Document Type: EIS-Administrative Record
Index Field: FINAL Environmental Document
Project Name: PMF Dam Safety Modifications
Project Number: 2009-69

DAM SAFETY MODIFICATIONS AT CHEROKEE, FORT LOUDOUN, TELLICO, AND WATTS BAR DAMS FINAL ENVIRONMENTAL IMPACT STATEMENT

Grainger, Jefferson, Loudoun, Rhea, and Meigs Counties, Tennessee

Prepared by:
TENNESSEE VALLEY AUTHORITY
Knoxville, Tennessee

May 2013

COVER SHEET

Final Environmental Impact Statement for Dam Safety Modifications at Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams

Proposed Action: To minimize the potential effects of the Probable Maximum Flood (PMF) event determined based on revised modeling, the Tennessee Valley Authority (TVA) implemented temporary precautionary measures at four (Cherokee, Fort Loudoun, Tellico, and Watts Bar) dams. TVA has now developed permanent solutions for the temporary measures that were put in place to correct safety deficiencies identified at these dams. The purpose and need for the Proposed Action is to 1) prevent the potential impacts associated with a possible dam failure due to overtopping, and 2) prevent an increase in downstream flood elevations.

Type of document: Final Environmental Impact Statement

Lead agency: Tennessee Valley Authority

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Abstract:

The TVA has prepared an Environmental Impact Statement (EIS) for permanent dam safety modifications at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams in Tennessee. In 2009, TVA implemented precautionary measures and installed crushed stone-filled HESCO barriers at all four dams and strengthened the downstream embankment of Watts Bar Dam in order to minimize the potential effects of the PMF event determined from revised flood models. The HESCO barriers were installed as a temporary measure and TVA proposes to replace them with permanent modifications. Therefore, this EIS documents the analysis of a No Action Alternative (HESCO barriers remain in place), and two Action Alternatives (HESCO barriers removed and replaced by permanent flood protection structures).

Under the No Action Alternative (Alternative A), TVA would continue to use HESCO barriers to minimize the potential for failure of the four dams and prevent an increase in flooding at downstream locations, including TVA's nuclear plants during the PMF. Under the first of two Action Alternatives (Alternative B), TVA would remove the HESCO barriers and install permanent dam modifications in the form of a combination of concrete floodwalls and raised earthen embankments. Under the second Action Alternative (Alternative C), TVA would remove

the HESCO barriers and install permanent dam modifications consisting entirely of concrete floodwalls and gap closure barriers (no embankments or berms).

TVA completed scoping for the EIS, including a 55-day comment period, two open house meetings to collect public comments (in July and September 2011), and a request for input from Federal and state agencies, local organizations, and federally recognized Indian tribes. The Notice of Availability (NOA) for the draft EIS was published on September 28, 2012, initiating a 52-day public comment period.

Under the Preferred Alternative (Alternative B), construction of permanent modifications at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams would result in short-term, minor, adverse impacts to Geology and Soils, Air Quality and Greenhouse Gas Emissions, Water Resources, Terrestrial Ecology (vegetation and wildlife), Recreation, Solid and Hazardous Waste, and Public Safety. Potential short-term, significant impacts to Noise and Transportation could result from implementation of Alternative B. This alternative would also result in short- and long-term impacts, both minor and significant, to Visual Resources at specific dam segments. Flooding and Floodplains and Socioeconomic Resources would be expected to experience beneficial, long-term impacts from the potential reduction in downstream flood risk. There would be no effects on wetlands or threatened and endangered species, and no adverse effects on historic properties.

SUMMARY

Purpose and Need for Action

The Tennessee Valley Authority (TVA) has prepared this Final Environmental Impact Statement (EIS) for Dam Safety Modifications to Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams in order to evaluate the proposed permanent solutions for the temporary measures, which were put in place to correct safety deficiencies previously identified at these four structures.

The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in a particular drainage area. To minimize the potential effects of the PMF event determined based on revised flood modeling, temporary measures were implemented in 2009 at four dams (Cherokee, Fort Loudoun, Tellico, and Watts Bar) in Grainger, Jefferson, Loudoun, Rhea, and Meigs Counties, Tennessee. These measures consisted of raising dam elevations approximately 3 to 8 feet by installing interconnected, fabric-lined, crushed stone-filled HESCO barriers in order to safely pass the simulated worst-case floodwaters, to avoid dam overtopping and possible impacts to the embankments, and to provide additional floodwater storage capacity. The downstream embankment of Watts Bar Dam was also strengthened using concrete matting.

The purpose and need of the permanent modification Proposed Action is to (1) minimize the potential for the failure from overtopping of Cherokee, Fort Loudoun, Tellico, and Watts Bar dams during the PMF; and (2) prevent an increase in flooding during the PMF at downstream locations including Watts Bar, Sequoyah, and Browns Ferry Nuclear Plants.

Alternatives

TVA has developed alternatives for minimizing the potential for the failure of Cherokee, Fort Loudoun, Tellico, and Watts Bar dams during the PMF, and for prevention of increased flooding at downstream locations during the PMF. Development of these alternatives took into consideration the level of risk reduction to the public, constructability, potential environmental impacts, and cost. TVA has performed preliminary internal scoping and identified a No Action Alternative and two Action Alternatives: (1) Permanent Modifications to Dam Structures: Combination of Concrete Floodwalls and Earthen Embankments, and (2) Permanent Modifications to Dam Structures: All Concrete Floodwalls.

Alternative A: No Action Alternative

Alternative B: Permanent Modifications of Dam Structures:
Combination of Concrete Floodwalls and Earthen Embankments

Alternative C: Permanent Modifications of Dam Structures:
All Concrete Floodwalls

Under both Alternatives B and C, the permanent modification features would vary in height from 3.5 feet to 6.6 feet depending on the location.

Affected Environment and Environmental Consequences

The baseline conditions of 17 specific resource areas and the environmental consequences of the alternatives on these resource areas are evaluated. The specific resource areas were chosen to reflect:

- Operating objectives of the TVA flood protection system (e.g., flood control and public safety);
- Issues raised during the scoping and public comment processes; and,
- Typical National Environmental Policy Act (NEPA) review topics (e.g., Solid and Hazardous Waste).

The Affected Environment discussion for each resource area identifies the issues of concern used to measure potential impacts on the resource, the study area (or boundaries) for the analysis, the regulatory programs and TVA management activities that govern the resource area, and the existing conditions and future trends for the resource area. Resources evaluated include: Geology and Soils, Water Resources, Air Quality and Greenhouse Gas Emissions, Flooding and Floodplains, Wetlands, Aquatic Ecology, Terrestrial Ecology, Threatened and Endangered Species, Land Use, Socioeconomics and Environmental Justice, Cultural and Historic Resources, Noise, Transportation, Visual Resources, Recreation, Solid and Hazardous Waste, and Public Safety.

The Environmental Consequences of the alternatives are also discussed for the same 17 individual resource areas with borrow/staging areas, parking lots, roadway alterations, and gap closure barriers considered as appropriate. The Environmental Consequences discussions describe the potential impacts of the proposed permanent dam safety modifications on each of the affected environment resource areas.

A comparison of the impacts of the alternatives is provided in Table ES-1 below. Although the No Action Alternative would result in fewer impacts than Alternative B, it is not an adequate long-term solution for addressing the purpose and need of this project.

Alternatives B and C, the action alternatives, consist of construction of permanent modifications to the dams along similar alignments and to similar heights, and therefore, are generally comparable in nature. Differences in the potential impacts associated with Alternative B versus Alternative C would be negligible for the following resource areas: Geology and Soils, Water Resources, Wetlands, Flooding and Floodplains, Aquatic Ecology, Threatened and Endangered Species, Land Use, Socioeconomics and Environmental Justice, Cultural Resources, Solid and Hazardous Waste, and Public Safety.

Alternative C would result in fewer short-term impacts to Air Quality, given that without the construction of earthen berms, there would be less particulate matter with the potential to mobilize than compared to Alternative B. Because the construction of earthen embankments typically requires a slightly lengthier construction period, the potential construction-related, temporary impacts to Noise and Visual Resources would be slightly less under Alternative C than Alternative B. Both alternatives would require road closures during construction at Cherokee, Watts Bar and Fort Loudoun dams. However, overall Alternative B would result in fewer visual impacts at Cherokee, Tellico, and Watts Bar dams than would Alternative C. Construction cost evaluations indicate that Alternative C would be slightly more costly compared to Alternative B, given that floodwalls are somewhat more expensive to construct than earthen embankments .

Table ES-1.
Summary and Comparison of Alternatives by Resource Area

Resource Area	Impacts from the No Action Alternative A	Impacts from Action Alternative B	Impacts from Action Alternative C
Geology and Soils	No direct, indirect or cumulative impacts anticipated	Minor, temporary negative impacts at the dam sites during construction. Ongoing existing and new negative impacts to soils at the borrow areas.	Minor, temporary negative impacts at the dam sites during construction.
Water Resources	No direct, indirect or cumulative impacts anticipated	No direct, indirect or cumulative impacts anticipated, with the use of appropriate BMPs.	No direct, indirect or cumulative impacts anticipated, with the use of appropriate BMPs.
Air Quality and Greenhouse Gas Emissions	No direct, indirect or cumulative impacts anticipated	Minor temporary negative impacts during construction, with use of BMPs.	Minor temporary negative impacts during construction, with use of BMPs.
Flooding and Floodplains	No direct, indirect or cumulative impacts anticipated	No direct impacts. Positive indirect impacts due to downstream flood risk reduction.	No direct impacts. Positive indirect impacts due to downstream flood risk reduction.
Wetlands	No direct, indirect or cumulative impacts anticipated	No direct, indirect or cumulative impacts anticipated.	No direct, indirect or cumulative impacts anticipated.
Aquatic Ecology	No direct, indirect or cumulative impacts anticipated	No direct, indirect or cumulative impacts anticipated, with use of BMPs.	No direct, indirect or cumulative impacts anticipated, with use of BMPs.
Terrestrial Ecology	No direct, indirect or cumulative impacts anticipated	Minor direct negative impacts to vegetation (tree clearing), as well as to marginal, already disturbed areas on the dam reservations. Minor temporary indirect impacts to wildlife due to noise and run-off during construction. Minor permanent indirect impacts to wildlife (habitat loss) due to clearing. Minor negative impacts at the borrow areas.	Minor direct negative impacts to marginal, already disturbed areas on the dam reservations. Minor temporary indirect impacts to wildlife due to noise and run-off during construction.
Threatened and Endangered Species	No direct, indirect or cumulative impacts anticipated	Potential indirect impacts to Indiana bats due to the clearing of forested areas containing suitable habitat. TVA would mitigate these impacts. No direct, indirect, or cumulative impacts to any other listed species.	No direct, indirect or cumulative impacts anticipated to listed species.

Table ES-1.
Summary and Comparison of Alternatives by Resource Area

Resource Area	Impacts from the No Action Alternative A	Impacts from Action Alternative B	Impacts from Action Alternative C
Land Use	No direct, indirect or cumulative impacts anticipated.	No direct, indirect or cumulative impacts anticipated as all construction would occur on the dam reservations.	No direct, indirect or cumulative impacts anticipated as all construction would occur on the dam reservations.
Socioeconomics and Environmental Justice	No direct impacts. Indirect negative impacts downstream due to increased flooding risk.	Short term beneficial impacts from construction, minor long term beneficial impacts to employment and minor indirect beneficial impacts due to reduced flood risk.	Short term beneficial impacts from construction, minor long term beneficial impacts to employment and minor indirect beneficial impacts due to reduced flood risk.
Cultural and Historic Resources	No direct, indirect or cumulative impacts anticipated	No direct, indirect or cumulative impacts to archeological or historic resources anticipated.	No direct, indirect or cumulative impacts to archeological or historic resources anticipated.
Noise	No direct, indirect or cumulative impacts anticipated	Temporary negative impacts ranging from minor to significant depending on the segment.	Short-term, minor, adverse impacts; fewer noise impacts compared to Alternative B due to the need for less construction equipment.
Transportation	Temporary minor to significant direct negative impacts during maintenance, depending on the segment.	Temporary minor to significant direct negative impacts during construction, depending on the segment. Possible cumulative impacts at Fort Loudoun and Tellico during construction.	Temporary minor to significant direct negative impacts during construction, depending on the segment. Possible cumulative impacts at Fort Loudoun and Tellico during construction.
Visual Resources	Continuing negative impacts	Negative direct impacts ranging from minor to significant, depending on the dam segment.	Negative direct impacts ranging from moderate to significant, depending on the dam segment. Somewhat greater impacts to visual resources than Alternative B since floodwalls do not blend into the natural surroundings as well as earthen embankments.
Recreation	Continuing negative impacts	Temporary negative impacts during construction ranging from minor to significant due to short-term closure of recreation access at Cherokee, Tellico, and Watts Bar.	Minor temporary negative impacts during construction.

Table ES-1.
Summary and Comparison of Alternatives by Resource Area

Resource Area	Impacts from the No Action Alternative A	Impacts from Action Alternative B	Impacts from Action Alternative C
Solid and Hazardous Waste	No direct, indirect or cumulative impacts anticipated	Minor temporary increases during construction.	Moderate temporary increases during construction.
Public Safety	No direct, indirect or cumulative impacts anticipated	Minor temporary negative impacts during construction. Minor indirect positive impacts due to flood risk reduction.	Minor temporary negative impacts during construction. Minor indirect positive impacts due to flood risk reduction.

