minimization or avoidance measures implemented during construction and operation, or relocation of the mussels encountered if effects are unavoidable

With implementation of these conditions and appropriate Best Management Practices, you have determined that only relatively minor impacts to federally listed mussels in the Clinch River are expected to occur.

Typically, the Fish and Wildlife Service does not concur with a "not likely to adversely affect determination" at the programmatic consultation level when such determination is based on a commitment to consult on specific projects in the future when details become known. If there is a potential for a "likely to adversely affect" determination to be made during site-specific consultation in the future, the Service advises that "likely to adversely affect" is the appropriate determination at the programmatic consultation level also. However, after numerous discussions with your staff and a thorough review of this project and associated conservation measures, we believe the likelihood of reaching a determination of "likely to adversely affect" at the site-specific consultation level in the future in discountable. Therefore, we concur with your conclusion that the proposed Land Plan is not likely to adversely affect the pink mucket. In view of this, we believe that the requirements of section 7 of the Endangered Species Act (Act), as they apply to this programmatic action, have been fulfilled. However, obligations under section 7 of the Act must be reconsidered if: (1) new information reveals that the proposed action may affect listed species in a manner or to an extent not previously considered, (2) the proposed action is subsequently modified to include activities which were not considered in this biological assessment, or (3) new species are listed or critical habitat designated that might be affected by the proposed action. Because this is a programmatic level consultation on the Land Plan, site-specific consultations will still be needed, but can tier back to this consultation. It is incumbent

upon both of our agencies to coordinate adequately in the future so as to minimize the likelihood of any specific actions resulting in an adverse effect to listed species.

Your interest and initiative to protect endangered and threatened species is greatly appreciated. If you have questions or if we can be of further assistance, please contact Mary Jennings of my staff at (931) 528-6481, extension 203.

Sincerely,

Mary E Jennings

for Lee A. Barclay, Ph.D.
Field Supervisor

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Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, TN 37902-1499

February 29, 2008

Dr. Lee Barclay
U.S. Fish and Wildlife Service
446 Neal Street
Cookeville, TN 38501

Dear Lee:

The enclosed Biological Assessment (BA) describes the potential future effects on federally listed species and designated critical habitat present in and around Watts Bar Reservoir, Loudon, Meigs, Rhea, and Roane Counties, Tennessee, resulting from actions facilitated by land use designations on TVA-owned or controlled property on Watts Bar Reservoir. TVA is submitting this BA pursuant to Section 7(a)(2) of the Endangered Species Act (ESA) to ensure that future actions resulting from the proposed land allocations are not likely to jeopardize the continued existence of listed species or adversely modify designated critical habitat for these species.

Because the Watts Bar Land Plan is a programmatic document, it considers the assignment of broad use zones or activities to parcels of TVA-controlled land. It does not consider any specific potential future actions that might occur on planned lands as a result of the assignment of these use zones. These future actions, should they occur, will be considered in appropriate future environmental review and your office would be consulted as appropriate. However, a range of potential effects can be identified for these use zones, and potential future impacts to endangered species are addressed in the BA. Federally-listed species are only found in three areas that could be affected by land actions addressed in the Land Plan; the Clinch River downstream of Melton Hill Dam, downstream of Ft. Loudoun Dam, and downstream of Watts Bar Dam.

TVA has determined that there would be no effect on the two plants present in the project area, Virginia spirea and Cumberland rosemary; four of the five mussels, fanshell, rough pigtoe, shiny pigtoe, and orangefoot pimpleback; the two fish, snail darter and spotfin chub; and the one mammal, gray bat. TVA has determined that this project is not likely to adversely affect the pink mucket. This project would not result in adverse modification of designated critical habitat for the spotfin chub in the Obed or Emory Rivers. We respectfully request your concurrence on these endangered species determinations for the programmatic Watts Bar Reservoir Land Plan.

Dr. Lee Barclay
Page 2
February 29, 2008

If you have questions, contact John (Bo) Baxter at (865) 632-3360.

Sincerely,

Peggy W. Shute, Manager
Heritage Resources

Enclosure

Biological Assessment

Watts Bar Reservoir Land Management Plan and Amended Draft Environmental Impact Statement (Land Plan)

Tennessee Valley Authority
29 February 2008

***Watts Bar Reservoir Land Management Plan and Amended Draft Environmental Impact Statement* (Land Plan) - Biological Assessment**
Tennessee Valley Authority
29 February 2008

1. Introduction
This Biological Assessment (BA) describes the potential future effects on federally listed species and designated critical habitat present in and around Watts Bar Reservoir, Loudoun, Meigs, Rhea, and Roane Counties, Tennessee resulting from actions facilitated by land use designations on TVA-owned or controlled property on Watts Bar Reservoir. A total of ten federally listed plant species are reported from the project area - two plants; Virginia spirea and Cumberland rosemary, five mussels; fanshell, rough pigtoe, pink mucket, shiny pigtoe, and orangefoot pimpleback, two fish; snail darter and spotfin chub, and one mammal; gray bat. Tennessee Valley Authority (TVA) is submitting this BA pursuant to Section 7(a)(2) of the Endangered Species Act (ESA) to ensure that future actions resulting from the proposed land allocations are not likely to jeopardize the continued existence of listed species or adversely modify designated critical habitat for these species.

A. Project History
The Watts Bar Reservoir, which is part of the Watts Bar project, is a multipurpose reservoir operated by TVA for navigation, flood control, power production, recreation, and economic development. The Land Plan is intended to be consistent with the purposes of the Watts Bar project. The Land Plan also seeks to address issues and concerns raised by the general public. Each reservoir land management plan is submitted for approval to the TVA Board of Directors and adopted as policy to provide for long-term stewardship and accomplishment of TVA responsibilities under the TVA Act of 1933

In May 2005, TVA issued a *Watts Bar Reservoir Land Management Plan and Draft Environmental Impact Statement* (2005 Plan) proposing to update the 1988 Plan for approximately 16,200 acres of TVA public land on Watts Bar Reservoir in Loudon, Meigs, Rhea, and Roane counties, Tennessee (TVA 2005a). Three alternatives were proposed in the 2005 Plan. These were a No Action Alternative to continue to use the 1988 Plan with accrued updates, a Balanced Development and Recreation Alternative with an emphasis on economic development and developed recreation, and a Balanced Conservation and Recreation Alternative with an emphasis on natural resource conservation and informal recreation activities.

In August 2007, TVA issued the *Watts Bar Reservoir Land Management Plan and Amended Draft Environmental Impact Statement* (Land Plan) to revise the 2005 Plan by incorporating the changes derived from implementation of the TVA Land Policy (November 2006). The Land Plan would allow an additional opportunity to assess environmental impacts of a reasonable range of alternatives for allocating TVA public land on Watts Bar Reservoir and provide a means for additional public involvement in the decision-making process. The proposed updated Reservoir Land Management Plan (Land Plan) would guide land use approvals, private water use facility permitting, and resource management decisions on Watts Bar Reservoir. The proposed Land Plan allocates land into broad categories or "Zones," including Project Operations, Sensitive Resource Management, Natural Resource Conservation, Industrial, Developed Recreation, and Shoreline Access.

In response to TVA's request for comments on the Land Plan, the U. S. Fish and Wildlife Service (FWS) recommended that TVA consult on this programmatic EIS. This Biological Assessment (BA) was prepared to address these comments and present TVA's rationale for a 'Not Likely to Adversely Affect' determination regarding the potential for this Land Plan to affect federally listed species.

B. Federal Action History (Discussion of Past Actions Relevant to the Proposed Project)

Watts Bar Reservoir Land Management Plan (TVA 1988)

In August 1988, the TVA Board of Directors approved a land management plan to guide TVA resource management and property administration decisions on 10,405 acres of TVA land on Watts Bar Reservoir. This review did not account for all TVA lands present on Watts Bar. Additional TVA lands are addressed in the current EIS. A multidisciplinary TVA team undertook a detailed planning process that resulted in the land use designation in the plan. Both public input and information from TVA specialists were analyzed in making land use decisions. It was determined that Watts Bar Reservoir supported 19 land use allocations (see Section 2.1). The 207 parcels of land on Watts Bar Reservoir were allocated for one or more of these 19 uses.

Record of Decision for the Lower Watts Bar Reservoir (USDOE 1995)

The record of decision for lower Watts Bar Reservoir was prepared by USDOE in accordance with the requirements under the Comprehensive Environmental Response, Compensation, and Liability Act to present the remedy that addresses the contamination of the Watts Bar Reservoir area by past USDOE operations. Remediation includes the continuance of institutional controls and long-term monitoring of water, sediment, and fish. Institutional controls are implemented primarily by the Watts Bar Working Group (WBWG), created in 1991, of which TVA is a signatory member along with the U.S. Environmental Protection Agency (USEPA), Tennessee Department of Environment and Conservation (TDEC), U.S. Army Corps of Engineers (USACE), and the USDOE. The WBWG implements a notification and screening methodology for member agency actions that may be impacted by the contaminants, whereby USDOE can then identify contaminants and provide appropriate remediation.

Shoreline Management Initiative (SMI): An Assessment of Residential Shoreline Development Impacts in the Tennessee Valley Final Environmental Impact Statement (TVA 1998)

TVA completed an environmental impact statement (EIS) on possible alternatives for managing residential shoreline development throughout the Tennessee River Valley. Under the alternative selected, sensitive natural and cultural resource values of reservoir shorelines would be conserved and retained by preparing a shoreline categorization for individual reservoirs; by voluntary donations of conservation easements over flowage easement or other shoreland to protect scenic landscapes; and by adopting a "maintain and gain" public shoreline policy when considering requests for additional shoreline access rights. This Land Plan will tier from the final SMI EIS.

The residential shoreline on Watts Bar Reservoir comprises 340 miles or 47 percent of the total 721 miles of shoreline. In accordance with the TVA Shoreline Management Policy (SMP), TVA categorized the residential shoreline for previous land plans based on resource data collected from field surveys. A resource inventory was conducted for sensitive species

and their potential habitats, archaeological resources, and wetlands along the residential shoreline.

Sale of Boeing Land Environmental Assessment (USDOE 2000)
USDOE prepared this environmental assessment (EA) to review the impacts of selling a narrow strip of former TVA land on the Clinch River to a private developer. Sale of this property reduced the amount of non-TVA-owned public shoreline and changed it to private shoreline available for shoreline access.

Agricultural Lands Licensing for 1999 Through 2003 Crop Years for Fontana, Fort Loudoun, Melton Hill, Tellico, and Watts Bar Reservoirs Environmental Assessment (TVA 1999)
TVA reviewed the environmental impacts associated with licensing 74 tracts of TVA land totaling over 1,200 acres to individuals for agricultural use on lands around five TVA reservoirs in east Tennessee and North Carolina. Thirty-four of these tracts totaling 335 acres are on Watts Bar Reservoir and are part of the TVA lands currently being planned. TVA is currently reassessing the continued licensing of these tracts.

Lower Watts Bar Management Unit Watts Bar Reservoir, Resource Management Plan and Final Environmental Assessment (TVA 2000)
TVA completed an EA on alternatives for TVA's resource management activities for the Lower Watts Bar Management Unit (LWBU) and implementing a management plan for the LWBU. The 3,481-acre LWBU is a major component of the TVA land that is the subject of the current planning process.

Modernization of Turbines at Watts Bar Hydro Plant, Rhea County, Tennessee Environmental Assessment (TVA 2001a)
The environmental impacts attributed to the proposed modernization of the electric generating turbines at the Watts Bar Dam and Hydro Plant were reviewed. Commitments of the action alternative include the stabilization of shoreline on TVA land included in the current planning process.

Proposed Issuance of Regulations Under Section 26a of the TVA Act for Nonnavigable Houseboats, Storage Tanks, Marina Sewage Pump-Out Stations, Wastewater Outfalls and Septic Systems, and Development Within Flood Control Storage Zones Environmental Assessment (TVA 2001b)
In 2001, TVA completed an EA for its issuance of regulations for nonnavigable houseboats, storage tanks, marina sewage pump-out stations, wastewater outfalls, septic systems, and development within flood control storage zones of TVA reservoirs. The complete update of the 1971 Section 26a regulations, incorporating the standards for residential development in the SMI EIS and the miscellaneous updates above, became final on September 8, 2003. Taken together, these regulations comprehensively updated the TVA requirements for development along the shoreline of TVA reservoirs, including Watts Bar. The regulations for marina sewage pump-out stations and holding tanks, fuel storage tanks and handling facilities, and development within the flood control storage zones were new. Actions requiring Section 26a approval by TVA frequently are requested and occur on TVA reservoir lands and consequently are governed by TVA Section 26a regulations.