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AADT	Average Annual Daily Traffic
ADA	Americans with Disabilities Act
APE	area of potential effect
ARPA	Archaeological Resources Protection Act of 1979
BEA	Bureau of Economic Analysis
BG	block group
BGEPA	Bald and Golden Eagle Protection Act
BLN	Bellefonte Nuclear Plant
BMPs	best management practices
CAA	Clean Air Act of 1963
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response and Liability Act
CFR	Code of Federal Regulations
CT	census tract
CWA	Clean Water Act
dB	decibel
dBA	A-weighted decibel
DNL	day-night average sound level
DO	dissolved oxygen
DOT	U.S. Department of Transportation
EA	Environmental Assessment
EAP	Emergency Action Plans
EIS	Environmental Impact Statement
EO	Executive Order
EPCRA	Emergency Planning and Community Right-to-Know Act
EPSC	Erosion Prevention and Sediment Control
ESA	Endangered Species Act
ETSC	endangered, threatened, or of state concern
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FR	Federal Register
FRP	Flood Risk Profile
GHG	greenhouse gas
gpm	gallons per minute
HMTA	Hazardous Material Transportation Act
HUC	hydraulic unit
IBI	Index of Biological Integrity
KOP	key observation point
$\mu g/m^3$	micrograms per cubic meter air
MBTA	Migratory Bird Treaty Act
mgd	million gallons per day
mg/L	milligrams per liter
msl	mean sea level
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Agency
NGVD	National Geodetic Vertical Datum

List of Acronyms (continued)

NHPA	National Historic Preservation Act of 1966
No.	number
NOA	Notice of Availability
NOI	Notice of Intent
NRC	U.S. Nuclear Regulatory Commission
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
OSHA	Occupational Safety and Health Administration
PCBs	polychlorinated biphenyls
P.L.	Public Law
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PM_{10}	particulate matter less than 10 microns in diameter
PMF	Probable Maximum Flood
ppm	parts per million
ppb	parts per billion
RCRA	Resource Conservation and Recovery Act
RFAI	Reservoir Fish Assembly Index
RLMP	Reservoir Land Management Plan
ROD	Record of Decision
ROS	Reservoir Operations Study
ROW	right-of-way
RRI	Reservoir Releases Improvement
SARA	Superfund Amendments and Reauthorization Act
SFI	Sports Fishing Index
SHPO	State Historic Preservation Officer
SMI	Shoreline Management Initiative
SMP	Shoreline Management Policy
SPCC	Spill Prevention Control and Countermeasures Plans
TDEC	Tennessee Department of Environment and Conservation
TDOA	Tennessee Division of Archaeology
TDOT	Tennessee Department of Transportation
TSCA	Toxic Substances Control Act
TSDC	Tennessee State Data Center
TVA	Tennessee Valley Authority
TWRA	Tennessee Wildlife Resources Agency
U.S.	United States
USACE	U.S. Army Corps of Engineers
U.S.C.	U.S. Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
VSMP	Vital Signs Monitoring Program
WRC	U.S. Water Resources Council
yds^3	cubic yards

CHAPTER 1 – PURPOSE AND NEED FOR ACTION

The Tennessee Valley Authority (TVA) was established by an act of Congress in 1933. As stated in the TVA Act, TVA is to “improve the navigability and to provide for the flood control of the Tennessee River; to provide for reforestation and the proper use of marginal lands in the Tennessee Valley; to provide for agricultural and industrial development of said valley; [and] to provide for the national defense....” A fundamental part of this mission was the construction and operation of an integrated system of dams and reservoirs. As directed by the TVA Act, TVA uses this system to manage the water resources of the Tennessee River for the purposes of navigation, flood control, power production, and, consistent with these purposes, a wide range of other public benefits.

Pursuant to the National Environmental Policy Act of 1969 (NEPA) and the Act’s implementing regulations promulgated by the Council on Environmental Quality (CEQ; 40 Code of Federal Regulations [CFR] 1500-1508), federal agencies are required to evaluate the potential environmental impacts of any proposals for major federal actions. This environmental impact statement (EIS) was prepared to assess the potential consequences of the TVA’s Proposed Action on the environment and human health in accordance with NEPA and the TVA’s procedures for implementing NEPA (TVA 1983).

As the Federal agency responsible for the operation of numerous dams, and consistent with the Federal Guidelines for Dam Safety (Federal Emergency Management Agency [FEMA] 2004), TVA prepares for the worst case flooding event in order to protect against dam failure, loss of life, major property damage and impacts to critical facilities. This worst case flooding event is known as the Probable Maximum Flood (PMF), defined as the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in a particular drainage area. United States (U.S.) Nuclear Regulatory Commission (NRC) nuclear plant operating regulations also require that nuclear plants be protected against the adverse effects of the PMF. TVA periodically reviews and revises its calculations of PMF elevations. During the most recent review (completed in 2008), TVA determined that the updated PMF elevations at Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams (Figure 1-1), as well as at TVA’s Watts Bar and Sequoyah Nuclear Plants, were higher than previously calculated.

The differences in PMF elevations are sufficient to indicate that a PMF event could cause water to flow over the top of the four dams, even with the floodgates wide open, possibly resulting in dam failure. Failure of one or more of these dams would result in extensive damage to buildings, infrastructure, property, and natural resources, as well as potential personal injury and loss of life.

In 2009, TVA implemented temporary measures at the dams to remain consistent with Federal guidelines and comply with nuclear operating regulations for safe operations of the river and reservoir system, and to minimize the potential effects of the PMF. These temporary measures consisted of raising the heights of the four dams by installing approximately 6,900 interconnected, fabric-lined HESCO Concertainer® units (herein referred to as “HESCO barriers”) filled with number (No.) 10 crushed stone on top of the earthen embankments of each dam. The alignments of the temporary modifications at all four dams are shown in Figures 1-2 through 1-5. These HESCO barriers raised the elevation of each dam by 3 to 8 feet and provided additional floodwater storage capacity. The length of HESCO barrier floodwalls totaled approximately 19,100 feet (7,000 feet at Cherokee; 4,500 feet at Fort Loudoun; 6,000 feet at

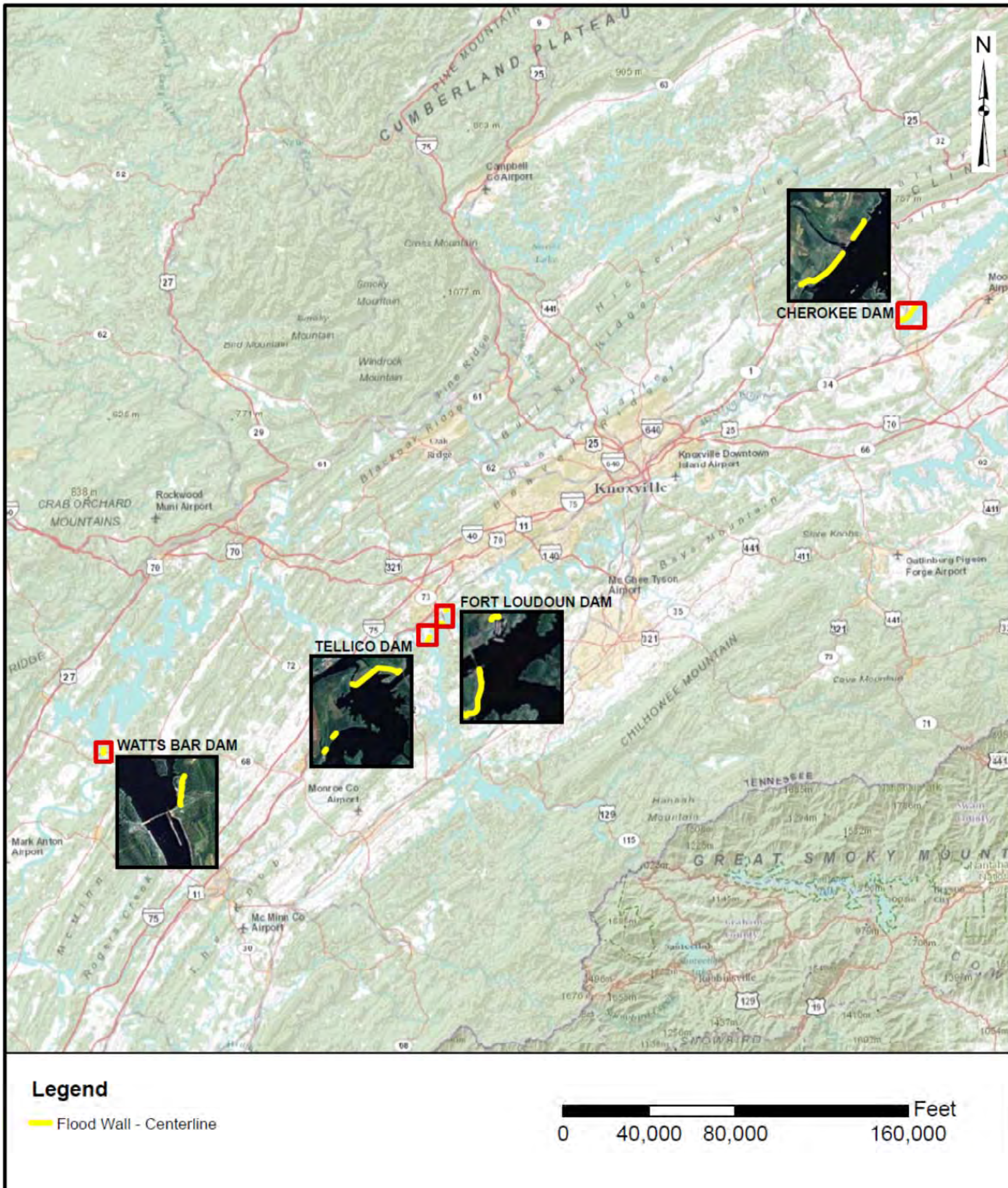
Tellico; and 1,600 feet at Watts Bar). TVA also installed a permanent concrete apron (ArmorFlex concrete mats) on approximately 2 acres of the downstream earthen embankment of Watts Bar Dam, just east of the Lock Operations Building (see Photo 53 in Appendix A). These temporary and permanent measures are described and depicted in detail in Section 2.1.1.

In a January 25, 2012 letter from NRC to TVA (NRC 2012), NRC outlined the need for replacement of the temporary HESCO barriers:

> *Based on our review of the licensee's documents (ADAMS Accession Nos. ML 110831047, ML 11112A137, ML 11145A163, and ML 111540463), the NRC staff finds that the sand baskets are not capable of resisting debris impact. These documents neither discuss the ability of sand baskets to withstand debris impact, or mention whether the baskets are designed for impact of debris loads. The NRC staff is unable to conclude that these sand baskets were designed to withstand impacts from large debris during a flood. If a design flood were to occur, there is a high likelihood that significant debris would accompany the flood waters which could impact the baskets. There is the potential for this debris to damage the baskets or push the individual baskets apart causing a breach. There would be no time to repair the baskets because the flood would already be in progress. Therefore, sand baskets that are not designed and constructed to withstand impacts from large debris are not acceptable as a long-term solution.*

TVA has therefore made the commitment to NRC to develop and implement permanent dam safety modifications to replace the temporary measures at the four dams.

The purpose and need of the Proposed Action is to (1) minimize the potential for the failure of Cherokee, Fort Loudoun, Tellico, and Watts Bar dams during the PMF; and (2) prevent an increase in flooding during the PMF at downstream locations including Watts Bar, Sequoyah, and Browns Ferry Nuclear Plants.



AECOM

Figure 1-1
Site Location Map

Tennessee Valley Authority

Legend

HESCO Barrier Alignment

TVA Owned Land

N

Feet
0 500 1,000 2,000

Source: Aerial is provided by ArcMap World Imagery 2012

AECOM

Figure 1-2
Cherokee Dam
HESCO Barrier Alignment

Tennessee Valley Authority

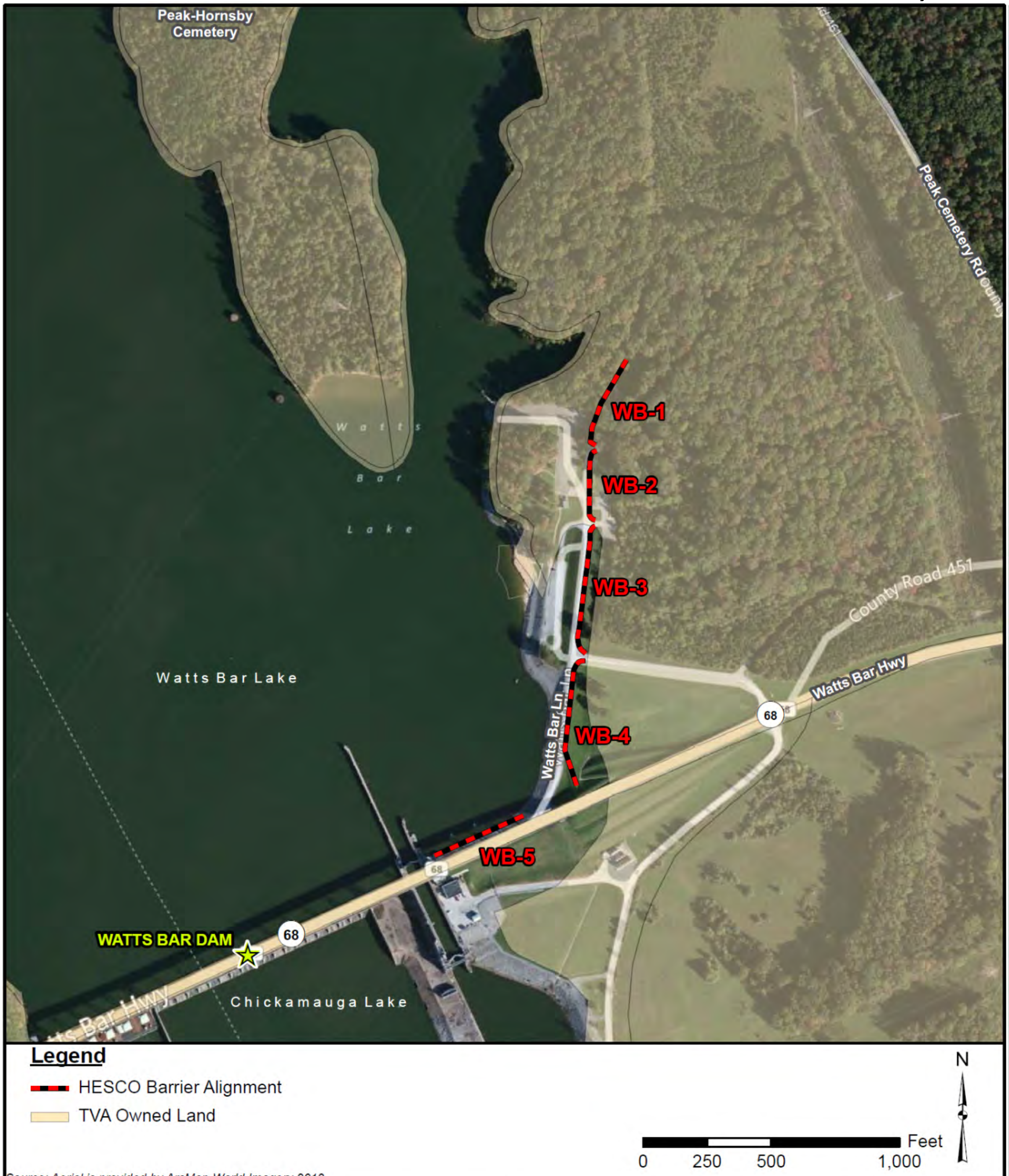
Source: Aerial is provided by ArcMap World Imagery 2012

AECOM

Figure 1-3
Fort Loudoun Dam
HESCO Barrier Alignment
Tennessee Valley Authority

Figure 1-4
Tellico Dam
HESCO Barrier Alignment

Tennessee Valley Authority



Source: Aerial is provided by ArcMap World Imagery 2012

AECOM

Figure 1-5
Watts Bar Dam
HESCO Barrier Alignment

Tennessee Valley Authority

1.1. Background

TVA has long had established design basis flood levels for its dams and nuclear plants based on detailed hydrologic and hydraulic simulations and analyses. Much of this work was completed in the period between the late 1970s and early 1990s. As part of TVA efforts to obtain a construction and operating license for the proposed Bellefonte Nuclear Plant (BLN) in North Alabama, in early 2008 NRC conducted a quality assurance audit of the design basis flood calculations for Bellefonte that had been completed approximately 30 years earlier. The audit produced several findings, most related to TVA's inability to readily produce supporting materials for the NRC review. As a result, TVA decided to reestablish the BLN design basis flood level by performing new hydrologic and hydraulic analyses. Following the completion of the new Bellefonte hydrology study, TVA decided to reestablish design basis flood levels for all of its dams.

TVA has historically used the PMF as the design basis flood event, both for planned and operating nuclear plants and for all dams, which are classified (based on the potential for property damage and loss of life) as high hazard. Estimation of the PMF is based on a deterministic approach, which uses a series of empirical and physically based relationships to predict the response of a watershed to extreme storm rainfall. Model predictions based on a deterministic approach will always provide the same answer as long as the set of model inputs does not change. The PMF is an extremely rare event of unknown probability.

An alternative, probabilistic modeling approach could be used for estimating the frequency of occurrence of PMF elevations. In recent years, advancements have been made in hydrologic analysis based on a probabilistic approach. In such an approach, many thousands of possible events are simulated; each simulation is based on estimates of a series of model inputs which are drawn from underlying statistical distributions, and represents a possible outcome of a given hydrologic event. By simulating a very large number of events, some of those events will occur at the extreme ends of possible distributions, and can be used to make inferences about the likelihood or probability of the occurrence of an event of a given magnitude. The primary drawbacks to such an approach include limitations of computational resources and the amount of uncertainty in the underlying statistical distributions for model input parameters, particularly for values well beyond those that have been observed within the historic record.

While the probabilistic approach shows promise, the deterministic approach is currently used for nuclear power plant sites in the U.S. (NRC 2011). The Federal Guidelines for Dam Safety (FEMA 2004) state that "When flooding could cause significant hazards to life or major property damage, the flood selected for design should have virtually no chance of being exceeded." TVA has historically used the PMF as the design basis for its high hazard dams, and has judged such an approach to be fully consistent with the intent of the Federal Guidelines. For these reasons, TVA has used a deterministic approach to estimate the PMF at the locations of interest in this study.

The updated PMF elevations at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams, as well as at TVA's Watts Bar and Sequoyah Nuclear Plants, were higher than previously calculated. These differences are due to changes in river operating assumptions, higher initial reservoir levels under the current reservoir operating policy (TVA 2004), and revised data from a reanalysis of spillway water flow rates. The previous and revised PMF elevations are as follows:

**Table 1-1.
Previous and Revised PMF Elevations**

Facility	Previous PMF elevation* (feet)	Revised PMF elevation (feet)	Difference (feet)
Cherokee Dam	1089.4	1093.6	+4.2
Fort Loudoun Dam	833.5	834	+0.5
Tellico Dam	828.6	832.9	+4.3
Watts Bar Dam	766.1	767.4	+1.3
Watts Bar Nuclear Plant	734.9	739.2	+4.3
Sequoyah Nuclear Plant	719.6	722.0	+2.4
Browns Ferry Nuclear Plant	572.5**	571.7	-0.8

* All elevations are feet above mean sea level, based on the National Geodetic Vertical Datum of 1929.
**Although higher than the revised PMF elevation, the 572.5 elevation continues to be used as the NRC licensing basis PMF value for Browns Ferry.

1.2. Description of the Dams and Reservoirs

Cherokee Dam

Cherokee Dam is on the Holston River at mile 52.3 in Grainger and Jefferson Counties, Tennessee. Construction of Cherokee Dam began in August 1940; it was completed on a greatly accelerated schedule in December 1941 and the first commercial power was generated in April 1942. The hydroelectric plant has four generating units with a total net capacity of 148 megawatts. Cherokee Reservoir extends upstream about 54 miles and has about 400 miles of shoreline and 28,780 acres of water surface at the June 1 Flood Guide. The flood storage capacity is 749,400 acre-feet. The typical June 1 Flood Guide elevation is 1,071 feet and the typical January 1 Flood Guide elevation is 1,045 feet. Much of the inflow to Cherokee Reservoir is regulated by upstream dams.

The dam is 175 feet high and 6,760 feet long. The dam consists of a 2,150-foot long north earthen embankment, a central 1,697-foot-long concrete portion containing the spillway and penstock intakes, and a 2,913-foot-long south earthen embankment. Three separate earth-fill saddle dams, totaling 1,770 feet in length, are located to the south of the main dam.

TVA previously completed a PMF-related modification of the dam in 1985. This modification consisted of the construction of a 7.5-foot-high concrete wall on portions of the central concrete portion of the dam.

Fort Loudoun Dam

Fort Loudoun Dam is located in Loudon County, Tennessee at Tennessee River mile 602.3. It forms Fort Loudoun Reservoir which extends upstream past Knoxville to a short distance upstream of the junction of the French Broad and Holston Rivers. Fort Loudoun is the uppermost of the nine TVA reservoirs located on the Tennessee River. Construction of Fort Loudoun Dam began in 1940 and was completed in 1943. The hydroelectric plant consists of four generating units with a total net capacity of 162 megawatts. A 60- by 360-foot lock raises and lowers boats about 70 feet between Fort Loudoun and Watts Bar Reservoirs. Fort Loudoun Reservoir has 379 miles of shoreline and 14,600 acres of water surface at the June 1 Flood Guide elevation. The June 1 Flood Guide elevation is 813 feet and the January 1 Flood Guide elevation is 807 feet. The reservoir has a flood storage capacity of 111,000 acre-feet. It is connected by a short canal to Tellico Reservoir and during normal operations water is diverted through the canal to pass through the Fort Loudoun hydroelectric plant. Cherokee Dam and Douglas Dam, on the French Broad River, regulate much of the inflow to Fort Loudoun.

Fort Loudoun Dam is 122 feet high and 4,190 feet long. The 1,550-foot-long concrete portion of the dam, containing the spillway, lock and penstock intakes, is located on the north side against a rock bluff. The remainder of the dam to the south is an earthen embankment faced with rock. A separate earth-fill saddle dam about 550-feet-long spans a low area near Fort Loudon Marina, about 3/4 mile northeast of the main dam. State Route 95/73/U.S. Highway 321 was built on piers across the dam in 1960-1961. The Tennessee Department of Transportation (TDOT) is reconstructing the highway on a new alignment with a new bridge crossing the Tennessee River downstream of the dam. As part of this project, the current Carmichael Greer Bridge will be removed from the dam.

In 1986, TVA prepared a combined Dam Safety Analysis Report for Fort Loudoun and Tellico dams to evaluate alternatives for new modifications to enable the dams to safely pass the PMF event (TVA 1986a). Due to their close proximity and interconnected drainage area, Fort Loudoun and Tellico were handled as a single, integrated project. Several alternatives were considered in the 1986 analysis: (1) raising the tops of the embankments, (2) increasing the spillway capacity, and (3) a combination of these actions (TVA 1986a). The preferred alternative, selected primarily because of cost differences, was raising the Fort Loudoun embankments and increasing the spillway capacity at Tellico. TVA completed the modifications to Fort Loudoun in 1989. They included the construction of a 3.25-foot-tall concrete barrier wall atop the south embankment adjacent to the navigation lock and a 2.67-foot-tall concrete barrier wall atop the saddle dam near Fort Loudon Marina. Concrete and rock armoring was also added to the south embankment adjacent to the Lock Operations Building.

Tellico Dam

Tellico Dam is located in Loudon County at Little Tennessee River mile 0.35, just upstream from the confluence of the Little Tennessee and Tennessee Rivers. Its operation is closely integrated with the operation of Fort Loudoun Dam and a canal links the two reservoirs. Construction of Tellico Dam began in 1967 and was completed in 1979. The reservoir extends upstream about 33 miles and has 357 miles of shoreline and 15,560 acres of water surface at the June 1 Flood Guide elevation. It has a flood storage capacity of 120,000 acre-feet. The January 1 and June 1 Flood Guide elevations are the same as for Fort Loudoun, 813 feet on June 1 and 807 feet on January 1. Most of the inflow to Tellico Reservoir is regulated by upstream reservoirs on the Little Tennessee River and its tributaries.

Tellico Dam is 129 feet high and 3,238 feet long. The main concrete portion, approximately 538 feet long and containing the spillway, is located at the west end of the dam. The remainder of the dam is earthen fill faced with rock. Three separate earthen fill saddle dams totaling 2,980 feet in length are located to the south of the main dam.

In 1989, TVA completed PMF-related modifications of Tellico Dam; they consisted of the construction of a 2,000-foot-long, ungated concrete spillway and a spillway apron energy dissipater on the downstream side of Tellico Saddle Dam No. 1. The spillway crest was connected to the south abutment by a concrete retaining wall.

Watts Bar Dam

Watts Bar Dam is located at Tennessee River mile 529.9 in Rhea and Meigs Counties, Tennessee. Construction of Watts Bar Dam began in 1939 and was completed in January 1942. The hydroelectric plant contains five generating units with a total net capacity of 182 megawatts. The impounded area extends 72 miles up the Tennessee River to Fort Loudoun Dam and 23 miles up the Clinch River to Melton Hill Dam. These dams, as well as Norris Dam, regulate most of the inflow to Watts Bar Reservoir. The reservoir has a flood storage capacity of 379,000 acre-feet. The June 1 Flood Guide elevation is 741 feet and the January 1 Flood Guide elevation is 735 feet. At the June 1 Flood Guide elevation, Watts Bar Reservoir has 722 miles of shoreline and 39,090 acres of water surface. Watts Bar Dam has one 60- by 360-foot lock that lifts and lowers boats as much as 70 feet to Chickamauga Reservoir.

Watts Bar Dam is 112 feet high and 2,960 feet long. The concrete portion of the dam adjoins a rock bluff on the west side of the river. The concrete portion is 1,726 feet long and includes the penstock intakes, spillway, and lock. A 1,234-foot-long earthen embankment faced with stone extends east from the concrete portion of the dam. State Route 68 was built on piers across Watts Bar Dam in the mid-1950s.

TVA previously completed PMF-related modification to Watts Bar Dam in 1998. These included construction of a concrete retaining wall immediately downstream of the bridge bents and spanning from the lock operations building to the bridge abutment, and construction of reinforced concrete slabs on the upstream and downstream slopes adjacent to the lock.

1.3. Description of Temporary Measures

Temporary measures were installed to prevent floodwaters from potentially overtopping the dams and to ensure the integrity of the embankments, thus increasing the public safety of downstream residents and the safety of TVA's critical nuclear facility operations. These modifications, implemented to effectively raise dam embankments 3 to 8 feet and to prevent flood overtopping and potential impacts to the dam embankments and possibly dam failure, are described and depicted below.

Cherokee Dam

Using 2,261 HESCO barriers that contained 8.2 million pounds of No. 10 crushed stone, TVA raised the north embankment, south embankment (Figure 1-6), and the saddle dam of the Cherokee Dam (a total of 6,783 feet in total length) by 3 feet. Additionally, TVA placed 2,500 tons of riprap on the downstream side of the north embankment (see Photo 2 in Appendix A). The temporary measure alignments currently in place at Cherokee Dam have been identified by segments (running north to south): C-1 is the north main embankment; C-2 is the south main embankment; C-3 is a short portion near the roundabout parking area; C-4 runs along the sidewalk on the east side of the TVA Parkway access road; C-5 is located along the sidewalk between the restroom facilities and the covered picnic area; and C-6 is located along the boundary between parking lots near the boat ramp (Figure 1-2).

Figure 1-6. Cherokee Dam – Segment C-2 (South Embankment)

Fort Loudoun Dam

Figure 1-7. Fort Loudon Marina – Saddle Dam

TVA used a total of 1,907 (1,095 of the 3'x3'x4' barriers and 812 of the 3'x3'x3' barriers) HESCO barriers containing approximately 9.8 million pounds of crushed stone, to raise the earth embankment and one saddle dam of Fort Loudoun Dam. Approximately 3,785 feet was raised by 4 feet and another 570 feet was raised by 3 feet. Additionally, some portions of the Fort Loudoun dam segments (specifically the area under the Fort Loudoun Bridge and the saddle dam near the marina) were raised to a height of 7 to 8 feet using stacked HESCO barriers (Figure 1-7). The temporary measure alignments of the HESCO barriers at Fort Loudoun Dam have been broken up into three north-to-south segments (Figure 1-3): FTL-1 is the saddle dam portion at Fort Loudon Marina (Figure 1-7); FTL-2 is the portion of stacked barriers located underneath the Carmichael Greer Bridge just south of the dam itself; and FTL-3 is the longest portion located along U.S. Highway 321 (Figure 1-8).

Figure 1-8 Fort Loudoun Dam – Segment FTL-3 (U.S. Highway 321 Portion)

Tellico Dam

At Tellico Dam, TVA raised the portion of the concrete dam, the pedestrian walkway (Figure 1-9), the main earth embankment (Figure 1-10), and two saddle dams. A total of approximately 6,011 feet of embankment was raised by 4 feet utilizing 1,993 HESCO barriers (3'x3'x4') containing approximately 10.8 million pounds of crushed stone. At Saddle Dam No. 2 (Segment T-3 in Figure 1-4), 175 HESCO barriers were used to raise the 525-feet portion of Tellico Dam. At Saddle Dam No. 3 (Segment T-4 in Figure 1-4), 97 HESCO barriers were used to raise the 291-foot portion of Tellico Dam. The temporary measure alignments currently in place at Tellico Dam have been identified by segments: T-1 is the canal saddle dam (Right Rim Extension) that runs from the Tellico recreation area entrance to the north end of the Tellico main embankment; T-2 is the main embankment; T-3 is Saddle Dam No. 2; and T-4 is Saddle Dam No. 3 (Figure 1-4).