Routine Operations and Maintenance of TVA's Water Control Structures in the Tennessee River Watershed (TVA 2005a)
TVA formally consulted with U.S. Fish and Wildlife Service (FWS) under Section 7 of the Endangered Species Act on the potential for routine operation and maintenance activities

on the TVA Reservoir system to affect species on the U.S. Endangered Species List. TVA and FWS biologists determined that 65 of the 101 federally listed plant and animal species found within the Tennessee River watershed could be affected by TVA's activities. In the mainstem Tennessee River (including Watts Bar Reservoir, and portions of the Clinch River system) five mussels (fanshell, pink mucket, white wartyback, orangefoot pimpleback, and sheepnose) apparently successfully reproduce at some localities. However, in spite of this, all five are considered to be in decline, for unknown reasons. Important habitat parameters may be affected by altered daily and seasonal flow patterns at these mainstem dams.

Individuals of five other mussel species (spectaclecase, dromedary pearlymussel, oyster mussel, ring pink and rough pigtoe) persist and are living out their long lifespans at some scattered localities. Although their demise is believed to be a result of habitat alterations that resulted from creating the reservoirs and is not believed to be the direct result of TVA's routine operations, these old individuals may also be affected by altered daily and seasonal flow patterns at mainstem dams.

Completion of Watts Bar Nuclear Plant Unit 2, Rhea County, Tennessee, Supplemental Environmental Impact Statement and Record of Decision (TVA 2007)
TVA has issued a Supplemental EIS (SEIS) for the completion and operation of Watts Bar Nuclear Plant (WBN) Unit 2 in July 2007. TVA is proposed this action as a means of meeting the demand for additional baseload electrical generating capacity on the TVA system and maximizing the use of its existing assets. The unit would be completed as originally designed, alongside its sister unit, WBN Unit 1, which has been operating since 1996. No expansion of the existing site footprint would be required.

The final SEIS augments the analyses in the draft SEIS by further discussing WBN cooling water systems, hydrothermal conditions in the Tennessee River for two-unit operation, and chemical additives to raw water. It also updates these sections: need for power, socioeconomic, floodplains, nuclear plant safety and security, radiological effects, and decommissioning. The final SEIS concluded that WBN Unit 2 could be completed and operated without significant adverse impacts on the environment.

On August 2, 2007, the TVA issued a Record of Decision for the proposed completion and operation of WBN Plant Unit 2. TVA intends to implement the preferred alternative identified in its final SEIS for the Completion and Operation of Watts Bar Nuclear Plant Unit 2, Rhea County, Tennessee.

TVA determined that activities associated with completion of WBN Unit 2 are not likely to adversely affect listed species in this reach of the Tennessee River. FWS has concurred with these findings.

TVA Land Policy (TVA 2006)
In November 2006, the TVA Board instituted a TVA Land Policy governing TVA's retention, disposal, and planning of its lands. This policy describes residential, economic development, recreation, and other uses for TVA's reservoir lands; provides specific definitions of these uses; and requires a suitability assessment of all TVA land allocated for recreation and economic development use. This policy in being implemented through TVA's reservoir land plans currently under design and review.

II. Description of the Action and Action Area

A. Discussion of Federal Action and Legal Authority / Agency Discretion
TVA has been charged by Congress with improving navigation, controlling floods, providing for the proper use of marginal lands, providing for industrial development, and providing power at rates as low as feasible, all for the general purpose of fostering the physical, economic, and social development of the Tennessee Valley region.

As stewards of this important resource, it is TVA's policy to manage its lands to protect the integrated operation of the TVA reservoir and power systems, to provide for appropriate public use and enjoyment of the reservoir system, and to provide for continuing economic growth in the Valley. TVA recognizes that historical land transfers have contributed substantially to meeting these multipurpose objectives, and it is TVA's policy to preserve reservoir lands remaining under its control in public ownership except where different ownership would result in significant benefits to the public.

TVA proposes to amend the *Watts Bar Reservoir Land Management Plan and Draft Environmental Impact Statement* (2005 Plan), issued in May 2005, and to update the 1988 *Watts Bar Reservoir Land Management Plan* (1988 Plan) for approximately 16,200 acres of TVA public land on Watts Bar Reservoir in Loudon, Meigs, Rhea, and Roane counties, Tennessee. The proposed updated *Watts Bar Reservoir Land Management Plan and Amended Draft Environmental Impact Statement* (Land Plan) would guide land use approvals, private water use facility permitting, and resource management decisions on Watts Bar Reservoir. The proposed Land Plan allocates land into broad categories or "zones," including Project Operations, Sensitive Resource Management, Natural Resource Conservation, Industrial, Developed Recreation, and Shoreline Access.

This Land Plan incorporates modifications to the three alternatives proposed in the 2005 Plan as a result of TVA's November 2006 Land Policy and other administrative changes. These alternatives are a No Action Alternative to continue to use the 1988 Plan with accrued updates; a Modified Development and Recreation Alternative, providing suitable industrial use and developed recreation; and a Modified Conservation and Recreation Alternative, providing an emphasis on natural resource conservation and informal recreation activities. TVA's preferred alternative is the Modified Development and Recreation Alternative.

B. Description of the Project Purpose and Objectives
TVA proposes to update the 1988 *Watts Bar Reservoir Land Management Plan* (1988 Plan) for TVA public land around Watts Bar Reservoir.

Watts Bar Reservoir is a 65-year-old multipurpose impoundment of the Tennessee River formed by Watts Bar Dam and Lock, which is located at Tennessee River Mile (TRM) 530 in Meigs and Rhea counties, Tennessee. Currently, TVA owns and manages about 16,200 acres of land on the reservoir. TVA proposes to use an updated *Watts Bar Reservoir Land Management Plan and Amended Draft Environmental Impact Statement* (Land Plan) to guide future decision making and manage these reservoir properties.

The reservoir flows from the northeast to southwest through Loudon, Meigs, Rhea, and Roane counties in east Tennessee. The reservoir extends 72.4 miles up the Tennessee River to Fort Loudoun Dam, and 62.5 miles to Melton Hill Dam on the Clinch River. It also includes parts of the Emory and Little Emory Rivers. At full pool, the reservoir shoreline length is 721 miles, and the surface area is about 39,000 acres. Of the

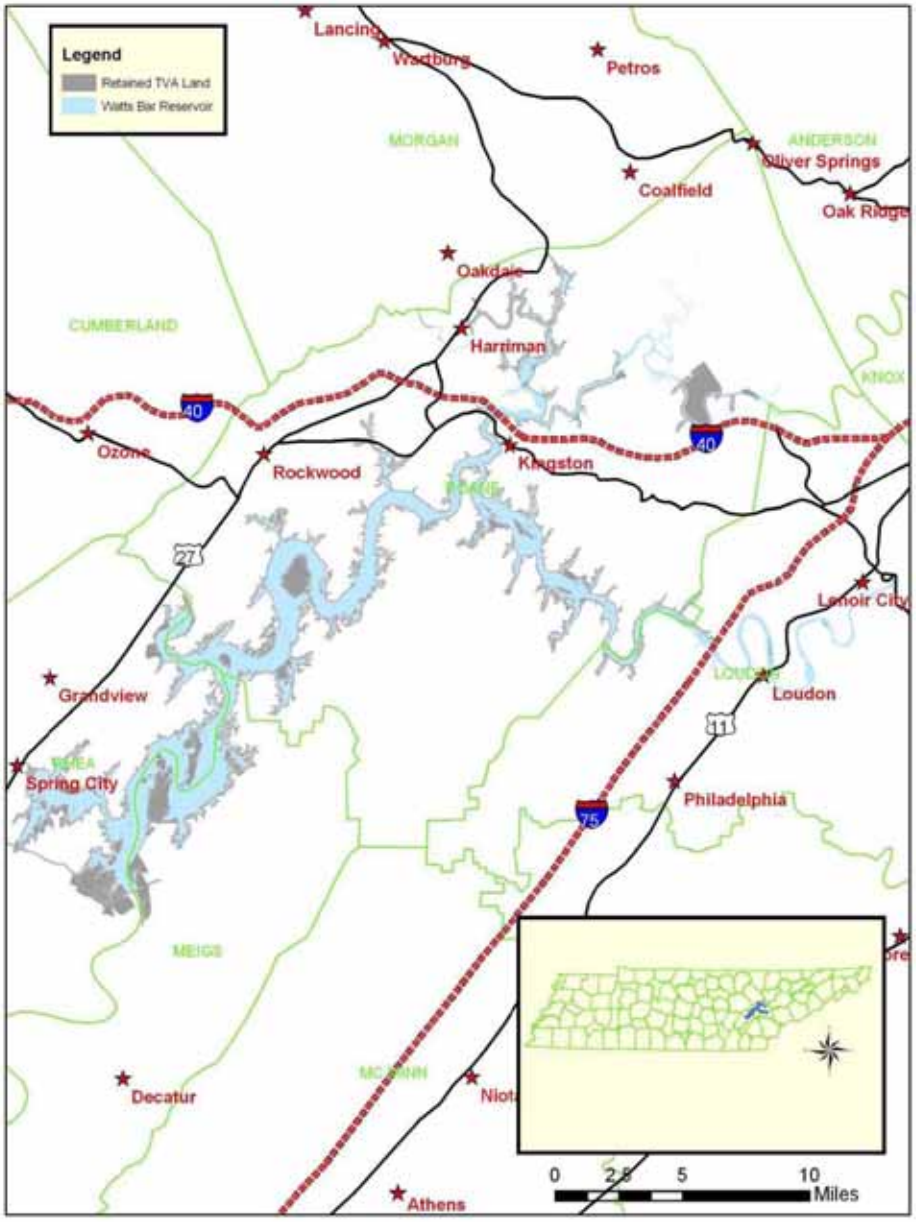

Figure 1. Map of Watts Bar Reservation and Vicinity

721 miles of shoreline, 340 miles (47 percent) are available for Shoreline Access uses (where TVA sold tracts with deeded or implied rights for access and/or water use facilities across TVA land), which include current development. The available area also includes previously planned lands determined by TVA policy to be available for consideration of water use facilities.

TVA originally acquired approximately 55,000 acres of land for the Watts Bar project including flowage and easements (TVA 1949). Subsequent purchases for fossil and nuclear plants, for transfers and/or sales of land to U.S. Department of Energy (USDOE), and for various commercial, industrial, residential, and recreational uses have resulted in a current balance of about 16,200 acres of TVA public land being available for lands planning.

TVA manages public land on Watts Bar Reservoir to protect and enhance natural resources, generate prosperity, and improve the quality of life in the Tennessee Valley. This TVA public land, together with adjoining private land, is used for public and commercial recreation, economic development, natural resource management, and a variety of other community needs. The purpose of the land planning effort is to apply a systematic method of evaluating and identifying the most suitable use of public land under TVA stewardship. Public input and resource data are used to help allocate land to the following land management categories or allocation zone. These allocations are then used to guide the types of activities that would be considered on each parcel of land. Each reservoir land management plan is submitted for approval to the TVA Board of Directors and adopted as policy to provide for long-term stewardship and accomplishment of TVA responsibilities under the TVA Act of 1933.

TVA LAND USE ZONES

Zone 1 - Non TVA Shoreland

Shoreland located above summer pool elevation that TVA does not own in fee or land never purchased by TVA. TVA is not allocating private or other non-TVA land. This category is provided to assist in comprehensive evaluation of potential environmental impacts of TVA's allocation decision. Non-TVA shoreline includes:

- ***Flowage easement land***—Privately or publicly owned land where TVA has purchased the right to flood and/or limit structures. Flowage easement rights are generally purchased to a contour elevation. Since construction on flowage easement land is subject to TVA's 26a permitting requirements, the SMP guidelines discussed in the definition of Zone 7 would apply to the construction of residential water use facilities fronting flowage easement land. SMP guidelines addressing land-based structures and vegetation management **do not** apply.
- ***Privately owned reservoir land***—This was land never purchased by TVA and may include, but is not limited to, residential, industrial, commercial, or agricultural land. This land, lying below the 500-year flood elevation, is subject to TVA's 26a approvals for structures.

Zone 2 - Project Operations

All TVA reservoir land currently used for TVA operations and public works projects includes:

- ***Land adjacent to established navigation operations***—Locks, lock operations and maintenance facilities, and the navigation work boat dock and bases.
- ***Land used for TVA power projects operations***—Generation facilities, switchyards, and transmission facilities and rights-of-way.
- ***Dam reservation land***—Areas used for developed and informal recreation, maintenance facilities, watershed team offices, research areas, and visitor centers.
- ***Navigation safety harbors/landings***—Areas used for tying off commercial barge tows and recreational boats during adverse weather conditions or equipment malfunctions.
- ***Navigation dayboards and beacons***—Areas with structures placed on the shoreline to facilitate navigation.
- ***Public works projects***—Includes fire halls, public water intakes, public treatment plants, etc. (These projects are placed in this category as a matter of convenience and may not relate specifically to TVA projects.)
- ***Land planned for any of the above uses in the future.***

Zone 3 - Sensitive Resource Management

Land managed for protection and enhancement of sensitive resources. Sensitive resources, as defined by TVA, include resources protected by state or federal law or executive order and other land features/natural resources TVA considers important to the area viewscape or natural environment.

Recreational natural resource activities, such as hunting, wildlife observation, and camping on undeveloped sites, may occur in this zone, but the overriding focus is protecting and enhancing the sensitive resource the site supports. Areas included are:

- TVA-designated sites with potentially ***significant archaeological resources***.
- TVA public land with ***sites/structures listed on or eligible for listing on the National Register of Historic Places.***
- ***Wetlands***—Aquatic bed, emergent, forested, and scrub-shrub wetlands as defined by TVA.
- ***TVA public land under easement, lease, or license to other agencies/individuals for resource protection purposes***.
- ***TVA public land fronting land owned by other agencies/ individuals*** for resource protection purposes.
- ***Habitat Protection Areas***—These TVA Natural Areas are managed to protect populations of species identified as threatened or endangered by the FWS, state-listed species, and any unusual or exemplary biological communities/geological features.
- ***Ecological Study Areas***—These TVA Natural Areas are designated as suitable for ecological research and environmental education by a recognized authority or agency. They typically contain plant or animal populations of scientific interest or are of interest to an educational institution that would utilize the area.
- ***Small Wild Areas***—These TVA Natural Areas are managed by TVA or in cooperation with other public agencies or private conservation organizations to

protect exceptional natural, scenic, or aesthetic qualities that can also support informal, low-impact types of outdoor recreation.

- ***River corridor with sensitive resources***—A river corridor is a linear green space along both stream banks of selected tributaries entering a reservoir managed for light boat access at specific sites, riverside trails, and interpretive activities. These areas will be included in Zone 3 when identified sensitive resources are present.
- ***Significant scenic areas***—These are areas designated for visual protection because of their unique vistas or particularly scenic qualities.
- ***Champion tree site***—Areas designated by TVA as sites that contain the largest known individual tree of its species in that state. The state forestry agency "Champion Tree Program" designates the tree, while TVA designates the area of the sites for those located on TVA public land.
- ***Other sensitive ecological areas***—Examples of these areas include heron rookeries, uncommon plant and animal communities, and unique cave or karst formations.
- ***Land planned for any of the above uses in the future.***

Zone 4 - Natural Resource Conservation

Land managed for the enhancement of natural resources for human use and appreciation. Management of resources is the primary focus of this zone. Appropriate activities in this zone include hunting, timber management to promote forest health, wildlife observation, and camping on undeveloped sites. Areas included are:

- ***TVA public land under easement, lease, or license*** to other agencies for wildlife or forest management purposes.
- ***TVA public land fronting land owned by other agencies*** for wildlife or forest management purposes.
- ***TVA public land*** managed for wildlife or forest management projects.
- ***Informal recreation areas*** maintained for passive, informal recreation activities, such as hunting, hiking, bird watching, photography, primitive camping, bank fishing, and picnicking.
- ***Shoreline Conservation Areas***—Narrow riparian strips of vegetation between the water's edge and TVA's back-lying property that are managed for wildlife, water quality, or visual qualities.
- ***Wildlife Observation Areas***—TVA Natural Areas with unique concentrations of easily observed wildlife that are managed as public wildlife observation areas.
- ***River corridor without sensitive resources present***—A river corridor is a linear green space along both stream banks of selected tributaries entering a reservoir managed for light boat access at specific sites, riverside trails, and interpretive activities. River corridors will be included in Zone 4 unless sensitive resources are present (see Zone 3).
- ***Islands of 10 acres or less.***
- ***Land planned for any of the above uses in the future.***

Zone 5 - Industrial

Land managed for economic development including businesses in distribution/processing/assembly and light manufacturing. Preference will be given for businesses requiring water access. Parcel descriptions should describe the primary type of use.

Access for water supply or structures associated with navigation such as barge terminal, mooring cell, etc.

Land-based development potential.

Areas included are:

- **TVA public land under easement, lease, or license to other agencies/individuals** for purposes described above.
- **TVA public land fronting land owned by other agencies/individuals for industrial** purposes described above.
- **Sites planned for future use supporting sustainable development**

Types of development that can occur on this land are:

- ***Business Parks***—TVA waterfront land which would support businesses and light manufacturing activities. Business parks should not include retail, service-based businesses like laundry, fast food, grocery stores, gas stations, daycares, or any walk-in-type businesses.
- ***Industrial access***—Access to the waterfront by back-lying property owners across TVA property for water intakes, wastewater discharge, or conveyance of commodities (i.e., pipelines, rail, or road). Barge terminals are often associated with industrial access corridors.
- ***Barge terminal sites***—Public or private facilities used for the transfer, loading, and unloading of commodities between barges and trucks, trains, storage areas, or industrial plants.
- ***Fleeting areas***—Sites used by the towing industry to switch barges between tows or barge terminals which may have both offshore and onshore facilities.
- ***Minor commercial landing***—A temporary or intermittent activity that takes place without permanent improvements to the property. These sites can be used for transferring pulpwood, sand, gravel, and other natural resource commodities between barges and trucks.

Zone 6 - Developed Recreation

The designations below are based on levels of development and the facilities available to the public, graduating from informal use to more developed uses. Parcel descriptions should describe the primary type of use and identify access potential for infrastructure and potential for development.

Water Access – small parcels of land, generally less than 10 acres, and typically shoreline areas conveyed to public agencies for public access.

Public – more recreational opportunities, some facilities more than just launching a boat and typically greater than 10 acres. This includes areas conveyed for public recreation.

Commercial – property suitable and capable to support commercial water-based operations. This includes areas conveyed for commercial recreation.

All reservoir land managed for concentrated, active recreational activities that require capital improvement and maintenance, including:

- **TVA public land under easement, lease, or license to other agencies/individuals for recreational purposes.**
- **TVA public land fronting land owned by other agencies/individuals for recreational purposes.**
- **TVA public land developed for recreational purposes, such as campgrounds, day use areas, etc.**
- **Land planned for any of the above uses in the future.**

Types of development that can occur on this land are:

Water access – e.g., areas that tend to be informal and can include: launching ramp, courtesy pier, canoe access, parking areas, picnic area, trail, etc.

Public recreation – recreation on publicly owned land. These areas typically have facilities or uses developed by a public agency and provide amenities open to the general public. Facilities at "public recreation" areas could include: playgrounds/play structures, picnic facilities, tennis courts, horseshoe areas, play courts, recreation center, athletic fields, trails, natural areas, amphitheaters, food concessions (vending, snack bar), access to water for fishing and boating, swimming areas and swimming pools, marina facilities owned by the public entity, parking, and campgrounds.

Public recreation, will not include residential use, cabins, or other overnight accommodations (other than campgrounds) except if a recreation area is owned by a state agency and operated as a component of a state park system in which case cabins and other overnight accommodations will be permitted, e.g., local, state, and federal parks and recreation areas.

Public recreation uses typically include areas and facilities owned and operated by the federal, state, county, or local government (municipalities/communities) and in some cases by park and school districts. However, private entities may operate recreation facilities on public property as concessionaires under agreement with the public entity controlling the property. Recreation uses may be structured and formal or unstructured and informal. These may be offered free or for a fee. This does not allow for public/private partnership where facilities are owned by private investors. All structures and facilities should be owned by the public entity.

Commercial Recreation – is defined as recreation amenities that are provided for a fee to the public intending to produce a profit for the owner/operator. These primarily water-based facilities typically include: marinas and affiliated support facilities like restaurants

and lodges; campgrounds; cabins; military vessel attractions; and excursion tour vessels (restaurant on the water). These uses and activities can be accommodated through changes in existing conveyance agreements. These areas do not include residential use, long-term accommodations or individually owned units. Where applicable, TVA will request appropriate compensation for use of the property.

Greenways – e.g., linear parks or developed trails located along natural features, such as lakes or ridges, or along man-made features, including abandoned railways or utility rights-of-way, which link people and resources together.

Zone 7 - Shoreline Access

TVA-owned land where Section 26a applications and other land use approvals for private shoreline alterations are considered. Requests for private shoreline alterations are considered on parcels identified in this zone where such use was previously considered and where the proposed use would not conflict with the interests of the general public. As provided for in the SMP, shoreline access would be divided into three categories based on the presence of sensitive ecological resources and navigation restrictions. The categories are: (1) Shoreline Protection, where no shoreline access alterations would be permitted; (2) Shoreline Access Mitigation, where special analysis would be needed; and (3) Managed Shoreline Access, where no known sensitive resources exist. Types of development/management that can occur on this land are:

- ***Private water use facilities***, e.g., docks, piers, launching ramps/driveways, marine railways, boathouses, enclosed storage space, and nonpotable water intakes.
- ***Shoreline access corridors***, e.g., pathways, wooden steps, walkways, or mulched paths which can include portable picnic tables and utility lines.
- ***Shoreline stabilization***, e.g., bioengineering, riprap and gabions, and retaining walls.
- ***Shoreline vegetation management*** on TVA-owned shoreline access shoreland.
- ***Conservation easements*** for protection of the shoreline.
- ***Other activities***, e.g., fill, excavation, grading, etc.

C. Project Descriptions

The preferred Alternative (Modified Alternative B - Table 1) would continue to provide suitable economic and recreation opportunities as prescribed by the TVA Land Policy and the minor changes from the 2005 Draft Land Plan would be included. When compared to the original Alternative B this Modified Development and Recreation Alternative would allocate less land to Zone 5 (Economic Development or Industrial) and more to Zones 3, 4, and 6 (Sensitive Resource Management, Natural Resource Conservation, and Developed Recreation) than the original Alternative B, but more than the original Alternative C.

Table 1. Proposed Land Uses for the 2007 Plan by Alternatives

Existing (1988) Allocation Categories	2007 Land Use Zones	Alternative A - No Action		Alternative B	
		Acres	%	Acres	%
Retained Developed[1] Previously Unplanned[2]	Zone 2 - Project Operations	3578	22%	4373	27%
Historic Preservation, Habitat Protection, Visual Management and Protection, Small Wild Areas	Zone 3 -Sensitive Resource Management	3474	21%	3781	23%
Wildlife Management Forest Management Agriculture, Open Space, Right-of-Way Protection	Zone 4 - Natural Resource Conservation	3357	21%	3854	24%
Industrial Sites, Barge Terminal Sites, Minor Landings, Fleeting Area, Industrial Access	Zone 5 -Economic Development	1531	9%	376	2%
Public Recreation, Commercial Recreation, Water Access, Informal Recreation	Zone 6 - Developed Recreation	2003	12%	1560	10%
Previously Unplanned[3]	Zone 7 - Shoreline Access	2303	14%	2302	14%
Total		16,246	100	16,246	100

Under the Preferred Alternative 3,781 acres of land could be allocated to sensitive resource management-type uses; 3,854 acres could be allocated to natural resource conservation-type uses. This results in an increase of 806 acres in these allocations when compared to the current plan. Less land would be allocated for industrial use (Zone 5) at the Lowe Branch site than under the No Action Alternative and the majority of the Former Breeder Site would be retained as Zone 2 - Project Operations or placed in a conservation buffer (Zone 4), resulting in a net reduction of 360 acres available for industrial-type uses. Three hundred and seventy-six (376) acres could be allocated to non-TVA industrial development uses; and 1,560 acres could be allocated to developed recreational use (a 443 acre reduction).

[1] Retained development - A TWRA maintenance area (9 acres) and Kingston Pumping Station (16 acres) are the only inclusions from the1988 Plan.
[2] Primarily consists of TVA project lands from dam and electric power plant reservations.
[3] Consists of TVA lands described as marginal strip in the 1988 Plan.

Table 2. Comparison of Acres Allocated to Sensitive and Natural Resource Uses

Modified Alternative	Allocation	Acres
Alternative A - No Action Alternative	Historic Preservation, Habitat Protection, Visual Management and Protection, Small Wild Areas, Wildlife Management, Forest Management, Agriculture, Open Space, Right-of-Way Protection	6,831
Alternative B - Preferred Alternative	Zone 3 – Sensitive Resource Management Zone 4 – Natural Resource Conservation	7,635

Under the preferred alternative, TVA would continue to conduct individual environmental reviews prior to the approval of any proposed development or activity on public land to address site-specific issues. This alternative would guide TVA resource management and property administration decisions on the TVA public land surrounding Watts Bar Reservoir until the Land Plan is revised in the future, which is expected to be about 10 years.

D. Projected Future Land Use

Future land use on TVA-owned or controlled parcels on Watts Bar Reservoir would be guided by decisions made in this Land Plan. The primary land use on Watts Bar Reservoir (on TVA lands and privately held lands) is expected to be residential development (47% of available shoreline). One large tract; the Lowes Branch Industrial site would likely be developed for industrial uses under the preferred alternative. Several other small parcels (all <10 acres) would also be developed for industry. The former Clinch River Breeder site had been proposed for industrial development in the Draft 2007 Land Plan, but would be retained by TVA as part of its Project Operations (Zone 2) lands in the final Land Plan. The majority of remaining available shoreline is designated for resource protection, natural resource conservation, managed recreation, and project operations lands. This lands plan allocates uses for land under TVA control and considers impacts to private land.