Figure 1-9. Tellico Dam Pedestrian Walkway – Segment T-1

Figure 1-10. Tellico Dam Main Embankment – Segment T-2

Watts Bar Dam

At Watts Bar Dam, TVA used 540 3'x3'x3' HESCO barriers containing 1.5 million pounds of crushed stone to raise a 1,600-foot portion of the earth embankment by 3 feet (Figure 1-5). The HESCO barrier tied-in to the existing berm located at the northeast end of the Watts Bar Highway Bridge (Photo 52 in Appendix A and Figure 1-11). Additionally, to ensure Watts Bar main dam integrity, TVA needed to protect the downstream slope below the existing concrete floodwall. Two acres were protected using ArmorFlex® concrete mats (Figure 1-12). A total of 373 concrete mats held by steel cables were placed on the embankment, ranging in weight from 5,000 pounds to 13,000 pounds each.   The temporary measure alignments currently in place at Watts Bar Dam have been identified by segments (running north to south): WB-1 runs from basketball court at the north end to the first access road with yellow metal swing gate; WB-2 runs from that access road to the east side parking lot entrance; WB-3 runs from the parking lot entrance to the recreation access road intersection; WB-4 runs from the access road intersection to the bridge abutment; and WB-5 run underneath the bridge (Figure 1-5).

Figure 1-11. Watts Bar Dam – East Embankment

Figure 1-12. Watts Bar Dam – Downstream Embankment

1.4. Related Environmental Reviews and Consultation Requirements

TVA is the lead Federal agency in the preparation of this EIS and there are no cooperating agencies. Federal, state, and local agencies and governmental entities were notified when the draft EIS was released for review. These agencies included the U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), Tennessee Department of Environment and Conservation (TDEC), and the Tennessee State Historic Preservation Officer (SHPO).

As the lead agency, the TVA initiated consultation with the USFWS Cookeville Field Office under Section 7 of the Endangered Species Act (ESA 16 USC § 1536) to determine the likelihood of effects on listed species.

TVA's reservoir land plans and major environmental reviews are briefly described in this section. A comprehensive listing of TVA's recently completed environmental assessments (EAs) and EISs can be found on TVA's Web site: http://www.tva.gov/environment/reports/index.htm.

River Operations Study Final Programmatic Environmental Impact Statement (TVA 2004)

Published in 2004, this EIS evaluated potential changes in TVA's policy for operating its reservoir system. Specifically, this study evaluated alternative ways to operate the TVA reservoir system in order to produce greater overall public value. The new operating policy, adopted by TVA, established a balance of reservoir system operating objectives to produce a mix of benefits that is more responsive to the values expressed by the public. These changes included enhancing recreational opportunities while avoiding unacceptable effects on flood risk, water quality, and TVA electric power system costs (TVA 2004).

Cherokee Reservoir Land Use Management Plan Final Environmental Assessment (TVA 2001); Tellico Reservoir Land Management Plan Final Environmental Impact Statement (TVA 2000); and Watts Bar Reservoir Land Management Plan Final Environmental Impact Statement (TVA 2009a)

These land plans and associated EISs and EA, were completed in 2009 for Watts Bar Reservoir, 2001 for Cherokee Reservoir, and 2000 for Tellico Reservoir. They allocate the TVA-managed land on each of the reservoirs (16,220 acres on Watts Bar, 8,187 acres on Cherokee, and 12,643 acres on Tellico) to one of six land use categories. The lands where the proposed permanent dam modifications would occur were allocated in each plan to Zone 2 - TVA Project Operations. Dam reservation lands are typically given this allocation and are managed for the primary purpose of supporting the operation and maintenance of the dams and associated infrastructure. Secondary uses may include developed and dispersed recreation and visitor centers.

Natural Resource Plan and Final Environmental Impact Statement (TVA 2011)

In 2011, TVA completed the Natural Resource Plan and associated programmatic final EIS. This strategic plan addresses TVA's management of biological, cultural, and water resources; recreation; reservoir lands planning, and public engagement (TVA 2011). The EIS evaluates alternative management plans with varying levels of effort and commitment of resources. Under the selected alternative, TVA would continue to operate and maintain the recreation facilities at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams.

1.5. Scoping and Public Involvement

Scoping

In June 2011, TVA published a Notice of Intent (NOI) in the Federal Register for the preparation of either an EA or EIS for permanent dam safety modifications. Subsequently, following additional analysis of alternatives and field studies, as well as consideration of public comments, TVA determined that an EIS would be required.

TVA completed scoping for the EIS, including a 55-day comment period, open house meetings at Lenoir City, Tennessee in July 2011 and at Louisville, Tennessee in September 2011 to collect public comments, and a request for input from Federal and state agencies, local organizations, and federally recognized Indian tribes. TVA received a total of 248 letters containing 557 individual comments during the scoping period; primary topics included impacts to scenery, land use, and recreation at the dams; the methodology used to calculate the PMF, and alternatives to the permanent dam modifications. Table 1-2 provides a breakdown of the number of comments and issue category. Due to the volume of comments and the similarity of issues raised by commenters, similar comment themes were grouped and summarized; each comment was categorized by major issue(s). Seven predominant themes or issues were identified: Project Scope and Alternatives, Flood Control-Flood Risk Concerns, Visual Aesthetics, Traffic and Safety, Socioeconomic Concerns, Recreation, Public Participation, and NEPA Compliance/Adequacy.

Table 1-2.
Overview of Comments Received During Public Scoping Organized by Issue Categories

Issue Category	Number of Comments
Remove the HESCO Barriers	120
HESCO Barriers Are Not Adequate to Prevent Flood Damage	101
HESCO Barriers Are Affecting Property Values	95
Opposed to the Costs Associated with HESCO Barriers and/or Permanent Barriers	75
Other Viable Alternatives Need to be Developed	47
HESCO Barriers are an Eyesore/Barriers Have Obstructed Views of the Lake	41
TVA Needs to Improve Communication	21
An Environmental Impact Statement Should Be Prepared	18
Remove the HESCO Barriers and Do Not Replace Them	13
Traffic And Safety Have Been Impacted By HESCO Barriers	9
HESCO Barriers Have Negatively Impacted Recreation	7
Visual Impacts Will Hurt The Local Economy	5
Comments In Support of TVA's Efforts	5
Total Individual Concerns/Issues	**557**

The summary below includes the potential environmental issues and themes identified from all the comments received during the public scoping process.

Project Scope and Alternatives - Most comments request the HESCO barriers be removed permanently, and some respondents further indicate they do not want any other types of barriers built to replace the HESCO barriers. Others expressed support for the alternative to remove the HESCO barriers and replace them with permanent structures. Several respondents indicated there was a need to develop other viable alternatives for the proposed project and some commenters provided ideas for other alternatives, such as removing the HESCO barriers and building barriers at TVA's nuclear plant sites.

Flood Control-Flood Risk Concerns - Comments were received related to concerns that the HESCO barriers would not provide adequate flood damage protection in the event of a PMF. Other respondents expressed uncertainty regarding how and why the PMF calculations were developed. Some also questioned why TVA used a deterministic modeling approach for calculating PMF elevations instead of a probabilistic modeling approach.

Visual Aesthetics - Comments were received related to the perceived adverse visual impacts the HESCO barriers are having on the area or that the HESCO barriers themselves are unsightly. Other comments indicate the HESCO barriers are blocking the view of the water.

Traffic and Safety - Comments largely pertain to concerns for traffic dangers created by the HESCO barriers. Other comments express general safety concerns associated with the HESCO barriers. Some commented that the safety benefits of the HESCO barriers preventing flood damage are more important than the aesthetic impacts of the flood barriers.

Socioeconomic Concerns – Comments were received related to the perceived adverse impacts the HESCO barriers would have on property values, the local economy, and tourism. Other comments focus on the costs incurred by TVA to construct and/or remove the HESCO barriers or the anticipated future costs associated with the proposed permanent solutions.

Recreation - Comments were received related to the availability and use of hiking/biking/walking trails located in the vicinity of the HESCO barriers. Some respondents indicated that the trails are no longer accessible or that the HESCO barriers negatively impact the recreation experience because they block the views of the water.

Public Participation - Comments were received concerning public involvement during the scoping period for the proposed project. Some comments indicated TVA could have done a better job communicating with the public prior to the HESCO barriers being installed. Others indicated that the public has not been informed properly throughout the scoping process for the Proposed Action. Many commenters thanked TVA for their efforts to reach out and involve the public.

NEPA Compliance/Adequacy - Comments were received related to many aspects of NEPA compliance, including the level of environmental review TVA should consider for the Proposed Action. Most respondents indicated that an EIS should be prepared.

Public Review of Draft EIS

The Notice of Availability of the draft of this EIS was published on September 28, 2012, initiating a public review and comment period that ended November 19, 2012. TVA notified those who have previously expressed an interest in the project of the availability of the draft EIS and sent copies of it to agencies and organizations, as well as individuals who had requested them. The availability of the draft EIS and a public meeting to explain and accept comments were also announced on the TVA website, in media announcements, and in advertisements in area media. The public meeting was held on October 22, 2012 in Lenoir City, Tennessee and attended by seven people. Fourteen individuals, one organization, three government agencies, and one Native American tribe submitted comments on the draft EIS. Their comments addressed several issues, including but not limited to recreation and visitor use at the dams, visual impacts of the proposed floodwalls, potential flooding related to the 2008 revised PMF elevations, transportation safety, and NEPA compliance. The comments were carefully reviewed and synthesized into 70 individual comments. These comments and TVA's responses to them are provided in Appendix B of this final EIS. As a result of the comments, TVA made several changes to the final EIS. TVA also considered the comments during additional engineering and design analyses of the Proposed Action conducted following the publication of the draft EIS.

1.6. Decision to be Made

The Senior Vice President of River Operations and Renewables will consider TVA staff recommendations, the final EIS, public comments, and other factors, and make a decision following the Notice of Availability of this final EIS and after public comments on the final EIS are considered. The final decision will be documented in a Record of Decision (ROD) and made available to the public.

1.7. Necessary Permits or Licenses

TVA thoroughly examined the project components and determined that construction stormwater permits are the only permits and/or licenses potentially necessary to complete the permanent dam modifications. Stormwater-related permits would be site-specific and their need is dictated by the total area of temporary and permanent disturbance at each dam (i.e., area of excavation at each dam).

No Section 404(b), state aquatic resource alteration permits, State 401 certification, ESA Section 7 incidental take permits, or any other similar, resource-specific permits would be required for implementing the Proposed Action.

1.8. Environmental Impact Statement Overview

This EIS consists of seven chapters as outlined below. In addition, this document includes three appendices, which generally contain more detail on technical analyses and supporting data.

- **Chapter 1:** Describes the purpose and need for the Dam Safety Modification EIS, scope of the EIS, decision to be made, related environmental reviews and consultation requirements, necessary permits or licenses, and EIS overview.

- **Chapter 2:** Describes the Action and No Action Alternatives, alternatives eliminated from further consideration, provides a comparison of alternatives, identifies mitigation measures, and discusses the Preferred Alternative.

- **Chapter 3:** Discusses both the Affected Environment and Environmental Consequences of each alternative on various resources including: Geology and Soils, Water Resources, Flooding and Floodplains, Wetlands, Aquatic Ecology, Terrestrial Ecology, Threatened and Endangered Species, Land Use, Socioeconomics and Environmental Justice, Cultural and Historic Resources, Air Quality and Greenhouse Gas Emissions, Noise, Transportation, Visual Resources, Recreation, Solid and Hazardous Waste, and Public Safety. Direct and indirect impacts are evaluated for each resource in this chapter.

- **Chapter 4:** Addresses the Cumulative Impacts of the alternatives identified in the EIS, in consideration of other major actions in the region of influence.

- **Chapters 5-7:** Contains the list of preparers, EIS distribution list, and a list of literature cited.

- **Appendix A:** Contains a Photo Log of the project areas at each of the four dams.

- **Appendix B:** Contains Public Comments and TVA responses
- **Appendix C:** Contains Consultation Correspondence.

CHAPTER 2 - ALTERNATIVES

TVA has developed alternatives for minimizing the potential for the failure of Cherokee, Fort Loudoun, Tellico, and Watts Bar dams during the PMF, and for prevention of increased flooding at downstream locations during the PMF. Development of these alternatives took into consideration the level of risk reduction to the public, constructability, potential environmental impacts, and cost. TVA considered the results of internal and public scoping and identified a No Action Alternative and two Action Alternatives: (1) Permanent Modifications to Dam Structures: Combination of Concrete Floodwalls and Earthen Embankments, and (2) Permanent Modifications to Dam Structures: All Concrete Floodwalls. The Action Alternative consisting of a combination of concrete floodwalls and earthen embankments has been further refined following additional engineering and design analyses and consideration of the public comments on the draft EIS.

2.1. Description of Alternatives

TVA considered several potential alternatives which minimize the potential for failure of Cherokee, Fort Loudoun, Tellico, and Watts Bar dams, and which prevent an increase in flooding at downstream locations, including TVA's nuclear plants, during the PMF. These potential alternatives included both structural modifications to TVA facilities and non-structural changes to TVA reservoir operations. The following sections describe the three alternatives analyzed in detail in this EIS and the alternatives considered but rejected from detailed consideration.

2.1.1. Alternative A – No Action Alternative

As described in Section 1.3, TVA made temporary and permanent modifications to the four dams in 2009. These modifications consisted of the installation of a total of approximately 17,880 linear feet of 3- or 4-foot-tall HESCO barriers (stacked two barriers high in some portions to increase the height of those dam segments by 7 or 8 feet) on the four dams and the installation of permanent concrete mats covering a 2-acre area at Watts Bar Dam. The HESCO barriers were installed as an interim measure. Under the No Action Alternative, TVA would leave the HESCO barriers in place and replace or maintain them as necessary. The major maintenance activity would be the replacement of the geotextile liners on an approximately five-year cycle. This would require removing the crushed stone from the containers, removing and replacing the liners, and then refilling the containers with the previously used crushed stone. TVA currently conducts monthly inspections of the HESCO barriers; these would be continued under the No Action Alternative.