E. Project Area

This biological assessment is to address planning of the approximately 16,200 acres of TVA public land on Watts Bar Reservoir in Loudon, Meigs, Rhea, and Roane counties, Tennessee and the streams, rivers and reservoirs immediately adjacent to these public lands. In addition to the lands that will actually be managed under this plan, potential direct, indirect, and cumulative impacts to receiving waters within the Watts Bar watershed will be addressed. Waterbodies discussed include; segments of the Clinch River from its confluence with the Tennessee River upstream to Melton Hill Dam (CRM 22.0), the Emory River from its confluence with upstream to river mile 11.0, and the Tennessee River from TRM 516 (downstream of Watts Bar Dam) upstream to Ft. Loudoun Dam (TRM 602). These areas (and specific parcels mentioned in the discussion) and their relationship to the river miles listed above can be seen on the maps included with the draft Land Plan (Panels 1-4).

Lands that are not under TVA control (non-TVA lands) are not considered part of the planning process and will not be analyzed with regard to direct or indirect effects. Non-TVA lands will be discussed as they relate to cumulative effects on protected species. TVA proposes no actions for lands not under its control (non-TVA Land) and these lands are not part of the planning process. Impacts to non-TVA lands will be discussed as they pertain to TVA actions on TVA controlled land.

Status of Species and Critical Habitat -
This section describes the occurrence of federally listed species and designated critical habitat segments in areas potentially affected by land use authorized under this Lands Plan. Species accounts, including current range-wide status of these species, species trends, and habitat and biological requirements for these species are included in Appendix A. Species occurrence data and status information discussions are summarized from data in the TVA Natural Heritage database.

Table 3. Federally listed species currently known to occur in Loudon, Meigs, Rhea, or Roane County, Tennessee. The project area is defined as those parcels of TVA-owned or controlled land considered as part of this planning process or areas directly or indirectly affected by development or use of these parcels.

Common Name	Scientific Name	Federal Status	Reported from the Project Area since 1980?
Plants			
Virginia spirea	*Spirea virginiana*	Threatened	No
Cumberland rosemary	*Conradina verticillata*	Threatened	No
Mussels			
Fanshell	*Cyprogenia stegaria*	Endangered	Yes
Rough pigtoe	*Pleurobema plenum*	Endangered	Yes
Pink mucket	*Lampsilis abrupta*	Endangered	Yes
Shiny pigtoe	*Fusconaia cor*	Endangered	No
Orangefoot pimpleback	*Plethobasus cooperianus*	Endangered	Yes
Fish			
Snail darter	*Percina tanasi*	Threatened	Yes
Spotfin chub	*Erimonax monachus*	Threatened	No
Mammals			
Gray bat	*Myotis grisescens*	Endangered	Yes

Plants
At present, no populations of plants listed under the ESA as threatened or endangered are known to occur on or immediately adjacent to Watts Bar Reservoir lands. Four populations of Virginia spirea and one population of Cumberland rosemary occur within one mile of the reservoir on the Emory River. However, all of the land parcels in this area non-TVA lands and are not included in this planning process. In addition, there is a historical record of American hart's tongue fern, last observed in 1849 in a cave approximately two miles west of Caney Creek. This species is no longer known from within the project area.

Mussels

Individuals or populations of federally listed mussels are present in three areas within the project area; the mainstem of the Clinch River between Melton Hill Dam and Poplar Creek (CRM 22 - CRM 12), the mainstem of the Tennessee River downstream of Loudoun Dam (TRM 602 - TRM 588), and the mainstem of the Tennessee River downstream of Watts Bar Dam (TRM 530 - TRM 516).

Clinch River - Melton Hill tailwater

One federally listed mussel (pink mucket) and one federal candidate species (sheepnose) occur in the Clinch River downstream of Melton Hill Dam. Surveys in the Clinch River have resulted in the collection of only a few, older individuals of these species. Relict shells of several other federally listed or candidate species (fanshell, ring pink, orangefoot pimpleback, shiny pigtoe, fine-rayed pigtoe, and Alabama lampmussel) have been collected from this reach, but no live individuals have been reported.

Land designations in this reach are primarily Zone 3 - Sensitive Resource Management, Zone 4 - Natural Resource Conservation, or Zone 1 - non-TVA land. The former Clinch River Breeder Reactor Site (Breeder Site) would be designated as Zone 2 - Project Operations. This site would be completely surrounded by a conservation buffer between the Breeder Site and the Clinch River. With this buffer Parcel 145 will be reduced by approximately 100 acres. This "buffer" will be included in parcel 144. Two small areas (< 25 acres) in this reach are designated as Zone 7 - Shoreline Access and one campground (~ 12 acres) is designated as Zone 6 - Developed Recreation. These areas are located in embayments of Watts Bar Reservoir and not on the main channel of the Clinch River where federally listed mussels are present.

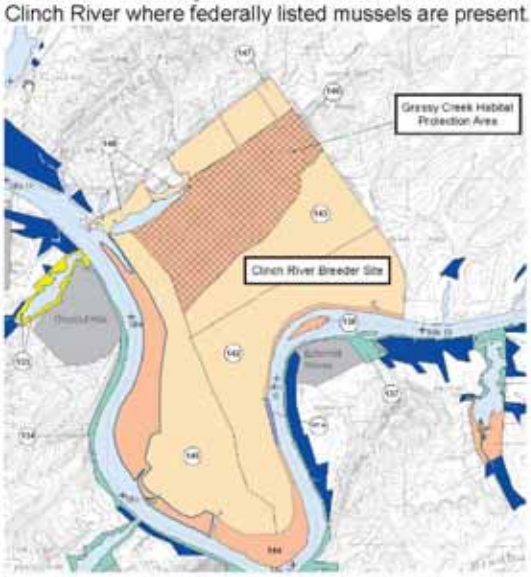

Figure 2. Map of Clinch River Breeder site and associated conservation buffer (Parcel 144).

Tennessee River - Ft. Loudoun Tailwater
Individuals of the pink mucket and orangefoot pimpleback mussels have been collected from the mainstem of the Tennessee River downstream of Ft. Loudoun Dam. While individual mussels were collected in the area, they were older specimens, and no evidence of reproduction or of a viable population of the species has been seen in the Ft. Loudoun Dam tailwater. Habitat alteration due to impoundment and displacement of host fish for these species has likely rendered these areas permanently unsuitable for future reproduction the pink mucket or orangefoot pimpleback. Most of the parcels in this area are non-TVA lands and will not be part of this planning process. The remaining parcels are assigned to Zone 3 - Sensitive Resource Management or Zone 4 - Natural Resource Conservation, with the exception of a small park operated by the City of Loudoun (Steekee Creek Park).

Tennessee River - Watts Bar Tailwater
Populations of the fanshell, rough pigtoe and pink mucket mussel are present in the mainstem of the Tennessee River downstream of Watts Bar Dam. Relict shells of the dromedary pearlymussel have also been collected from this reach. All parcels adjacent to these populations are currently designated as Zone 2 - Project Operations and are part of the Watts Bar Dam Reservation. No changes in designation are proposed for these parcels.

Fish
Tennessee River
The snail darter occurs in Sewee Creek, downstream of Watts Bar Dam, and is present in the mainstem of the Tennessee River downstream of the dam. All parcels adjacent to this population are currently designated as Zone 2 - Project Operations and are part of the Watts Bar Dam Reservation or are part of the Watts Bar Nuclear site. No changes in designation are proposed for these parcels.

Snail darters are also present in the mainstem of the Tennessee River downstream of Ft. Loudoun Dam. Most of the parcels in this area are non-TVA lands and will not be part of this planning process. The remaining parcels are assigned to Zone 3 - Sensitive Resource Management or Zone 4 - Natural Resource Conservation, with the exception of a small park operated by the City of Loudoun (Steekee Creek Park).

Emory River/Clinch River system
A stable population of the spotfin chub is present in the Emory River. This species is generally intolerant of reservoir conditions but may be occasionally found in the Emory River embayment of Watts Bar Reservoir. Spotfin chubs have only been collected upstream of Emory River Mile 13, in areas relatively unaffected by the impoundment. Only non-TVA parcels are located in this area. One specimen of spotfin chub was collected from the Poplar Creek drainage in 2003. The mouth of Poplar Creek is approximately 8 miles upstream from the mouth of the Emory River. This species has not been reported in subsequent collections and the single specimen reported is likely an individual that dispersed upstream from the Emory River population. It is the opinion of TVA biologists that a viable population of spotfin chub is not present in the Poplar Creek system.

Mammals

Gray bats roost in caves and forage over open water habitats. They have been reported from six caves within the vicinity of Watts Bar Reservoir. Only one of these caves is located on Watts Bar Reservoir land. Results of recent TVA surveys at this cave indicate that gray bats roost at this site on a transitional basis during spring and fall migration. This parcel containing this cave is designated as Zone 3 - Sensitive Resources Management and is included as part of the Marble Bluff Habitat Protection Area.

Designated Critical Habitat Segments

The Emory River is designated as critical habitat for the spotfin chub, beginning at approximately RM 14.6 and extending upstream in the system. No lands available for planning are present within or adjacent to the designated critical habitat segments.

IV. Environmental Baseline

Much of the environmental baseline for these species in the Tennessee River system is discussed in the 2005 TVA Biological Assessment titled 'Routine Operations and Maintenance of TVA's Water Control Structures in the Tennessee River Watershed' (TVA 2005). Many of the rivers in the Tennessee River drainage have been significantly modified from their original condition through impoundment and channel modifications designed to facilitate navigation. Specific conditions for federally listed species present in the Watts Bar project area are discussed below.

Plants
As described above, no federally listed plants are known from within the project area.

Mussels
Clinch River - Melton Hill tailwater
Pink mucket and sheepnose mussels are represented in this area by only a few, older individuals of these species. No evidence of reproduction has been seen in these populations, and mussel densities are extremely low. While live individuals of these species persist, it is not likely that a viable population of these species is present in this reach of the Clinch River. Habitat alteration (including impoundment of Watts Bar Reservoir, Melton Hill Reservoir and Ft. Loudoun Reservoir, cold water releases from Norris Reservoir and subsequent displacement of host fish for these species) has likely rendered these areas unsuitable for successful reproduction of these species (TVA 2005).

Relict shells of several other federally listed or candidate species (fanshell, ring pink, orangefoot pimpleback, shiny pigtoe, fine-rayed pigtoe, and Alabama lampmussel) have been collected from this reach, but no live individuals have been reported.

Tennessee River - Ft. Loudoun Tailwater
Individuals of the pink mucket and orangefoot pimpleback mussels have been collected from the mainstem of the Tennessee River downstream of Ft. Loudoun Dam. While individual mussels were collected in the area, they were older specimens, and no evidence of reproduction or of a viable population of the species was seen in the Ft.

Loudoun Dam tailwater. Habitat alteration due to impoundment of Watts Bar Reservoir and Ft. Loudoun Reservoir and subsequent displacement of host fish for these species has likely rendered these areas unsuitable for successful reproduction of the pink mucket or orangefoot pimpleback in these areas (TVA 2005).

Tennessee River - Watts Bar Tailwater

Populations of the fanshell, rough pigtoe and pink mucket mussel are present in the mainstem of the Tennessee River downstream of Watts Bar Dam. There is evidence that some more common mussel species are reproducing in this reach of the Tennessee River and that conditions might be suitable for reproduction of these listed species. Populations of common mussels seem to be relatively stable, and there are no significant threats to the remaining mussel resources in the Watts Bar tailwater. Relict shells of the dromedary pearlymussel have also been collected from this reach but it is not likely that a viable population of this species exists in the Watts Bar tailwater (TVA 2005).

Fish

Snail darters are known from Sewee Creek, downstream of Watts Bar Dam, and specimens have been collected from the mainstem of the Tennessee River downstream of Watts Bar. The Sewee Creek population has persisted since at least the early 1980's and the population in Sewee Creek and the Tennessee River downstream of Watts Bar Dam appear to be stable.

Snail darters are also known from the Tennessee River arm of Watts Bar Reservoir downstream of Ft. Loudoun Dam. Habitat conditions are marginal for this species in the area, and the occurrences of snail darter in the Ft. Loudoun tailwater may be the result of downstream drift of young from good populations of this species in French Broad and Holston Rivers. It is difficult to adequately survey areas downstream of Ft. Loudoun Dam. Therefor, the size and viability of this population has not been assessed.

A stable population of the spotfin chub is present in the Emory River. A single specimen of spotfin chub collected from the Poplar Creek drainage by Department of Energy (DOE) biologists in 2003 is likely a fluke occurrence. In spite of numerous, regular surveys in Poplar Creek, spotfin chubs have not been encountered, with the exception of the specimen collected in 2003. Streams in the Poplar Creek system are seriously impacted by past land use, and contaminant issues stemming from the Oak Ridge National Laboratories (ORNL) complex. Habitat conditions are poor and this system does not appear to support a viable population of spotfin chubs.

Mammal

Gray bats roost in caves and forage over open water habitats. They have been reported from six caves within the vicinity of Watts Bar Reservoir. Only one of these caves is located on Watts Bar Reservoir land. Results of recent surveys at this cave indicate that gray bats roost at this site on a transitional basis during spring and fall migration. This parcel is designated as Zone 3 - Sensitive Resources Management and is part of the Marble Bluff Habitat Protection Area.

V. Effects of the Action

Watts Bar LMP Effects Matrix

The following effects matrix (Table 4) shows future potential land actions that may be facilitated by Land Planning Zone designations resulting from the Land Plan. Each potential use is assigned either a 'Low', 'Medium', or 'High' potential to adversely affect listed species, and a 'Low', 'Medium', or 'High' potential to benefit listed species. If no species are present in areas that could see a potential future use (or areas that could be affected by that use) they are assigned a 'Low' potential for both adverse effects and beneficial effects. As an example: No species are present on or adjacent to Zone 2 - Project Operations - land adjacent to existing navigation operations. Therefore lands in this classification are assigned both a 'Low' potential to adversely affect listed species, and a 'Low' potential to benefit listed species. These potential future uses are not addressed in detail in the Biological Assessment (BA).

Lands that have federally listed species on or adjacent to them and have a 'Low' potential to adversely effect listed species and/or a 'Low' potential to benefit listed species are likewise not addressed in further detail in the BA.

Lands where federally listed species are known or likely to occur are addressed in more detail in the BA if a Land Use has a 'Medium' or 'High' potential to affect listed species, or a 'Medium' or 'High' potential to benefit listed. The majority of these areas identified would have primarily beneficial effects (Zones 3 and 4). The other areas where planned Land Use would have a 'Medium' potential to affect listed species occur within or adjacent to Zone 2 - Project Operations parcels (particularly the Former Breeder Site on the Clinch River).

Zone 1 (non-TVA Lands) are included in the matrix, but because TVA does not have control over planning of future land use on these parcels, they are not directly addressed as part of the BA. Potential future actions on non-TVA lands could have 'Low', 'Medium', or 'High' potential to either adversely affect, or benefit federally listed species. Some, but not all, of these actions would be subject to future review by TVA as part of the 26a permitting process.

Table 4. Matrix of Potential Land Actions resulting from Parcel Allocation and Potential Effects to Listed Species.

	Land Use and Potential Land Actions	Land Zoned For This Use in the Vicinity of Federally Listed Species Occurrences?	Potential To Adversely Affect Federally Listed Species or Habitat - High, Medium, Low	Potential to Benefit Federally Listed Species or Habitat - High, Medium, Low
Zone 1 - Non TVA Shoreland				
	Flowage easement land	Yes- but these lands are not under direct or indirect TVA control, and are not considered "plannable"	Low, Medium, High	Low, Medium, High
	Privately owned reservoir land	Yes- but these lands are not under direct or indirect TVA control, and are not considered "plannable"	Low, Medium, High	Low, Medium, High
Zone 2 - Project Operations				
	Land adjacent to established navigation operations	No	Low	Low
	Land used for TVA power projects operations	Yes - Ft. Loudoun Tailwater, Watts Bar Tailwater, Clinch River (Old Breeder Site)	Medium	Low
	Dam reservation land	Yes - Ft. Loudoun Tailwater, Watts Bar Tailwater	Low	Low
	Navigation safety harbors/landings	Yes - Ft. Loudoun Tailwater, Watts Bar Tailwater, Clinch River (Old Breeder Site)	Low	Low
	Navigation dayboards and beacons	Yes - Ft. Loudoun Tailwater, Watts Bar Tailwater, Clinch River (Old Breeder Site)	Low	Low
	Public works projects	No	Low	Low
Zone 3 - Sensitive Resource Management				
	Significant archaeological resources	Yes - Ft. Loudoun Tailwater, Watts Bar Tailwater, Clinch River (Old Breeder Site)	Low	Medium - indirect benefits from development restrictions

	Land Use and Potential Land Actions	Land Zoned For This Use in the Vicinity of Federally Listed Species Occurrences?	Potential To Adversely Affect Federally Listed Species or Habitat - High, Medium, Low	Potential to Benefit Federally Listed Species or Habitat - High, Medium, Low
	Sites/structures listed on or eligible for listing on the National Register of Historic Places	No	Low	Low
	Wetlands	Yes - Ft. Loudoun Tailwater, Watts Bar Tailwater, Clinch River (Old Breeder Site)	Low	Medium - indirect benefits from development restrictions
	TVA public land under easement, lease, or license to other agencies/individuals for resource protection purposes	Yes - Gray bats in vicinity of Paint Rock Wildlife Refuge	Low	Medium, High - direct and indirect benefits from management activities
	TVA public land fronting land owned by other agencies/ individuals for resource protection purposes	Yes - Gray bats in vicinity of Paint Rock Wildlife Refuge	Low	Medium, High - direct and indirect benefits from management activities
	Habitat Protection Areas	Yes - Gray Bats - Marble Bluff HPA	Low	Medium, High - direct and indirect benefits from management activities
	Ecological Study Areas	No	Low	Low
	Small Wild Areas	No	Low	Low
	River corridor with sensitive resources	Yes - Clinch River	Low	Medium, High - direct and indirect benefits from management activities
	Significant scenic areas	No	Low	Low
	Champion tree sites	No	Low	Low
Zone 4 - Natural Resource Conservation				
	TVA public land under easement, lease, or license to other agencies for wildlife or forest management purposes	Yes - Gray bats in vicinity of Paint Rock Wildlife Refuge	Low	Low, Medium - some forest management practices may benefit some species
	TVA public land fronting land owned by other agencies for wildlife or forest management purposes	Yes - Gray bats in vicinity of Paint Rock Wildlife Refuge	Low	Low, Medium - some forest management practices may benefit some species

	Land Use and Potential Land Actions	Land Zoned For This Use in the Vicinity of Federally Listed Species Occurrences?	Potential To Adversely Affect Federally Listed Species or Habitat - High, Medium, Low	Potential to Benefit Federally Listed Species or Habitat - High, Medium, Low
	TVA public land managed for wildlife or forest management projects	No	Low	Low
	Informal recreation areas	Yes	Low	Low
	Shoreline Conservation Areas	Yes	Low	Medium, High - direct and indirect benefits from management activities
	Wildlife Observation Areas	No	Low	Low
	River corridor without sensitive resources present	No	Low	Low
	Islands of 10 acres or less	Yes	Low	Low
Zone 5 - Industrial				
	Access for water supply or structures associated with navigation such as barge terminal, mooring cell, etc	No	Low	Low
	Land-based development potential	No	Low	Low
	TVA public land under easement, lease, or license to other agencies/individuals for purposes described above	No	Low	Low
	TVA public land fronting land owned by other agencies/individuals for industrial purposes described above	No	Low	Low
	Sites planned for future use supporting sustainable development	No	Low	Low
	Business Parks	No	Low	Low
	Industrial access	No	Low	Low
	Barge terminal sites	No	Low	Low
	Fleeting areas	Yes†	Low, Medium - potential impacts from operation of fleeting areas	Low

	Land Use and Potential Land Actions	Land Zoned For This Use in the Vicinity of Federally Listed Species Occurrences?	Potential To Adversely Affect Federally Listed Species or Habitat - High, Medium, Low	Potential to Benefit Federally Listed Species or Habitat - High, Medium, Low
	Minor commercial landing	No	Low	Low
Zone 6 - Developed Recreation				
	TVA public land under easement, lease, or license to other agencies/individuals for recreational purposes	Yes - Ft. Loudoun Tailwater	Low - Public Park, no planned expansion to this site	Low
	TVA public land fronting land owned by other agencies/individuals for recreational purposes	No	Low	Low
	TVA public land developed for recreational purposes, such as campgrounds, day use areas, etc	No	Low	Low
	Water access	Yes - Ft. Loudoun Tailwater	Low - Public Park, no planned expansion to this site	Low
	Public recreation **Commercial Recreation**	Yes - Ft. Loudoun Tailwater No	Low - Public Park, no planned expansion to this site Low	Low Low
	Greenways	No	Low	Low
Zone 7 - Shoreline Access				
	Private water use facilities,	No	Low	Low
	Shoreline access corridors	No	Low	Low
	Shoreline stabilization,	No	Low	Low

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	Land Use and Potential Land Actions	Land Zoned For This Use in the Vicinity of Federally Listed Species Occurrences?	Potential To Adversely Affect Federally Listed Species or Habitat - High, Medium, Low	Potential to Benefit Federally Listed Species or Habitat - High, Medium, Low
	Shoreline vegetation management	No	Low	Low
	Conservation easements	No	Low	Low
	Other activities, e.g., fill, excavation, grading, etc.	No	Low	Low

Terrestrial Resources

Because the actions resulting from this land plan directly affect land use, the potential for direct effects on terrestrial resources is greater than to aquatic resources. The fact that only one listed terrestrial species (gray bat) is known to be present on or adjacent to lands being planned minimizes that potential. TVA policy regarding protection of natural resources would further reduce that potential. Under the Preferred Alternative, approximately 47% of the shoreline being planned would be assigned to Zone 3 - Sensitive Resource Management or Zone 4 - Natural Resources Conservation. Any future proposals for Industrial, Residential, or Developed Recreational developments on TVA lands would be reviewed to consider potential adverse effects on terrestrial resources and ensure that any adverse effects are minimized or eliminated.

Plants

Because no federally listed plants or designated critical habitat segments are present in areas that could be affected by land use on Watts Bar Reservoir lands, no direct, indirect, or cumulative impacts to federally listed plants or their habitats would occur as a result of TVA Lands Planning.

Mammals

Direct Effects - The one cave on Watts Bar Reservoir known to support gray bats is located on TVA land that has been designated as Zone - 3 - Sensitive Resource Management. This site has been determined to be used only on a transitional basis during the spring and fall migration. This area is afforded further protection by being designated as part of the Marble Bluff Habitat Protection Area by TVA. No commercial, residential, or industrial development would be allowed in the vicinity of this cave. Because gray bats forage over water, land management activities would have no direct impacts to gray bats.

Indirect Effects - Shoreline development and associated clearing of riparian areas on TVA lands along the Watts Bar shoreline could indirectly affect gray bats by having negative effects on reservoir water quality and reservoir aquatic insect populations that

serve as a food base for gray bats. All future land use actions would be subject to environmental review under Section 26a of the TVA Act, and all appropriate Best Management Practices (BMPs) would be employed to minimize potential effects on reservoir water quality. In addition, the only cave known to be used by gray bats on Watts Bar Reservoir is in close proximity to the Paint Rock Wildlife Refuge. Restrictions on development in the refuge would also protect reservoir water quality and aquatic insect populations and therefore protect gray bats using this transitional cave.

Cumulative Effects - Under either alternative, shoreline development could occur in many non-TVA lands along Watts Bar Reservoir. This development has the same potential to affect gray bats as would development on TVA lands. Development on non-TVA lands is expected to be primarily residential. As with future actions on TVA lands many of these development actions would be subject to review under Section 26a of the TVA Act. TVA would require the same BMPs for residential development permitted under 26a as would be required on TVA lands. Even if these developments are not subject to 26a review, there would still be subject to other State and Federal permitting requirements (e.g. ARAP, 404, etc.) Potential impacts to gray bats and essential habitat (including the food base) would be minimized as a result of the permitting process.

Aquatic Resources

Current habitat conditions in Watts Bar Reservoir and its tailwaters are driven more by the presence of the reservoir and its operation and the presence and operation of upstream reservoirs (Ft. Loudoun, Melton Hill, and Norris) than by surrounding land use (TVA 2005). However, certain types of land use can have definite, local adverse effects on water quality and habitat conditions. This is especially true when considering industrial and residential development.

Potential effects of Land Use Designations on surface quality and aquatic habitats

Direct and Indirect Effects

Zone 1 - Non-TVA Lands

Shoreland located above summer pool elevation that TVA does not own in fee or land never purchased by TVA but is subject to TVA's 26a approvals for structures. This includes flowage easement land which is privately or publicly owned land where TVA has purchased the right to flood and/or limit structures, and privately owned reservoir land which is land lying below the 500-year flood elevation that was never purchased by TVA .

Overall land use patterns can contribute to cumulative effects on listed species. The vast majority of non-TVA lands on Watts Bar are likely to be developed as residential properties. However, these lands are not under the control of TVA and are not considered directly as a part of this Biological Assessment.

Zone 2 - Project Operations **-** These lands are owned and controlled by TVA. For the most part, these lands consist of dam and electric power plant reservations. Only minor future activities would occur on these parcels currently designated as Zone 2 - Project Operations within the 10 year planning window. Management of the Lower Watts Bar Unit is addressed in an existing Environmental Assessment (TVA 2000). The proposed completion of the Watts Bar Unit 2 reactor was the subject of consultation with the FWS (TVA 2007). TVA determined that activities associated with completion of WBN Unit 2

are not likely to adversely affect listed species in this reach of the Tennessee River. FWS has concurred with these findings. Snail darter, fanshell, rough pigtoe, and pink mucket occur downstream of Watts Bar Dam adjacent to the Watts Bar Nuclear site. No significant future activities are planned for these parcels. No direct or indirect impacts to listed species would result from planned activities on existing TVA Project Operations lands at or downstream of Watts Bar Dam.