Under the No Action Alternative, the HESCO barriers would continue to minimize the potential for failure of the four dams and prevent an increase in flooding at downstream locations, including TVA's nuclear plants during the PMF. However, in a letter to TVA dated January 25, 2012, the NRC stated, "the NRC staff finds that the HESCO barriers are not capable of resisting debris impact...if a design flood were to occur, there is a high likelihood that significant debris would accompany flood waters which could impact the barriers. There is the potential for this debris to damage the barriers or push the individual barriers apart causing a breach... Therefore, HESCO barriers that are not designed and constructed to withstand impacts from large debris are not acceptable as a long-term solution."

While TVA has therefore concluded that the No Action Alternative is not an adequate long-term solution for addressing the PMF, it represents the baseline conditions against which the effects of the Action Alternatives are evaluated. The No Action Alternative is the current existing condition at the Cherokee, Fort Loudoun, Tellico, and Watts Bar Dam sites. A permanent concrete mat structure was installed in the downstream embankment of Watts Bar Dam, and HESCO barriers were installed at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams (see Section 1.3 for detailed discussion of temporary measures). These items would remain in place and would be maintained as needed.

2.1.2. Alternative B – Permanent Modifications of Dam Structures: Combination of Concrete Floodwalls and Earthen Embankments

Under Action Alternative B, the HESCO barriers would be removed and permanent dam modifications in the form of a combination of concrete floodwalls, raised earthen embankments, and roadway alterations would be made to each of the four dam structures. The concrete mat structure would remain in place at Watts Bar Dam. Concrete floodwalls would be constructed from reinforced concrete designed to withstand the hydrostatic forces resulting from the PMF. The concrete would be provided from existing concrete suppliers (Table 2-1). The approximate distances of the concrete suppliers to the project area (by dam) and the times it would take for concrete to be transported to the project area are also listed in Table 2-1.

Table 2-1.
Potential Concrete Suppliers for Floodwall Modifications

Dam	Concrete Plant	Approximate Distance from Project Area (in miles)	Approximately Time Required to Reach Project Area (in minutes)
Cherokee	AW Ready Mix	28.6	44
Cherokee	Blalock Incorporated	26.8	41
Cherokee	Cloud 9 Materials	25.5	38
Cherokee	Concrete Materials, Dandridge	17.8	33
Cherokee	Concrete Materials, Morristown	21.3	33
Cherokee	Ready Mix USA	20.0	30
Fort Loudoun/Tellico	Adams Ready Mix	5.9	12
Fort Loudoun/Tellico	Lambcon Ready Mix	7.7	12
Fort Loudoun/Tellico	Knoxville Concrete	21.7	30
Fort Loudoun/Tellico	Harrison Construction	25.1	31
Fort Loudoun/Tellico	R&S Concrete	39.0	49
Watts Bar	Irving Materials – Dayton	17.0	22
Watts Bar	Irving Materials – Decatur	6.0	8
Watts Bar	Lambcon Ready Mix	19.4	27
Watts Bar	R&S Concrete	28.1	40

In several locations, the HESCO barriers would be replaced with raised earthen embankments instead of concrete floodwalls. Factors used in determining the feasibility of embankments in particular locations included the height increase necessary to meet PMF elevations, ease of access for construction equipment, and public use of the existing embankments. TVA determined the height increases necessary to meet PMF elevations at each dam as follows: Cherokee – 6.6 feet; Fort Loudoun – 6.0 feet to 4.8 feet; Tellico – 4.8 feet; and Watts Bar – 3.5 feet; all permanent modification structures (floodwalls and/or embankments) would be constructed to these specific heights per location. These heights are two feet greater than the PMF elevations because of the need to maintain adequate freeboard to minimize overtopping by waves.

Alternative B would prevent the potential for failure of the dams due to overtopping during a PMF event and prevent increased flooding at downstream locations during the PMF. This would ensure that the integrity of the embankments would be maintained and thereby increase the public safety of downstream residents and the safety of TVA's critical nuclear facilities.

The HESCO barriers installed as temporary modifications in 2009, which are currently in place at each dam, would be replaced by the permanent project actions. With implementation of Alternative B (as well as for Alternative C), the HESCO barriers at all project area dam segments would be removed and the crushed stone reused at other TVA locations for roadbed materials or other purposes, resold for use in non-TVA projects, or disposed of at a municipal landfill. The HESCO barriers would be removed by pulling the pins holding the wire baskets together and lifting the baskets with a tracked excavator, removing the stone with a vacuum truck or front-end loader, loading the stone into dump trucks, and cleaning the remaining stone off of roadway areas with a sweeper truck. The crushed stone would be temporarily stockpiled in the project areas until it could be hauled via dump truck to the final disposition area (yet to be determined). The HESCO barriers (wire basket structures) would either be reused at another location or disposed of at a municipal landfill. Depending on the particular site, TVA would either remove segments of the HESCO barriers following completion of the adjacent permanent modifications, or remove a small section of the HESCO barriers as the adjacent permanent modification is being constructed. In the latter case, TVA would maintain the ability to quickly reconstruct the HESCO barriers at locations where permanent modifications are under construction in the event a severe storm is forecast.

In order to construct the embankments and floodwalls, several sections of existing roadbed and sidewalk would be cut using jackhammers or other equipment, removed with an excavator or front-end loader, loaded into dump trucks, and disposed of, most likely at an approved landfill. To construct the concrete floodwalls, foundations would be excavated and forms and steel reinforcing bars installed (see schematics of floodwalls throughout this Chapter). Concrete would be poured for the foundation. After the concrete has cured, forms and steel reinforcing bars would be installed for the upright wall, and concrete poured. The forms would be removed after the concrete has cured. Excavated soil or other fill would be replaced around the foundation and the roadbed or walkway reestablished as appropriate.

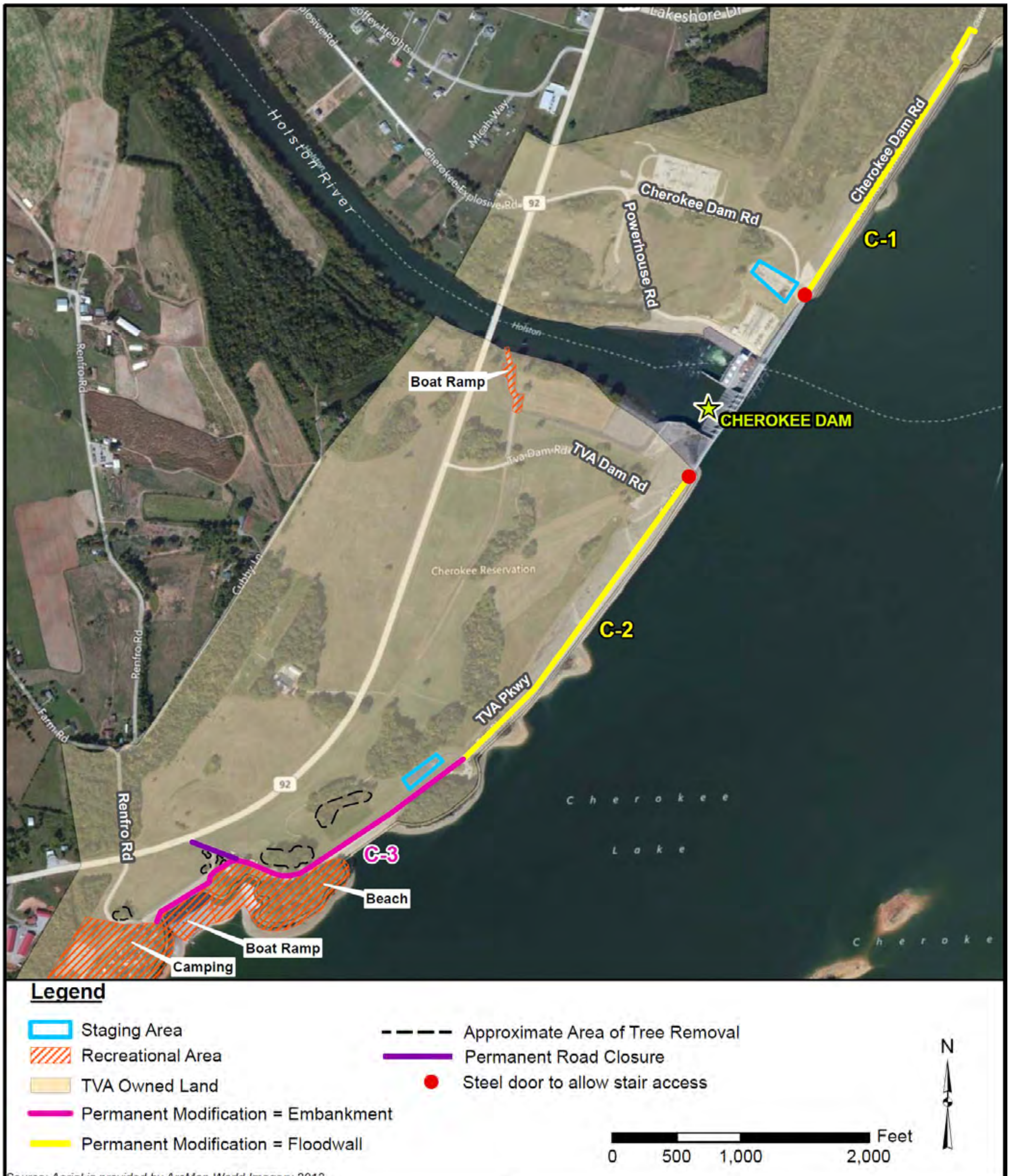
The embankments would be constructed by spreading and compacting approved impervious earthen borrow materials in multiple lifts to reach the desired elevations (see schematics of embankments throughout this Chapter). Proposed borrow areas for Cherokee, Fort Loudoun/Tellico, and Watts Bar dams are shown in Figures 2-2, 2-6 (Fort Loudoun and Tellico would share the same borrow area that is being used for the U.S. Highway 321 bridge reroute project), and 2-18, respectively. The embankments would be planted with native and/or non-invasive grass cover, and as necessary, stabilized with riprap. Upstream and downstream faces would have slopes of 3:1 to 4:1 depending on available land area, the frequency of grounds maintenance, and other factors. All construction would take place entirely within TVA right-of-way (ROW). Specific details of the modifications comprising Alternative B for Cherokee, Fort Loudoun, Tellico, and Watts Bar dams are provided below.

Under Alternative B at Cherokee, Tellico, and Watts Bar Dam reservations, several wooded areas have been identified for clearing to allow for the construction of earthen embankments. The specific forested areas to be cleared are shown on Figures 2-1, 2-13, and 2-18.

Most of the construction of the permanent modifications at all four dams proposed under Alternative B would occur simultaneously, and is estimated to take up to two years to complete. Construction crews of approximately 15 to 20 workers would be required per site for the earthen embankment work and up to 40 to 50 workers for concrete floodwall work. Construction at each individual dam is estimated to take up to 12 to 18 months to complete.

Cherokee Dam

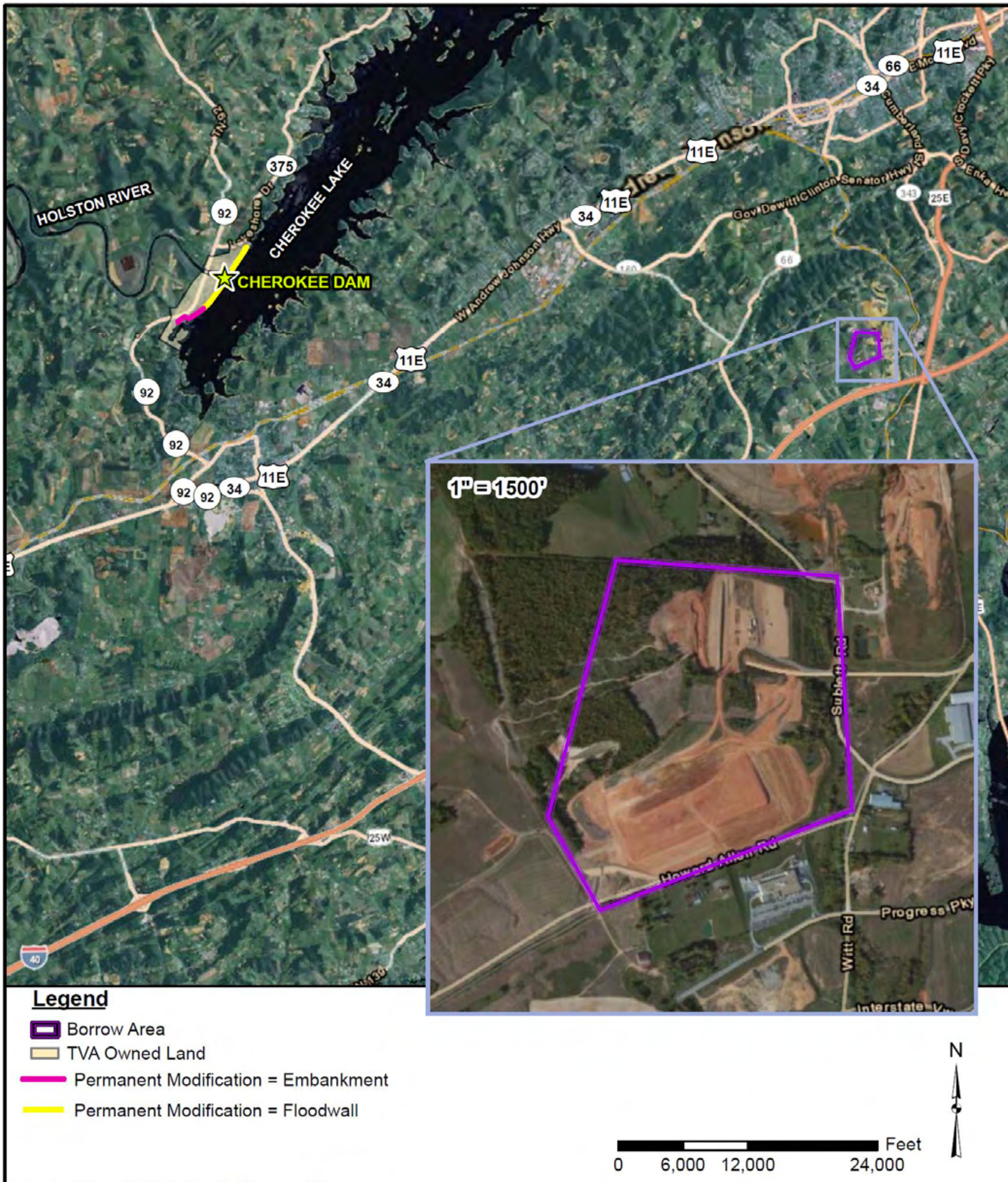
The Alternative B permanent modifications at Cherokee Dam Proposed Action are illustrated in Figure 2-1 and the borrow area is shown in Figure 2-2. Due to site and engineering constraints, floodwalls were selected as the permanent modification type for the Cherokee Dam main embankment segments (totaling approximately 5,200 feet).