Former Clinch River Breeder Reactor site - (CRM 14.5 - 19.0) - In addition to the lands currently designated as Zone 2, the Clinch River Breeder site would be designated as Zone 2 in this Land Plan. TVA would retain this site for future use. No specific plans are proposed for this tract within the planning cycle for the Land Plan (10 years), but it is most likely that the land would be developed for TVA's industrial use. Some impacts to water quality, aquatic habitat, and listed species could occur depending upon the type of TVA project operations development that takes place. Any future development of this site would be subject to a further review under ESA and NEPA statutes.

The potential for impacts to listed aquatic species in the Clinch River from industrial development for TVA projects at this site would come primarily from development on a barge terminal adjacent to the site or from installation and use of a water intake (or intakes) and/or wastewater outfall(s) servicing the industrial site. All appropriate BMPs and stormwater controls would be used during any construction on this site. The area that would be developed at the Breeder Site is surrounded by a conservation buffer between the site and the Clinch River (Figure 2). Only limited development would occur within this buffer, and would consist of corridors across the buffer for access to water use facilities or for placement of water withdrawal or outfall structures. Future TVA development at this site could include any combination of water use facilities, or may not require access to the river or water use.

Water Intakes and water use

There is potential for the construction and operation of water withdrawal structures in this section of the Clinch River as a result of TVA's future use of the former Breeder Site for project operations. Impacts from construction of water withdrawal structures would be similar to those described for construction of a barge facility. All of the conditions outlined above would be employed during construction of water withdrawal structures. The 'footprint' of this construction would be much smaller and the potential for impacts would be correspondingly reduced.

Operational aspects of any proposed water intake (including consumptive use) would be analyzed for potential effects on federally listed species, and any avoidance or mitigation measures needed to protect listed species would be developed in consultation with the FWS.

Water Outfalls

Construction effects for stormwater or wastewater outfalls would be similar to those described for construction of a barge terminal or water intake. As with the construction of a water intake, the 'footprint' of the construction work would be relatively small, and the potential for impacts would be reduced when compared to construction of a barge terminal.

However, wastewater and stormwater discharges can contain constituents that have the potential to affect water quality and have an adverse effect on listed species. Any outfall

constructed on would be subject to NPDES permitting requirements and all other applicable State and Federal regulations. Compliance with conditions imposed during this permitting process and during the ESA consultation process for the proposed projects would ensure that no effects or only insignificant effects on listed species would occur as a result of discharges to the Clinch River from the Breeder Site. Any project specific avoidance or mitigation measures needed to protect listed species from potential effects arising from wastewater or stormwater discharges from this site would be developed in consultation with the FWS.

If TVA were to develop a industrial facilities at this site or at any other site in Zone 2, the following measures would be employed to minimize the potential for effects on federally listed species:

1. TVA would consult with USFWSFWS in order to determine if the proposed action could affect listed mussels present in the area
2. Pre-construction mussel surveys would be conducted in all areas of the Clinch River (Watts Bar Reservoir) that would be affected by construction and use of the terminalassociated infrastructure (e.g. barge terminal, water intakes or water outfalls)
3. Any listed mussels found during these surveys would be dealt with according to terms and conditions imposed as a result the consultation process. These could consist of minimization or avoidance measures implemented during construction and operation, or relocation of the mussels encountered if effects are unavoidable

With implementation of these conditions and appropriate BMPs, only relatively minor impacts to federally listed mussels in the Clinch River are expected to occur.

Zone 3 - Sensitive Resource Management and Zone 4 - Natural Resource Conservation - Because no development would be allowed on lands designated in these categories, these designations would serve to protect shoreline habitats and water quality in Watts Bar Reservoir. Under the Preferred Alternative, approximately 47% of the TVA lands would be protected by these designations on Watts Bar Reservoir. Maintenance of these lands under Zone 3 or Zone 4 would directly benefit water quality and indirectly benefit listed aquatic species present in these areas.

Zone 5 - Industrial - Approximately 376 acres (2%) of the land considered in the Land Plan would be designated for industrial development. One large parcel is of interest when considering potential effects on federally listed aquatic species. Approximately 280 acres in the Lowe Branch Embayment would be designated for industrial development. This area is located upstream of Watts Bar Dam. No listed species are present in the area, but snail darter, fanshell, rough pigtoe, and pink mucket occur downstream of Watts Bar Dam. Development of these parcels would be subject to all applicable State and Federal permitting requirements, including ESA consultation.

Potential effects on instream habitat and water quality resulting from industrial development on these parcels would be similar to those discussed concerning the Breeder Site under Zone 2 - Project Operations. Because no listed species are present on or adjacent to these parcels, no direct effects on federally listed species would occur as a result of industrial development on these sites. All future actions on these sites

would be subject to further review under the NEPA and ESA statutes, and any potential effects to listed species identified and addressed. Any industrial wastewater discharges from this site would be subject to appropriate State and Federal permit requirements. Development of this site for industrial purposes is not likely to adversely affect any federally listed aquatic organisms or their habitats.

The remainder of lands designated as Industrial are small <10 acres and identified as areas suitable for placement of a barge terminal to serve back-lying industrial development. No listed species are present on or adjacent to these sites.

Zone 6 - Developed Recreation - Approximately 1560 acres (10%) are designated for developed recreation. Pink mucket and orangefoot pimpleback mussels are potentially present adjacent to Parcel 99 in the Ft. Loudoun tailwater/ Upper Watts Bar Reservoir. Parcel 136 on the Clinch River is located in the Caney Creek embayment. Caney Creek joins the Clinch River within the area known to be occupied by pink mucket and sheepnose mussels. This embayment is impacted by siltation and does not contain suitable habitat for these mussels. Parcel 99 is currently used for public recreation, and no future changes in use are expected. Because no changes in current use would occur (Parcel 99), or no listed species or habitat suitable for these species is present (Parcel 136), no impacts to listed aquatic species or their habitats in the project area would occur as a result of land uses on these parcels.

Zone 7 - Shoreline Access - Approximately 2302 acres (14%) of TVA land are designated for shoreline access. There are no known occurrences of federally listed species in the vicinity of the vast majority of these shoreline access areas. Approximately 20 acres of shoreline access areas are available along the Clinch River. These areas are located in embayments of Watts Bar Reservoir. The Watts Bar Dam and Ft. Loudoun Dam tailwaters where snail darters and listed mussels occur do not contain any parcels designated for shoreline access. Potential impacts to pink mucket in the Clinch River are expected to be minor and insignificant. No impacts to species in the Watts Bar or Ft. Loudon tailwaters are expected.

VI. Effects from Interdependent and Interrelated Actions
No interdependent or interrelated actions were identified during this analysis.

VII. Effects Determinations

Virginia spirea (Spirea virginiana) - Threatened - No Effect
While this species is present in the Emory River (a tributary to Watts Bar Reservoir), no populations exists in areas that would be affected by land use activities addressed in the Watts Bar Land Management Plan.

Cumberland rosemary (Conradina verticillata) - Threatened - No Effect
While this species is present in the Emory River (a tributary to Watts Bar Reservoir), no populations exists in areas that would be affected by land use activities addressed in the Watts Bar Land Management Plan.

Fanshell (Cyprogenia stegaria) - Endangered - No Effect
This species is currently present in the mainstem of the Tennessee River downstream of Watts Bar Dam. All reasonably foreseeable actions on TVA Zone 2 - Project Operations

lands in the vicinity of these occurrences have been addressed in other consultations with FWS. No changes to land use on these parcels would occur as a result of this plan, and no future actions that could affect this species would result.

Rough pigtoe (Pleurobema plenum) - No Effect
This species is currently present in the mainstem of the Tennessee River downstream of Watts Bar Dam. All reasonably foreseeable actions on TVA Zone 2 - Project Operations lands in the vicinity of these occurrences have been addressed in other consultations with FWS. No changes to land use on these parcels would occur as a result of this plan, and no future actions that could affect this species would result within the planning horizon of this document (10 years).

Pink mucket (Lampsilis abrupta) - Endangered - May Effect, Not Likely to Adversely Affect
As described for the fanshell and rough pigtoe above, this species is currently present in the mainstem of the Tennessee River downstream of Watts Bar Dam. All reasonably foreseeable actions on TVA Zone 2 - Project Operations lands in the vicinity of these occurrences have been addressed in other consultations with FWS. No changes to land use on these parcels would occur as a result of this plan, and no future actions that could affect this species would result within the planning horizon of this document (10 years). This species also occurs in the vicinity of Zone 6 - Developed Recreation parcels in Watts Bar Reservoir downstream of Ft. Loudoun Dam and in the Clinch River (Caney Creek). Actions resulting from land use designation in these areas would have no effect on the pink mucket.

Development on the Breeder Site (Zone 2) adjacent to the Clinch River has the potential to affect this species. Future development on this site is not likely to adversely affect the pink mucket given the conditions stated.

Shiny Pigtoe (Fusconaia cor) - Endangered - No Effect
This species has historically been collected in the project area, but all populations are believed to be extirpated from the project area.

Orangefoot pimpleback (Plethobasus cooperianus) - Endangered - No Effect
This species also occurs in the vicinity of Zone 6 - Developed Recreation parcels in Watts Bar Reservoir downstream of Ft. Loudoun Dam. Actions resulting from land use designation in these areas would have no effect on the pink mucket.

Snail darter (Percina tanasi) - Threatened - No Effect
This species is currently present in the mainstem of the Tennessee River downstream of Watts Bar Dam and downstream of Ft. Loudoun Dam. No changes to land use on these areas would occur as a result of this plan, and no future actions that could affect this species would result.

Spotfin chub (Erimonax monachus) - Threatened - No Effect
While this species is present in the Emory River (a tributary to Watts Bar Reservoir), no populations exists in areas that would be affected by land use activities addressed in the Watts Bar Land Management Plan.

Gray bat (Myotis grisescens) - Endangered - No Effect

The one cave on Watts Bar Reservoir known to support gray bats is located on TVA land that has been designated as Zone - 3 - Sensitive Resource Management. This site has been determined to be used only on a transitional basis during the spring and fall migration. No effects to gray bats are expected to result from this action.

Designated Critical Habitat for the spotfin chub - Emory and Obed rivers - No Adverse Modification would occur
None of the parcels that were considered in the Land Plan are located adjacent to or upstream of this critical habitat area. No effects on critical habitat for the spotfin chub in the Emory or Obed River would result.

VIII. Conclusions
Because this Land Plan is a programmatic document it considers the assignment of broad use zones or activities to parcels of TVA controlled land. It does not consider any specific potential future actions that might occur on planned lands as a result of the assignment of these use zones. These future actions, should they occur, will be considered in appropriate future environmental review and FWS would be consulted as appropriate. However, a range of potential effects can be identified for these use zones and potential future impacts to endangered species are addressed in the BA. Federally listed species are only found in three areas that could be affected by land actions addressed in the Land Plan; the Clinch River downstream of Melton Hill Dam, downstream of Ft. Loudoun Dam, and downstream of Watts Bar Dam.

Under the Preferred Alternative 3,781 acres of land would be allocated to sensitive resource management-type uses; 3,854 acres would be allocated to natural resource conservation-type uses. This results in an increase of 806 acres in these allocations when compared to the existing (1988) plan (No Action Alternative). Less land would be allocated for industrial use (Zone 5) at the Lowe Branch site than under the No Action Alternative and the majority of the Former Breeder Site would be retained as Zone 2 - Project Operations or placed in a conservation buffer (Zone 4), resulting in a net reduction of 360 acres available for industrial-type uses. Three hundred and seventy-six (376) acres could be allocated to non-TVA industrial development uses; and 1,560 acres could be allocated to developed recreational use (a 443 acre reduction).

Zone 1 - Non-TVA Shoreland parcels are not under the direct control of TVA and are not addressed as part of the Land Plan. Lands designated as Zone 3 - Sensitive Resource Management and Zone 4 - Natural Resource Conservation parcels are designated to protect sensitive state- or federally listed species, important cultural resources and other natural resources. Placement of parcels into these categories would benefit listed species. Few or none of the federally listed species known in the project area are found within or in areas that could be affected by land use on Zone 6 - Developed Recreation or Zone 7 - Shoreline Access parcels. Therefore, land use on Zone 6 and Zone 7 parcels has little or no potential to adversely affect federally listed species.

The highest potential for impacts to listed species occurs on lands designated as Zone 2 - Project Operations or Zone 5 - Industrial. The majority of these parcels are either located in areas where no listed species are found (most Zone 5 parcels), or have no future actions that would occur within the planning cycle (10 years) of the Land Plan.

The one exception to this is the Breeder Site on the Clinch River. Because TVA is retaining this parcel as Zone 2 - Project Operations, it has much more control over potential future activities on the Breeder Site. Any future action potentially affecting a threatened or endangered species would be the subject of consultation with FWS, and project specific avoidance or mitigation measures would be developed as a part of that consultation.

The overall increase in lands designated for resource protection (Zones 3 and 4), and the reduction in land available for industrial uses (Zones 2 and 6) would likely provide a net benefit to federally listed species in the project area when compared to the current land plan.

TVA has determined that there would be no effect on the two plants present in the project area; Virginia spirea and Cumberland rosemary, four of the five mussels; fanshell, rough pigtoe, shiny pigtoe, and orangefoot pimpleback, the two fish; snail darter and spotfin chub, and the one mammal; gray bat. TVA has determined that this project is not likely to adversely affect the pink mucket. This project would not result in adverse modification of designated critical habitat for the spotfin chub in the Obed or Emory Rivers.

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_____. 2000. *Resource Management Plan and Final Environmental Assessment: Lower Watts Bar Management Unit, Watts Bar Reservoir.* Norris: TVA Resource Stewardship.

_____. 2001a. *Modernization of Turbines at Watts Bar Hydro Plant, Rhea County, Tennessee, Environmental Assessment.*

_____. 2001b *Proposed Issuance of Regulations Under Section 26a of the TVA Act for Nonnavigable Houseboats, Storage Tanks, Marina Sewage Pump-Out Stations, Wastewater Outfalls and Septic Systems, and Development Within*

_____. 2004. *Reservoir Operations Study Final Environmental Impact Statement.* Technical Documentation, Knoxville, Tennessee.

_____. 2005a. *Watts Bar Reservoir Land Management Plan and Draft Environmental Impact Statement.*

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U.S. Department of Energy. 1995. *Record of Decision for the Lower Watts Bar Reservoir.* Prepared in Accordance With Requirements Under the Comprehensive Environmental Response, Compensation, and Liability Act.

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Appendix A. Species Accounts

Conradina verticillata Jennison
Cumberland Rosemary

Cumberland rosemary (*Conradina verticillata*), was listed as threatened in 1991 because of the small number of populations as well as the known threats to the species survival (FWS 1991). This small evergreen shrub of the mint family grows on seasonally inundated banks, gravel and boulder bars, and on over sandstone bedrock along swift Cumberland Plateau streams in Tennessee and Kentucky (Kral 1983, FWS 1996).

Cumberland rosemary's distribution is comprised of 91 extant occurrences, which are concentrated among three distinct population centers: (1) Big South Fork River and its tributaries in Morgan, Scott, and Fentress Counties, TN and McCreary County, KY; (2) Obed River in Morgan and Cumberland Counties, TN; and (3) Caney Fork River in Cumberland and White Counties, TN. One colony in McCreary County, KY is considered extirpated (FWS 1996). Critical habitat has not been designated for this plant. In general, this species appears to be stable (FWS 2003).

The species reproduces almost entirely by clonal spread and stem longevity (FWS 1996). When stems become disconnected during winter floods, fragments of the plant wash downstream and colonize new places. Sexual reproduction rarely occurs: it has been estimated that as few as 10 percent of seeds are fully developed and fertile (FWS 1996). Of these, germination is very low. Furthermore, even when seedlings are produced, summer drought and winter floods may play a significant role in preventing their long-term survival.

The only known cause of extirpation is inundation as a result of reservoir construction for recreational or hydroelectric purposes (FWS 1996). Although intolerant of prolonged inundation, the species is dependent upon yearly flooding that may reduce or eliminate competing vegetation along and in stream corridors. Additional threats include destruction of plants and habitat by campers, horseback riders, ATVs, and white-water rafters (FWS 1996). The mining of coal and exploration of gas and oil in the area may also adversely affect the species because those activities contribute to water pollution through sediment and fragment deposition and the leaching of chemicals from those particles (FWS 1996).

Cumberland Rosemary References:

Kral, R. 1983. A report on some rare, threatened or endangered forest-related vascular plants of the South. USDA Forest Service Technical Publication R8-TP2. 2 volumes, 1,305 pages.

U.S. Fish and Wildlife Service. 1991. Endangered and threatened wildlife and plants; *Conradina verticillata* determined to be threatened. *Federal Register*, 56(230): 60937-60941.

U.S. Fish and Wildlife Service. 1996. Cumberland rosemary recovery plan. U.S. Fish and Wildlife Service, Atlanta, Georgia, 42 pages.

U.S. Fish & Wildlife Service. 2003. Summary report to congress on the recovery program for threatened and endangered species, 1998 and 2000. U.S. Fish and Wildlife Service, Washington, DC, 35 pages.

Spiraea virginiana Britton
Virginia Spiraea

Virginia spiraea (*Spiraea virginiana*), listed as threatened in 1990, is a rare shrub that inhabits frequently disturbed, high gradient sections of second and third order streams (FWS 1990). It occurs "within the southern Blue Ridge and Appalachian (Cumberland) Plateaus physiographic provinces in the headwaters, or just over the divide, of streams that flow to the Ohio drainage basin" (FWS 1992). Historically, the species was known to occur in 39 populations in nine states ranging from southwestern Pennsylvania and south-central Ohio southwest along the Appalachian highlands to northwestern Georgia, with outlier sites in northwestern Alabama and central Kentucky (FWS 1992). Critical habitat has not been designated for this species.

Virginia spiraea is no longer known to occur in Alabama or Pennsylvania and several populations in the other states have been extirpated. The only documented cause of extirpation of *Spiraea virginiana* has been human activity (FWS 1992). These actions include the impoundment of streams, road construction activities, and development. The species' present distribution includes 31 populations in seven states. Most of these populations are protected and are stable (FWS 2003).

Populations of Virginia spiraea face several natural threats, in addition to human activities. The species exhibits poor capabilities for sexual reproduction, which complicates colonization of new sites by seed. As a consequence of mostly reproducing vegetatively, genetic diversity is low throughout its range and as few as 20 genotypes are known. Genetic fixation of the clonal material may have adverse effects on the breeding potential of the species in the future (FWS 1992). Invasive species such as Chinese privet (*Ligustrum sinense*), Japanese knotweed (*Polygonum cuspidatum*), Japanese meadowsweet (*Spiraea japonica*), and Multiflora rose (*Rosa multiflora*) could also be detrimental to populations of Virginia spiraea.

Virginia Spiraea References:

U.S. Fish and Wildlife Service. 1990. Endangered and threatened wildlife and plants; threatened status determined for *Spiraea virginiana* (Virginia spiraea). *Federal Register*, 55(116):24242-24246.

U.S. Fish and Wildlife Service. 1992. Virginia spiraea (*Spiraea virginiana* Britton) Recovery Plan. Newton Corner, Massachusetts, 47 pages.

U.S. Fish & Wildlife Service. 2003. Summary report to congress on the recovery program for threatened and endangered species, 1998 and 2000. U.S. Fish and Wildlife Service, Washington, DC, 35 pages.

Cyprogenia stegaria (Rafinesque)
Fanshell

The **Fanshell** (*Cyprogenia stegaria*) was listed as an endangered species in 1990 (FWS 1990). Originally, the fanshell occurred in the Ohio, Wabash, Cumberland, and Tennessee rivers and their larger tributaries; however, reproducing populations now occur only in the Clinch River, Tennessee and Virginia, and the Green and Licking rivers, in Kentucky (FWS 1991). Results from incidental collections indicate that non-reproducing populations or individuals persist in some suitable habitats within the former range, including Tygart's Creek in Kentucky, Cumberland and Tennessee rivers in Tennessee, Muskingum River in Ohio, Wabash River in Illinois and Indiana, East Fork White and Tippecanoe rivers in Indiana, and Kanawha River in West Virginia. The increasing infrequency of this species in survey results supports the conclusion that this species is declining in at least many parts of its present range (FWS 2003). Identified causes for the decline of the fanshell include the construction and operation of reservoirs and other impacts on water and substrate quality. No critical habitat has been designated for this species (FWS 1991).

Typical fanshell habitat is gravel or cobble substrate in medium to large rivers (FWS 1991). Potential fish hosts include tangerine darter (*Percina aurantiaca*), blotchside logperch (*Percina burtoni*), and greenside darter (*Etheostoma blennioides*) (Jones and Neves 2002).

Within the last 30 years, the fanshell has been found in scattered locations along the length of the Tennessee River and in the Clinch River. During this time period, this species has been encountered in all mainstem tailwaters (downstream from Kentucky, Pickwick, Wilson, Guntersville, and Watts Bar dams). Most of these occurrences are based on sightings of single individuals; however, several members of this species have been observed in the Pickwick Dam tailwater. In this evaluation, the fanshell is considered to occur in large and medium rivers.

Fanshell References:

Jones, J. W. and Neves, R. J. 2002. Life History and propagation of the endangered fanshell pearlymussel, *Cyprogenia stegaria* Rafinesque (Bivalvia: Unionidae). *Journal of the North American Benthological Society*, 21(1):76-88.

U.S. Fish and Wildlife Service. 1990. Endangered and threatened wildlife and plants; Designation of the freshwater mussel, the fanshell, as an endangered species. *Federal Register*, 55(120):25591-25595.

U.S. Fish and Wildlife Service. 1991. Fanshell (*Cyprogenia stegaria* (=*C. irrorata*)) Recovery Plan. U. S. Fish and Wildlife Service, Atlanta, Georgia, 37 pages.

U.S. Fish & Wildlife Service. 2003. Summary report to congress on the recovery program for threatened and endangered species, 1998 and 2000. U.S. Fish and Wildlife Service, Washington, DC, 35 pages.

Pleurobema plenum (Lea)

Rough Pigtoe

The **rough pigtoe** (*Pleurobema plenum*) was added to the list of endangered species in 1976 (FWS 1976). The original distribution of this species probably included the Ohio, Cumberland, and Tennessee rivers and their larger tributaries; however, records attributed to this species also have been reported from as far west as Kansas and Arkansas (Parmalee and Bogan 1998). Since the early 1970s, the rough pigtoe has been found alive in the Barren and Green rivers in Kentucky, and in the Clinch, Cumberland, and Tennessee rivers in Tennessee (FWS 1984). Critical habitat has not been identified for this species. The increasing scarcity of encounters with this species (at least in the Tennessee River system) supports the conclusion that it is declining (FWS 2003). The reasons for the decline of this species are not totally understood but, due to the longevity of most mussel species, they are especially vulnerable to stream perturbations such as impoundments, siltation, and pollution (FWS 1984).

The rough pigtoe typically is found in firmly packed sand and gravel. The fish host for this species has not been identified (Parmalee and Bogan 1998).

In recent years, the rough pigtoe has been encountered in the mainstem Tennessee River downstream from Pickwick, Wilson, Guntersville, and Watts Bar dams; and in Pickwick and Wheeler Reservoirs. Both of the reservoir records came from the upstream ends, very close to the identified extent of the adjacent flowing water areas. This species is considered to occur, typically, in large river habitats.

Rough Pigtoe References:

Parmalee, P. W. and A. E. Bogan. 1998. *The Freshwater Mussels of Tennessee*. University of Tennessee Press, Knoxville, Tennessee, 328 pages.

U.S. Fish and Wildlife Service. 1976. Endangered status for 159 taxa of animals. *Federal Register*, 41(115):24062-24067.

U.S. Fish and Wildlife Service. 1984. Recovery plan for the rough pigtoe pearly mussel (*Pleurobema plenum*). U.S. Fish and Wildlife Service, Atlanta, Georgia, 51 pages.

U.S. Fish & Wildlife Service. 2003. Summary report to congress on the recovery program for threatened and endangered species, 1998 and 2000. U.S. Fish and Wildlife Service, Washington, DC, 35 pages.

Lampsilis abrupta (Say)
Pink Mucket Pearlymussel

The **pink mucket** (*Lampsilis abrupta* = *L. orbiculata*) was added to the list of endangered species in 1976 (FWS 1976). This species once occurred in a variety of cobble, gravel, and other substrate types in medium to large rivers in the Ohio, Cumberland, Tennessee, and middle Mississippi River systems (Parmalee and Bogan 1998). In recent years, pink muckets have been found at locations scattered across the former range where suitable habitat still exists for a variety of riverine mussel species.

These locations extend from the Kanawha River, West Virginia; west to the Gasconade River, Missouri; south to the Black River, Arkansas; and east to the Tennessee and Cumberland River basins (FWS 1985). The most upstream site in the Tennessee River watershed where this species has been found recently is the Clinch River, in Claiborne County, Tennessee. As of 2000, the U.S. Fish and Wildlife Service considered this species to be declining (FWS 2003); however, continuing routine encounters of low numbers of this species suggest that most populations are relatively stable. The causes of the decline for this species are not totally understood but may be related to impoundments, siltation, and pollution (FWS 1985). Critical habitat has not been designated for this species.

Fish hosts for the pink mucket have been suggested to be the sauger, *Stizostedion* (= *Sander*] *canadense*, and freshwater drum, *Aplodinotus grunniens* (Fuller 1974). Those fishes, however, may be the hosts just for the closely-related Higgins' Eye, *Lampsilis higginsi* (Parmalee and Bogan 1998).