AECOM

Figure 2-1
Cherokee Dam Proposed Action

Tennessee Valley Authority



Source: Aerial is provided by ArcMap World Imagery 2012

AECOM

Figure 2-2
Cherokee Dam Borrow Area

Tennessee Valley Authority

Floodwalls would be installed to replace the 2,150-feet and 2,650-foot-long rows of HESCO barriers currently in place on the north and south embankments (Segments C-1 and C-2), respectively (Figure 1-2). Concrete floodwalls would be installed on the west (downstream) side of the access road/walkway that runs along crest of the main embankments, and would both be built to a height of 6.6 feet (Figure 2-3). In an effort to help maintain the downstream viewshed of Cherokee Dam for the many visitors who frequent the recreation area, the paved walkway located on top of Segment C-2 would be raised by approximately 3 feet; essentially making the finished floodwall height from the walkway, 3.6 feet.

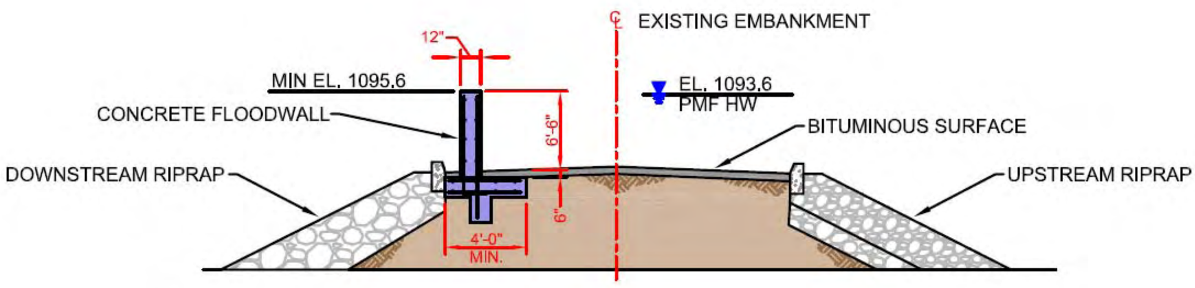


Figure 2-3. Cherokee Dam - Concrete Floodwall Concept for North Embankment (Segment C-1). The South Embankment (Segment C-2) would be similar except the walkway surface would be raised 3 feet.

Under Alternative B, two small steel doors would be installed at the south end of Segment C-1 and the north end of Segment C-2, respectively. These doors would be required in order to provide uninterrupted flood protection along the north and south main embankments at Cherokee Dam, while allowing for continued use of the pedestrian staircases that lead from the downstream toe of the embankments to the crests (Figure 2-1).

The final proposed segment (C-3) would be a continuous, downstream earthen embankment, approximately 3,150 ft long, beginning near the south end of Segment C-2, wrapping around the back side of the visitor's building, and eventually tying into the existing grade near the RV park and campgrounds (Figure 2-1). The alignment of Segment C-3, which would be constructed to a height of 6.6 feet, would require the permanent closure of the downstream parking lot south of Segment C-2, as well as the existing main access road into the Cherokee Dam Recreation Area (Figure 2-1). The current south access road (Renfro Road) into the recreation area near the boat ramp would become the new main access road. The existing parking lot and roundabout, located slightly north of the boat ramp parking lot would be widened to accommodate the additional traffic resulting from the closure of the existing main entrance road. Segment C-3 would be grassed (Figure 2-4) and TVA would allow public use (walking, running, biking, etc.).

During construction, access to the Cherokee Dam boat ramp would remain available, but the access road and parking lot would be shared with construction/delivery traffic and material staging.

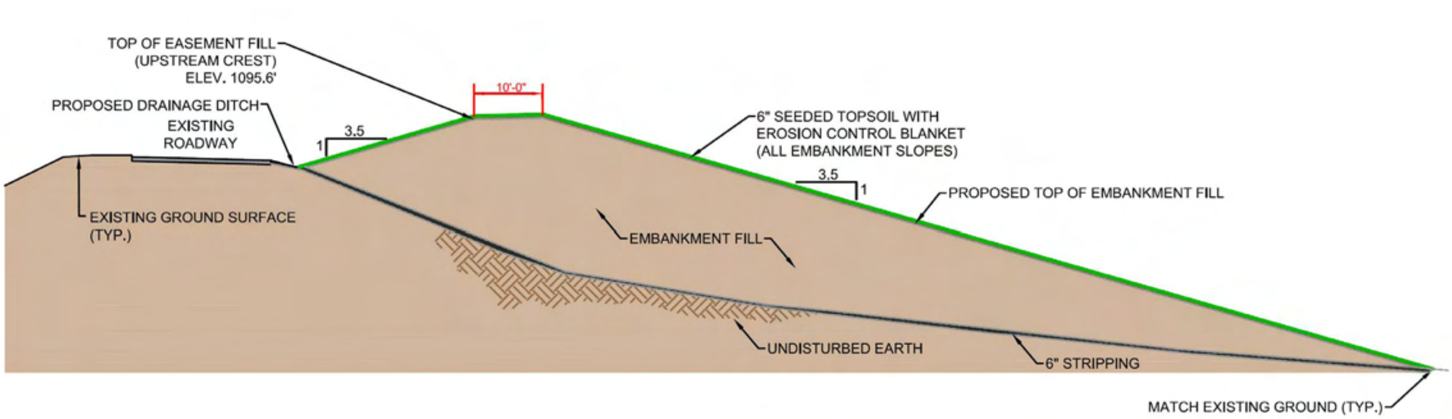
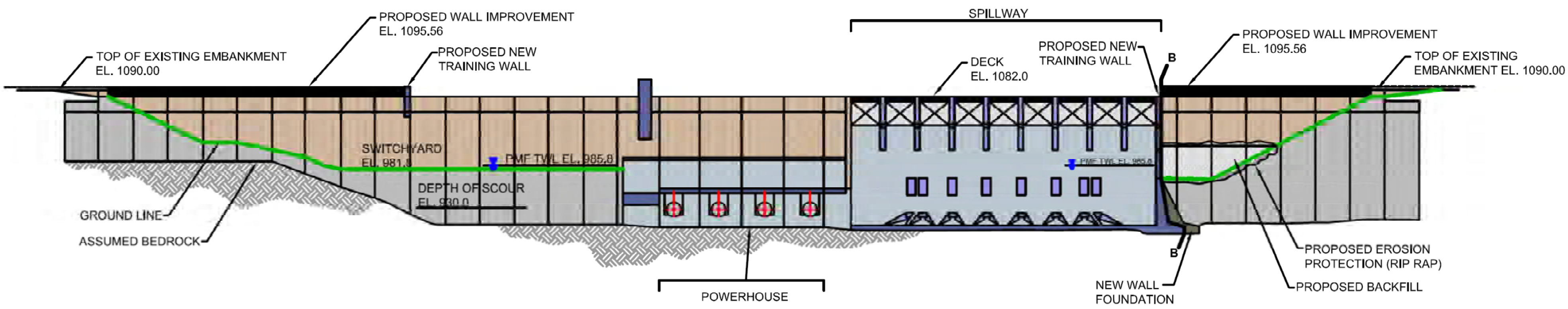


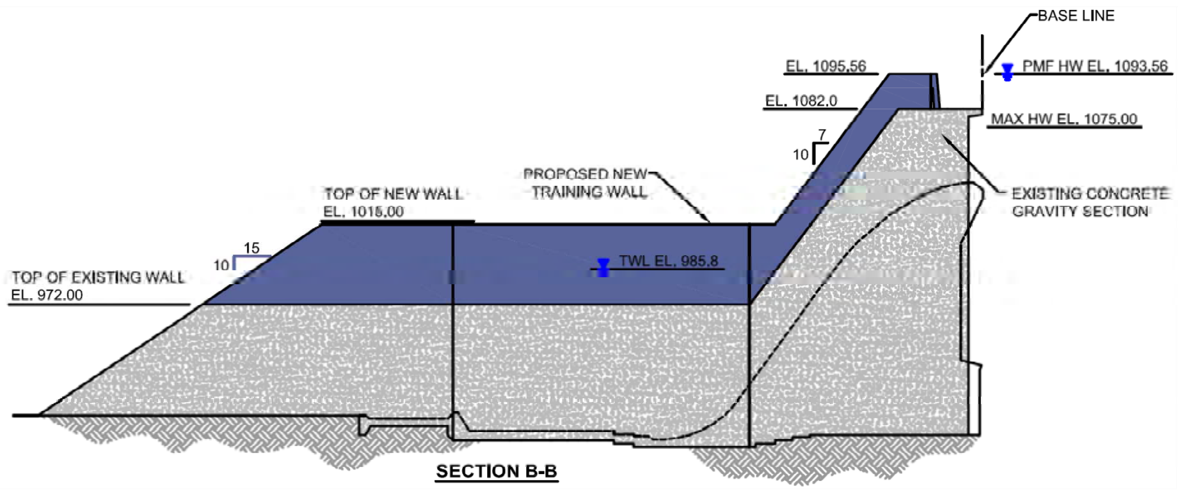
Figure 2-4. Cherokee Dam – Earthen Embankment Concept for Segment C-3

Additional dam safety modifications would be made to the central concrete portion of Cherokee Dam (Figure 2-5). About 40 post-tensioned anchors would be installed in two sections of the concrete portion of the dam - a 372-foot long section of the northern end and the spillway section. Post-tensioned anchors are multistrand metal tendons installed in holes drilled through the concrete portion of the dam into the underlying bedrock. They are anchored to the bedrock, stressed, locked off, and grouted to prevent corrosion. A drill rig and specialized equipment would be used to install the anchors. The anchors at the northern end of the dam would be installed in vertical holes using a drill rig mobilized on top of the dam. The anchors in the spillway section would be installed in angled holes using a drill rig operating from scaffolding installed on the downstream face of the spillways. The concrete floodwalls installed in 1985 on the north and south non-overflow portions of the concrete portions of the dam would be raised about 6 feet to an elevation of 1095.6 feet. Each of the floodwall sections is approximately 326 feet long. A new 13.6-foot tall floodwall would be built on the 93-foot wide section of the dam immediately south northern floodwall. A new 5-foot wide concrete training wall would be built on the downstream face of the dam at the southern end of this new 13.6-foot tall floodwall. Finally, TVA would raise the height of an approximately 400-foot long section of the concrete south spillway training wall by 40 feet and backfill much of the area behind the training wall (on the side opposite the river channel) with rock riprap to increase erosion protection (Figure 2-5).

Construction staging areas at Cherokee Dam are illustrated in Figure 2-1. The estimated quantities of construction materials for the floodwall and embankment work at Cherokee Dam are provided in Table 2-2. The necessary fill material for Segment C-3 would be obtained from an existing borrow area located to the northwest of the intersection of I-81 and US 25E, a few miles south of Morristown and in Hamblen County - a short distance from the Hamblen-Jefferson county line (Figure 2-2). Concrete would be delivered to the project area by truck from existing commercial concrete plants or produced at an onsite batch plant. Potential concrete suppliers for Cherokee Dam are listed in Table 2-1.



DOWNSTREAM ELEVATION



SECTION B-B

Figure 2-5. Central Concrete Portion Concept for Cherokee Dam

Table 2-2.
Cherokee Dam Construction Material Quantities* – Alternative B**

Earthen Design and Construction			Floodwall Design and Construction		
Item Description	**Quantity**	**Units**	**Item Description**	**Quantity**	**Units**
SITE PREPARATION			**SITE PREPARATION**		
General			Construction Survey	1	LS
Clearing and Grubbing	1	AC	Asphalt Removal	9,720	SY
Traffic Control	1	LS	Asphalt Disposal	1,620	CY
Demolition			Concrete Removal	290	CY
Flexible Pavement	5,430	SY	Concrete Disposal	290	CY
Curb and Gutter	4,960	LF	Light Poles-Removal and Relocation	31	EA
Rigid Pavement	160	SY	Clearing & Grubbing	1	Ac
Removal			Traffic Control	1	LS
Hesco Basket	1,920	LF	HESCO Unit Removal	5,050	LF
Concrete Bollard Post	150	EA	Chain Link Fence Removal	1,450	LF
Catch Basin	5	EA	Chain Link Fence Installation	1,450	LF
Manhole	1	EA	Pull Box-Remove and Replace	4	EA
Storm Pipe	60	LF	Control Box Remove and Replace	1	EA
Relocation			Metal Swing Gate w/ 8” Post-R&R	4	EA
Misc. Utility Boxes	7	EA	4x4 posts-Remove and Replace	2	EA
Light Poles	3	EA	**WALL CONSTRUCTION**		
Septic Tank	1	EA	Excavation-Riprap Embankment	3,920	CY
Manhole	1	EA	Excavation-Earthen Embankment	21,570	CY
Abandonment			Concrete	6,530	CY
Storm Pipe	2	EA	Steel	337,690	LB
Installation			Gap Closure System (Steel Door)	2	CY
Chain Link Fence Gate	3	EA	**EMBANKMENT CONSTRUCTION**		
Chain Link Fence Installation	1,980	LF	Earth Stripping and Stockpiling (on-site)	1,000	CY
DRAINAGE STRUCTURE INSTALLATION			Borrow Material	23,950	CY
Catch Basin	9	EA	Fill Placement and Compaction	23,950	CY
Manhole	2	EA	**EROSION PREVENTION AND SEDIMENT CONTROL (EPSC) MEASURES**		
End Walls	3	EA	Silt Fence with Wire Backing	20,800	LF
18” RCP	1,600	LF	Curb Inlet Protection	2	EA
EMBANKMENT CONSTRUCTION			Erosion Control Blanket	2,670	SY
Stripping and Stockpiling	51,210	SY	Seeding	1	Ac
Excavation (on-site disposal)	110	CY	Riprap Placement	3,690	CY
Embankment Fill (import, place, compact)	119,100	CY	Geotextile Fabric	7,380	SY
Place Riprap Class A-1	7	CY	**PAVING**		

Table 2-2.
Cherokee Dam Construction Material Quantities* – Alternative B**

Earthen Design and Construction			Floodwall Design and Construction		
Item Description	**Quantity**	**Units**	**Item Description**	**Quantity**	**Units**
EPSC MEASURES INSTALLATION			6” Cast in place curb with 18” gutter	240	LF
Silt Fence with Wire Backing	9,710	LF	Mineral Aggregate Base (2 ton/cy)	1,280	TON
Curb Inlet Protection	6	EA	Asphalt Pavement (2” thick)	3,690	SY
Erosion Control Blanket	38,710	SY			
Seeding and Fertilizing	12	AC			
PAVING					
Stone and Aggregate: Class A Aggregate (place, compact 6 to 8 in. thick)	620	CY			
Pavement: Flexible Pavement	2,180	SY			
Pavement: Rigid Pavement	150	SY			

*based on 65% design
** This does not include the quantities of concrete and riprap required for the work on the concrete section of the dam

Fort Loudoun Dam

At Fort Loudoun Dam, the temporary HESCO barriers (Figure 1-3) would be permanently replaced by two embankment segments and two floodwall segments. Permanent modifications at Fort Loudoun Dam and the potential construction areas are illustrated in Figure 2-6 and the location of the joint Fort Loudoun-Tellico borrow area is mapped on Figure 2-7.