Within the last 30 years, the pink mucket has been encountered in nearly all tailwaters of the mainstem Tennessee River dams and in parts of Bear Creek and the Clinch, French Broad, and Holston rivers (FWS 1985, TVA Heritage database and contributing sources). The pink mucket is known from 8 mainstem tailwaters (downstream from Kentucky, Pickwick, Wilson, Guntersville, Nickajack, Chickamauga, Watts Bar, and Fort Loudoun dams), 4 tributary tailwaters (downstream from Bear Creek, Norris, Cherokee, and Douglas dams), and 2 mainstem reservoirs (Kentucky and Wheeler). Although always uncommon or rare, this species is encountered most often in the flowing mainstem areas downstream from Pickwick and Guntersville dams. Its continued presence in pooled mainstem reservoirs and in tributary dam tailwaters is often limited to sightings of single, often old, individuals. The pink mucket is considered to typically occur in large river habitats.

Pink Mucket References

Fuller, S. L. H. 1974. Clams and Mussels (Mollusca: Bivalvia). Chapter 8 (pages 215 – 273) *in* Hart, C. W. Jr., and Fuller, S. L. H. *Pollution Ecology of Freshwater Invertebrates*. Academic Press, New York and London,

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***Fusconaia cor* (= *Fusconaia edgariana*)** (Conrad)
Shiny Pigtoe Pearlymussel

The **shiny pigtoe pearlymussel** (*Fusconaia cor*) was added (as *F. edgariana*) to the list of endangered species in 1976 (FWS 1976). The historic distribution of this species was limited to the Tennessee River and its tributaries upstream from Muscle Shoals (FWS 1983, Parmalee and Bogan 1998). Since the early 1970s, the shiny pigtoe has been found alive in the Clinch, Elk, North Fork Holston, Paint Rock, and Powell rivers (FWS 1983, Ahlstedt 1995-1996). Most populations of this species (with the possible exception of the population in the Clinch River) appear to be declining (FWS 2003). The identified reasons for the decline of this species include impoundment, siltation, and pollution (FWS 1983, Neves 1991). No critical habitat has been designated for this species. In 2001, the U.S. Fish and Wildlife Service included the shiny pigtoe in a proposal to establish nonessential experimental populations of several native mollusk species in riverine habitat just downstream from Wilson Dam (FWS 2001); however, this species has not yet been reintroduced into that reach of the Tennessee River.

The shiny pigtoe typically is found in riffle and shoal areas of clear streams with a moderate to fast current (Parmalee and Bogan 1998). Potential fish hosts include the whitetail shiner (*Notropis galacturus* [=*Cyprinella galactura*]) and common shiner (*Notropis cornutus*) (Neves 1991).

The shiny pigtoe persists in the lower Elk River upstream to Fayetteville, and the Elk River between Fayetteville and Tims Ford Dam. The most upstream record of this species found in 1980 (at Elk River Mile 118) was approximately 15 river miles downstream from Tims Ford Dam (Ahlstedt 1986). The shiny pigtoe is considered to occur in small rivers and large creek habitats.

Shiny Pigtoe References:

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Parmalee, P. W. and A. E. Bogan. 1998. *The Freshwater Mussels of Tennessee*. University of Tennessee Press, Knoxville, Tennessee, 328 pages.

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Plethobasus cooperianus (Lea)
Orangefoot Pimpleback

The **orangefoot pimpleback** (*Plethobasus cooperianus*) was listed as an endangered species in 1976 (FWS 1976). The historic distribution of this species included parts of the Ohio, Cumberland, Kanawha, Tennessee, and Wabash rivers (FWS 1984). Since the early 1970s, the orangefoot pimpleback has been found in the lower Ohio River (Miller et al. 1986), in the middle reach of the Cumberland River (Parmalee et al. 1980) and in the tailwaters of Kentucky, Pickwick, Wilson, Guntersville, and Ft. Loudoun dams on the Tennessee River (FWS 1984, Parmalee and Bogan 1998, TVA 1999). Critical habitat has not been identified for this species. The increasing rarity of this species during surveys supports the conclusion that it is continuing to decline (FWS 2003). The reasons for its decline are not totally understood but, due to its longevity and sedentary nature, the orangefoot pimpleback would be especially vulnerable to stream perturbations such as impoundment, siltation, and pollution (FWS 1984).

The orange-foot pimpleback is a large-river, shoal species, typically found in sand and coarse gravel. No fish host for this species has been identified (Parmalee and Bogan 1998).

In recent years, the orange-foot pimpleback has been found downstream from the following mainstem reservoirs: Kentucky, Pickwick, Wilson, Guntersville, Watts Bar, and Ft. Loudoun. The records from most of these tailwaters are based on sightings of just a few individuals; however, this species has been encountered fairly often in the river downstream from Pickwick Dam (UFWS 1984, Jenkinson 1987, TVA unpublished data).

Orangefoot Pimpleback References:

Jenkinson, J. J. 1987. Freshwater mussel survey of areas potentially affected by a proposed channel widening project, Tennessee River Miles 203 - 206. Tennessee Valley Authority, Knoxville, Tennessee, 20 pages.

Miller, A. C., B. S. Payne, and T. Siemsen. 1986. Description of the habitat of the endangered mussel *Plethobasus cooperianus*. *Nautilus*, 100(1):14-18.

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Percina tanasi Etnier
Snail Darter

The **snail darter** (*Percina tanasi*), was listed as an endangered species in 1975 (FWS 1975) and subsequently reclassified as a threatened species, and critical habitat rescinded in 1984 (USFW 1984). Historically, snail darters probably occurred in the main channel of the Tennessee River and many of its tributaries from northeastern Alabama upstream to at least Knoxville, Tennessee. For a few years following its discovery, the only known natural snail darter population occurred in the lower fifteen miles of the Little Tennessee River and the adjacent part of the adjacent Tennessee River (Hickman and Fitz 1978, FWS 1984). This population disappeared after Tellico Dam was closed in 1979. Several hundred snail darters were moved from the Little Tennessee River into the lower Hiwassee River (Polk County, Tennessee) in 1975 and into the lower Holston River (Knox County, Tennessee) in 1978 (Hickman and Fitz 1978, FWS 1984, TVA Heritage database). In the early 1980s, snail darters were found in small numbers in four other Tennessee River tributaries and a section of the mainstem Tennessee River. Presently, the species is relatively abundant in the lower French Broad, Holston, and Little Rivers near Knoxville, and in the Hiwassee River. The species is less abundant in Sewee Creek, South Chickamauga Creek, Sequatchie River, and Paint Rock River. (TVA Heritage database records). As of 2000, the U.S. Fish and Wildlife Service considered the status of this species to be uncertain (FWS 2003). Recent survey information indicates that, overall, the snail darter appears to be increasing in distribution and population size.

Adult snail darters occur and reproduce in stream reaches with extensive areas of clean-swept, sand-gravel shoals (Starnes 1977, Hickman and Fitz 1978). After hatching, larvae apparently drift downstream into deeper areas for a time before returning to upstream shoals as adults. Some snail darters apparently are able to tolerate reservoir conditions and can disperse in enough numbers to established new populations in adjacent streams.

Snail Darter References:

Hickman, G. D., and R. B. Fitz. 1978. *A Report on the Ecology and Conservation of the Snail Darter (Percina tanasi Etnier)*. TVA Technical Note B28, Norris, Tennessee, 182 pages.

Starnes, W. C. 1977. *The Ecology and Life History of the Snail Darter, Percina (Imostoma) tanasi Etnier*. Tennessee Wildlife Resources Agency Fisheries Research Report 77-52.

U.S. Fish & Wildlife Service. 1975. Endangered and threatened wildlife and plants; Amendment listing the snail darter as an endangered species. *Federal Register*, 40:47505-47506.

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Cyprinella* (=*Hybopsis* and *Erimonax*) *monacha (Cope)
Spotfin Chub

The **spotfin chub** (*Erimonax* = *Cyprinella, monachus*), was listed as threatened in 1977 (FWS 1977a). Historically, the spotfin chub probably occurred throughout most of the Tennessee River system from southwestern Virginia, western North Carolina, and northern Georgia, downstream at least as far as the Duck River system. Presently, the species is only known from five widely disjunct populations in four tributary streams: the North Fork Holston River in Virginia and Tennessee, the Little Tennessee River in North Carolina (and reintroduced in Tennessee), the Emory River system in Tennessee, and the Buffalo River system in Tennessee (Jenkins and Burkhead 1984). The spotfin chub has been encountered in the Holston River downstream from the confluence of the North Fork Holston and Middle Fork Holston Rivers; however, the infrequency of sightings of spotfin chubs in that river reach suggests that a persistent, reproducing population does not exist in the mainstem Holston River (Charlie Saylor, TVA, personal communication). The recent discovery of a single individual in a tributary to Watts Bar Reservoir on the Clinch River indicates that an additional, as yet unknown, population could exist somewhere in the lower part of the Clinch River system (Mike Ryon, Oak Ridge National Laboratory, personal communication with Peggy Shute in 2002). As of 2000, the U.S. Fish and Wildlife Service considered the status of this species to be uncertain (FWS

2003); however, recent field work suggests the species is probably increasing (Pat Rakes, Conservation Fisheries, Inc., personal communication with Peggy Shute in 2002). Designated critical habitat for this species includes parts of the Little Tennessee River upstream of Fontana Reservoir, parts of the Emory River and its tributaries upstream from Watts Bar Reservoir, and parts of the North Fork Holston River in Tennessee and Virginia (FWS 1977b). A reach of the Tellico River (in Monroe County, Tennessee) has been designated as Nonessential Experimental Population (FWS 2002), and an attempt at establishing a reintroduced population of spotfin chubs into this reach has begun (Pat Rakes, Conservation Fisheries, Inc., personal communication with Peggy Shute 2002). Also, a reach of Shoal Creek (direct tributary to the Tennessee River, Wilson Reservoir, and Lauderdale County, AL) has been designated as a Nonessential Experimental Population (FWS 2005).

Spotfin chubs are found in medium to large, clear streams with considerable current over bedrock and boulders. Young are found over gravel substrates (FWS 1983, Jenkins & Burkhead 1984). Recent collection records (TVA Heritage database) indicate that seasonal (fall) migration into very small tributaries may occur. Spotfin chub populations in the Little Tennessee River system (upstream of Fontana Reservoir) and in the Emory system are apparently stable (TVA Heritage database). Those in the North Fork Holston and Buffalo systems have apparently expanded their ranges, as indicated by recent observations (TVA Heritage database). Spotfin chubs have been reintroduced in Abrams Creek, Great Smoky Mountains National Park (Shute et al. 2005).

Spotfin Chub References:

Jenkins, R. E., and N. M. Burkhead. 1984. Description, biology and distribution of the spotfin chub, *Hybopsis monacha*, a threatened cyprinid fish of the Tennessee River drainage. *Bulletin of the Alabama Museum of Natural History*, 8:1-30.

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Myotis grisescens (Howell)
Gray Bat

The **gray bat** (*Myotis grisescens*) was listed as an endangered species in 1976 (FWS 1976). Although gray bats occur throughout much of the Midwest and southern United States, their populations are found mainly in Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee (FWS 1982). Gray bats are known from suitable caves throughout the Tennessee River Valley. Populations of gray bats have increased throughout portions of their range and the status of this species is considered to be improving (FWS 2003). Critical habitat has not been designated for this species.

Gray bats are year-round residents of limestone caves or cave-like habitats. Most individuals migrate seasonally between hibernating and maternity caves. They generally enter hibernation by early November, and emerge in March and April (FWS 1982). Fewer than five percent of available caves offer suitable habitat for this species. Gray bats form large colonies than can contain up to several hundred thousand individuals. They are therefore particularly vulnerable to habitat disturbances; human intrusions into caves used by maternity colonies or used as hibernacula are thought to be primarily responsible for their decline. Pesticide poisoning, reduction of insect prey, and flooding of caves due to either natural causes or impoundment have also threatened the species (FWS 1982). In an effort to protect and recover gray bat populations, the U.S. Fish and Wildlife Services has delegated TVA the tasks of protecting Nickajack, Hambrick's, Featherfoot, Norris Dam, and Key Caves, as these caves harbor significant numbers of gray bats. TVA has installed barriers at these cave entrances to prevent human disturbance, and surveys these sites annually to gather long-term data to help monitor and protect this endangered species.

Gray bats feed along reservoirs, rivers, and associated riparian habitats. They consume large numbers of flying insects over aquatic habitats (Henry 1998). During a 4-year study to determine feeding preferences of gray bats on Guntersville Reservoir, gray bats were recorded foraging over and adjacent to aquatic weed beds more than any other habitat type investigated (Henry 1998).

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Henry, T. H. 1998. Variation in use of habitats by the gray bat (*Myotis grisescens*) in northern Alabama. M.S. Thesis, Auburn University, Auburn, Alabama, 113 pages.

U.S. Fish and Wildlife Service. Gray Bat Species Account. Available: http://endangered.fws.gov/i/a/saa4l.html (Site accessed: September 30, 2002).

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