Figure 2-6
Fort Loudoun Dam Proposed Action

Tennessee Valley Authority

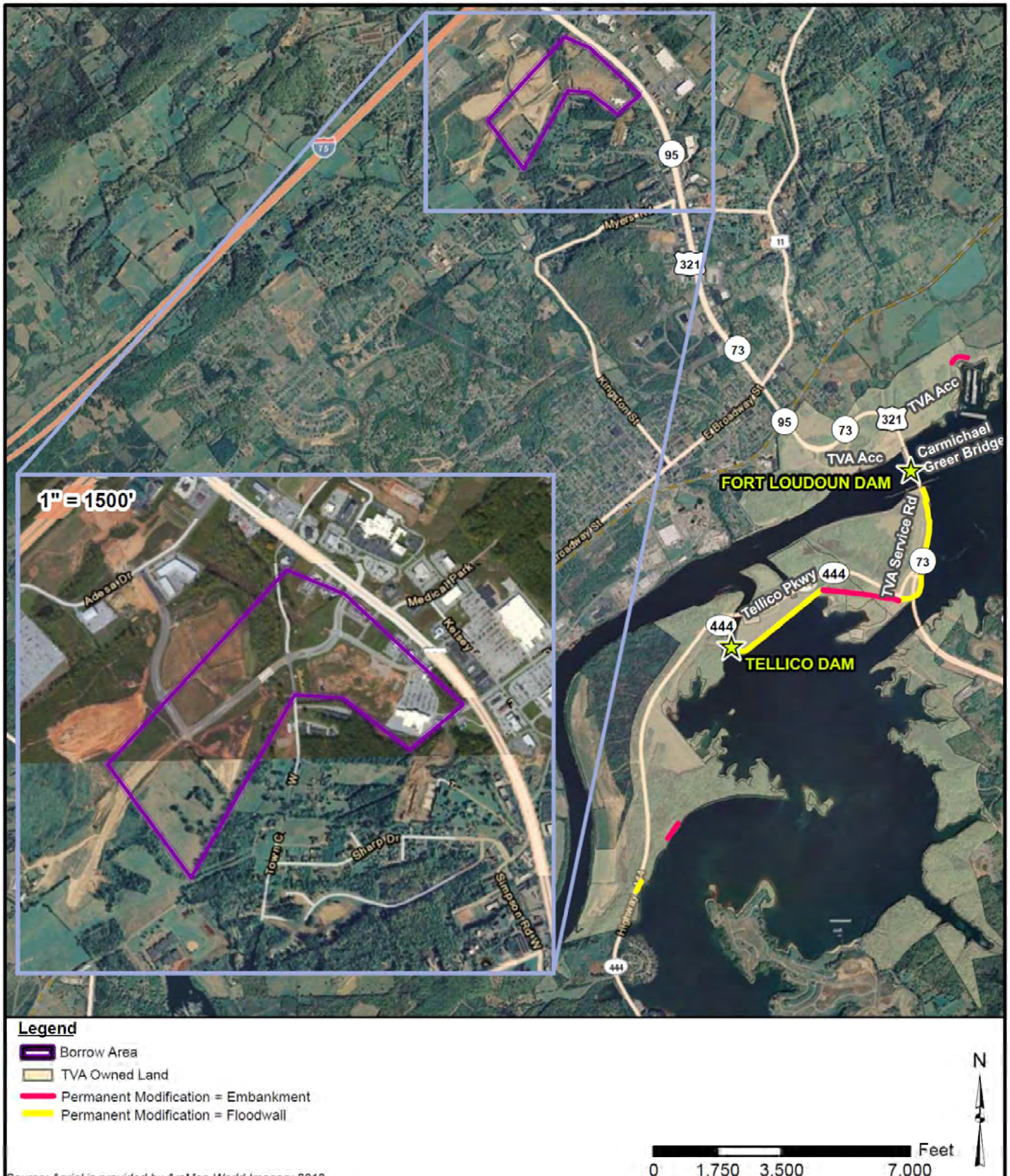


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Figure 2-7
Fort Loudoun/Tellico Borrow Area

Tennessee Valley Authority

The first segment (FTL-1) is located at the north saddle dam near Fort Loudon Marina. The existing floodwall is approximately 400 feet in length, terminates at elevation at both ends, and will need to be modified or completely rebuilt to accommodate the calculated PMF elevations. Under temporary measures, HESCO barriers were stacked two high at Segment FTL-1 to add approximately 7 to 8 feet to the overall height and prevent overtopping during the PMF; therefore, the proposed permanent modification for FTL-1 is an earthen embankment (Figure 2-8) built to a height of 6 feet. Although construction access for Segment FTL-1 would occur from the downstream side of the existing embankment, this permanent modification would require temporary closure of City Park Drive (across from the marina) for a period of approximately 12 days for piping work and HESCO basket removal.

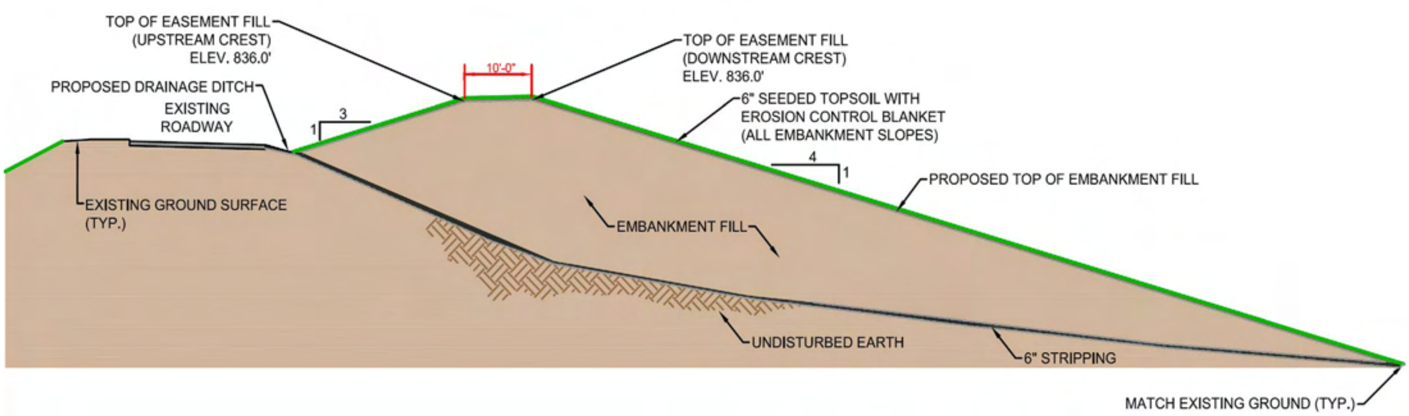


Figure 2-8. Fort Loudoun Dam – Earthen Embankment Concept for Segment FTL-1 (North Saddle Dam near Marina)

The second segment at Fort Loudoun Dam (FTL-2) is located immediately south of the concrete portion of Fort Loudoun Dam and extends from the USACE Lock Operations Building southward for 800 feet to the U.S. Highway 321 Carmichael Greer Bridge (Figure 2-6). The northern 390 feet of this floodwall would be built under the bridge on the upstream (east) side of the crest of the dam. The southern 470 feet of the floodwall would be built under the bridge on the downstream (west) side of the dam and would tie into the bridge abutment with grade beam closure. Under temporary measures, this portion of Fort Loudoun Dam has HESCO barriers stacked two-high to provide an additional 7 to 8 feet of height to the existing floodwall. The proposed permanent modification for Segment FTL-2 would be a concrete floodwall built to a height of 5.8 feet (Figure 2-9).

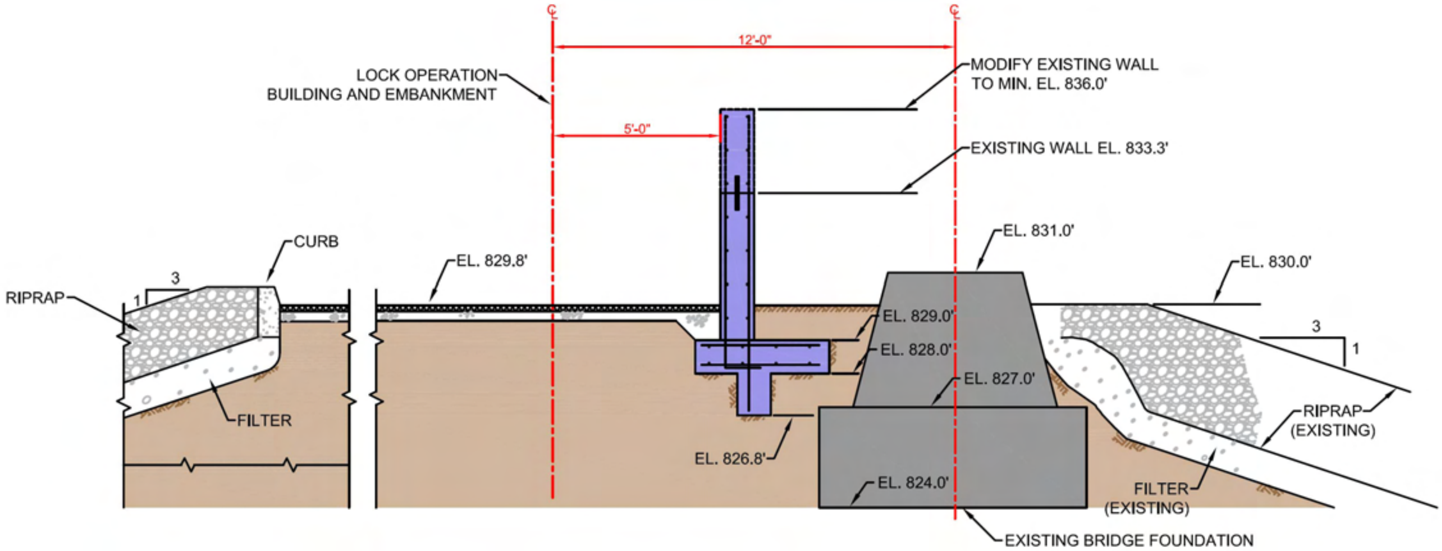


Figure 2-9. Fort Loudoun Dam – Concrete Floodwall Concept for Segment FTL-2 (Under U.S. Highway 321 Bridge)

The third segment at Fort Loudoun Dam (FTL-3) would be built along the shoulder of U.S. Highway 321 from the south end of the U.S. Highway 321 Bridge approximately 2,600 feet south to the entrance to the Tellico Recreation Area (Figure 2-6). This segment of concrete floodwall would be built on the upstream (east) side of U.S. Highway 321 and would be constructed to a height of 4.8 feet (Figure 2-10); the temporary HESCO barriers are currently located on the upstream side of U.S. Highway 321 due to identified traffic hazards associated with locating the barriers on the downstream side of U.S. Highway 321, adjacent to the existing floodwall. While increasing the height of the existing floodwall is an option, there are concerns that the same hazards would exist while also requiring a much higher wall to accommodate the lower elevations associated with the downstream side of the embankment.

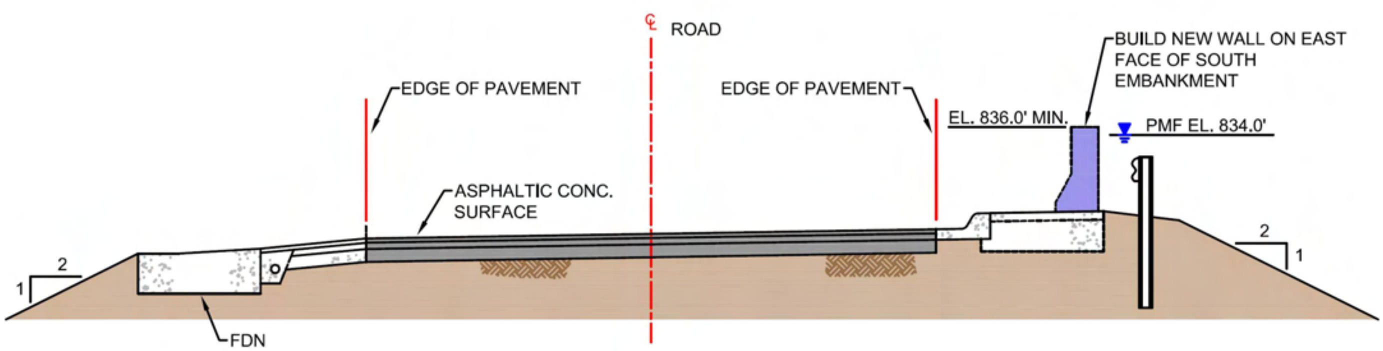


Figure 2-10. Fort Loudoun Dam – Concrete Floodwall Concept for Segment FTL-3 (U.S. Highway 321 Bridge to Tellico Recreation Area)

The fourth segment at Fort Loudoun Dam (FTL-4) would be aligned across the existing entrance road to the Tellico Recreation Area, connecting Segments FTL-3 and T-1 (Figure 2-6). The proposed permanent modification for this segment would be an earthen embankment, built to a height of 4.8 feet (Figure 2-11) using fill from the borrow area identified on Figure 2-7.

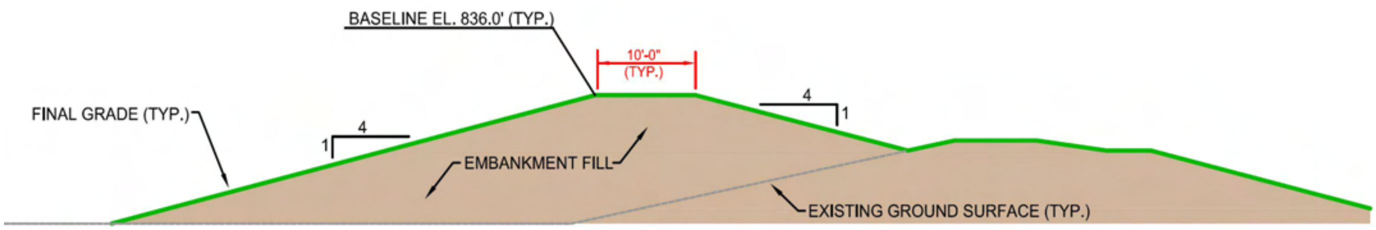


Figure 2-11. Fort Loudoun Dam – Earthen Embankment Concept for Segment FTL-4

Under Alternative B at Fort Loudoun Dam, an approximately 250-foot long portion of the Tellico Recreation Area entrance road would be rebuilt across the top of the Segment FTL-4 earthen embankment (Figure 2-12). The construction of Segment FTL-4 and the raised roadway would require the Tellico Recreation Area, including the bathrooms, boat ramp and boat ramp parking lot, walking trail parking lot, picnic area, and beach area to be temporarily closed to vehicle traffic for a period of approximately 2 weeks during construction. During this time, all facilities within the recreation area would remain open to public foot traffic. Following construction of the raised roadway, the north access entrance to the canal parking area for the Tellico Recreation Area bathrooms would be permanently closed; the existing south access entrance would become the main entrance to this parking area.

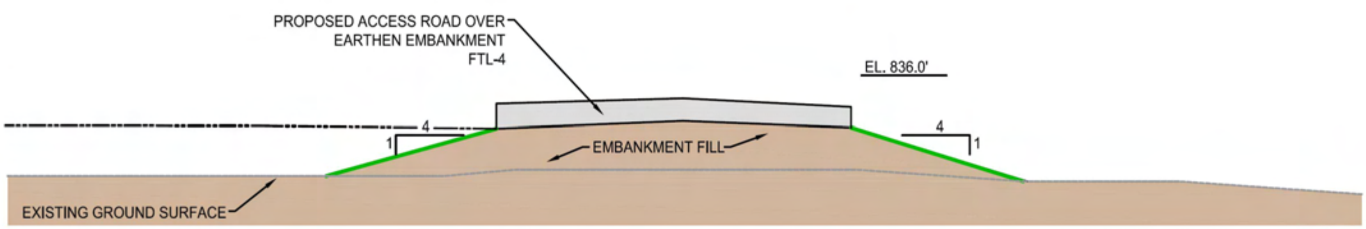


Figure 2-12. Fort Loudoun Dam – Raised Access Road Concept

Three existing parking lots would be used as temporary construction staging areas during the construction of permanent modifications at Fort Loudoun Dam (Figure 2-6); one of these is adjacent to the north saddle dam near the Fort Loudon Marina. The other two potential staging areas, which would also serve as staging areas for work at Tellico Dam, are located in the Tellico Recreation Area adjacent to: (1) the canal parking lot near the entrance, and (2) the boat ramp parking lot at the west end of the canal. These areas would be used to store construction materials for the duration of the construction period for permanent modification work at Fort Loudoun and Tellico dams. The estimated quantities of construction materials for the floodwall and embankment work at Fort Loudoun are provided in Table 2-3. Concrete would be delivered by truck from existing commercial concrete plants. Potential concrete suppliers for Fort Loudoun and Tellico dams are listed in Table 2-1. The necessary fill material for Segments FTL-1 and FTL-4 would be obtained from a previously disturbed borrow area located in the southwest quadrant of the I-75/ U.S. Highway 321 interchange in Lenoir City (Figure 2-7).

Removal of the HESCO barriers and construction of the floodwall at Segment FTL-3 would require closure of the adjacent lane of U.S. Highway 321 and, depending on the phase of construction of the TDOT U.S. Highway 321 bridge relocation project, the adjacent land of the entrance ramp from Highway 444 to northbound U.S. 321. Due to the TDOT project, construction is currently underway in this area. TVA would install additional construction warning signs and lane closure signs as necessary. TVA would also employ the use of flagmen or other means of regulating traffic flow through the construction area, and is considering constructing parts of the floodwall at night to minimize traffic congestion.

During construction of embankment FTL-4, the elevated access roadway, and embankment T-1 at the Tellico Recreation Area, access to the boat ramp and recreational facilities would be closed for approximately 30 to 45 days.

Table 2-3.
Fort Loudoun Dam Construction Material Quantities* – Alternative B**

Earthen Design and Construction			Floodwall Design and Construction		
Item Description	**Quantity**	**Units**	**Item Description**	**Quantity**	**Units**
SITE PREPARATIONS			**SITE PREPARATIONS**		
Construction Survey	1	LS	Construction Survey	1	LS
Asphalt Removal	1,025	SY	Asphalt Removal	600	SY
Asphalt Disposal	170	CY	Asphalt Disposal	200	CY
Curb and Gutter removal	235	LF	Curb and Gutter removal	1,000	LF
Concrete Disposal	30	CY	Sidewalk Removal	50	SY
Utilities Relocation	400	LF	Concrete Disposal	20	CY
Traffic Control	1	LS	Light Poles-Removal and Relocation	9	EA
HESCO Unit Removal	325	LF	Traffic Control	1	LS
DRAINAGE STRUCTURES			HESCO Unit Removal	3,245	LF
Drop Box Inlet	3	LS	Chain Link Fence Removal	1,600	LF
12” CMP	40	LF	Chain Link Fence Installation	100	LF
EROSION PREVENTION AND SEDIMENT CONTROL (EPSC) MEASURES			Guard Rail Removal	500	LF
Silt Fence	1,000	LF	Portable Concrete Barrier	2,500	LF
Silt Fence with Wire Backing	500	LF	**WALL CONSTRUCTION**		
Filter Sock	250	LF	Excavation	7,650	CY
Rock Check Dam	1	EA	Concrete	3,020	CY
Culvert Protection	1	EA	Steel	147,750	LB
Catch Basin Protection	3	EA	Expansion Joint Filter	700	LF
Erosion Control Blanket	4,500	SY	**EXISTING WALL MODIFICATION**		
Seeding	3	AC	Excavation	1,350	CY
18” CMP (Temp. Const. Entrance)	20	LF	Concrete	975	CY
Riprap (1.4 ton/cy)	20	Ton	Steel	53,640	LB
PAVING			Concrete Drilling (18” depth)	1,460	EA
6” cast in place curb with 18” gutter	70	LF	Epoxy Anchors	2,190	LF
Mineral Aggregate Base (2 ton/cy)	125	Ton	Gap Closure System	3	LF
Asphalt Pavement (6” thick)	475	SY	**EMBANKMENT CONSTRUCTION**		
Concrete Sidewalk (4” thick)	425	SF	Borrow Material	3,030	CY
			Fill Placement and Compaction	3,030	CY
			EPSC MEASURES		

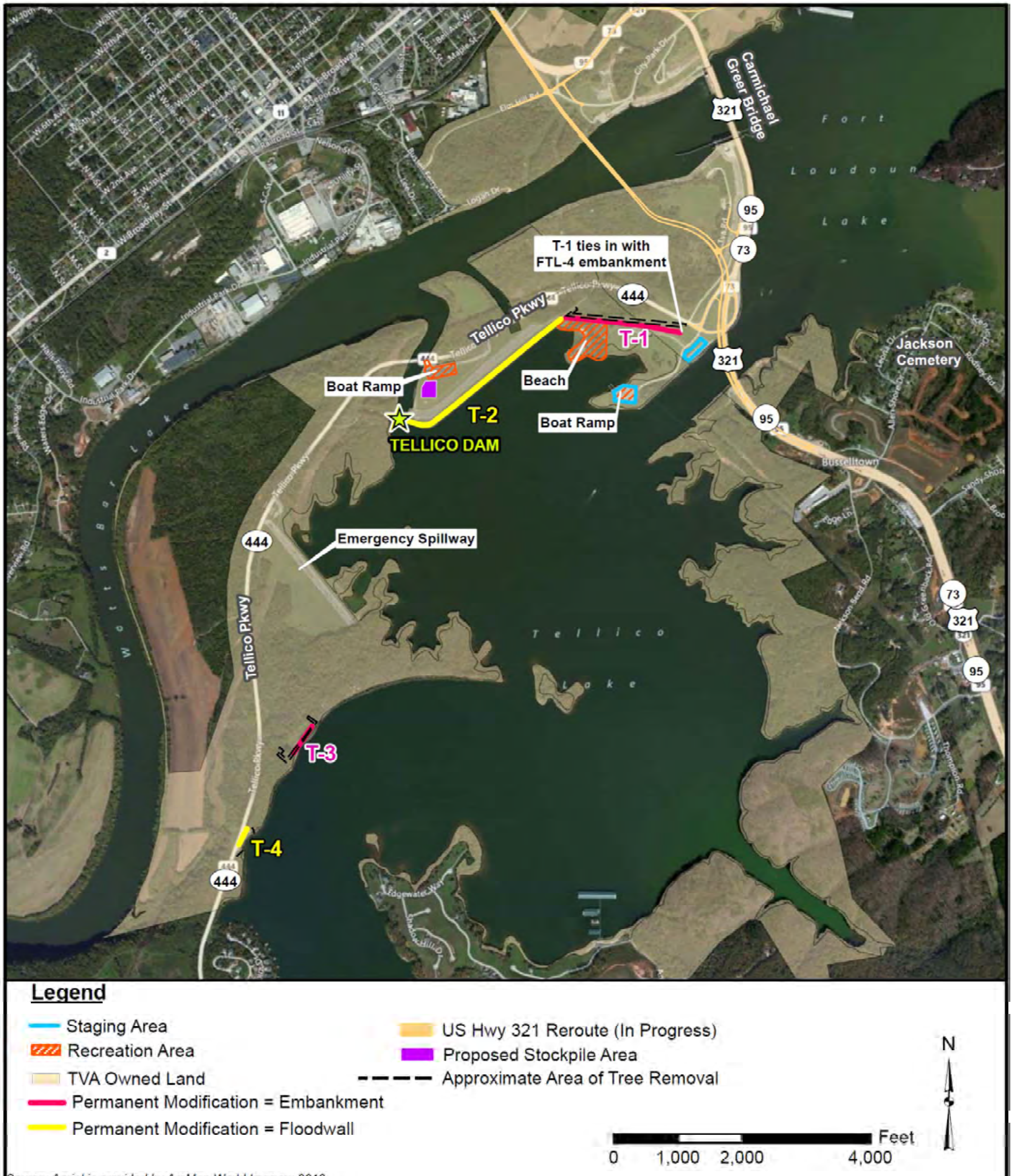
Table 2-3.
Fort Loudoun Dam Construction Material Quantities* – Alternative B**

Earthen Design and Construction			Floodwall Design and Construction		
Item Description	**Quantity**	**Units**	**Item Description**	**Quantity**	**Units**
			Silt Fence with Wire Backing	6,600	LF
			Curb Inlet Protection	5	EA
			Rock Check Dam	5	EA
			Catch Basin Protection	3	EA
			Erosion Control Blanket	400	SY
			Seeding	1	Ac
			Riprap Placement	2,950	CY
			Geotextile Fabric	5,900	SY
			PAVING		
			Mineral Aggregate Base (2 ton/cy)	260	Ton
			Asphalt Pavement (6" thick)	600	SY
			Concrete Sidewalk (4" thick)	50	SF

*based on 30% design
** This does not include the quantities of concrete and riprap required for the work on the concrete section of the dam

Tellico Dam

Under Alternative B, permanent modifications at Tellico Dam are proposed for a total of four segments (Figure 2-13). Earthen fill material for construction of embankments at Tellico Dam would be collected from the borrow area location shown in Figure 2-7. This borrow area would also be used to provide fill material for the earthen work at Fort Loudoun Dam, as well as for the neighboring TDOT U.S. Highway 321 Bridge reroute project.



Source: Aerial is provided by ArcMap World Imagery 2012

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Figure 2-13
Tellico Dam Proposed Action

Tennessee Valley Authority

The first Tellico Dam segment (T-1) would begin just west of the Tellico Recreation Area entrance road and would tie-in to embankment Segment FTL-4 (Figures 2-6 and 2-13). The proposed modification for this segment would be an approximately 1,800-foot long earthen embankment built on the downstream side of the existing embankment to a height of 4.8 feet and the existing walkway on this canal saddle dam would be rebuilt atop the raised embankment (Figure 2-14). The construction of the embankment would require the removal of a few trees on the southern edge of the wooded area north of the embankment to provide adequate area for the embankment fill and construction equipment.

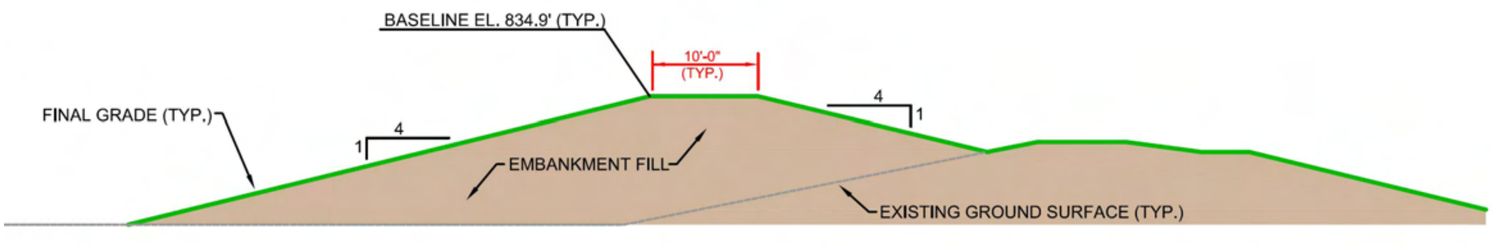

Figure 2-14. Tellico Dam – Raised Embankment Concept for Segment T-1 (Canal Saddle Dam)

The second Tellico Dam segment (T-2) is referred to as the Tellico Main Embankment and runs approximately 3,000 feet from the Tellico Dam Access Road and terminates at the first training wall of the concrete portion of the dam (Figure 2-13). A 4.8-foot-tall concrete floodwall would be constructed on the upstream side of the main Tellico embankment and span the entire 3,000-foot length of the embankment under this alternative (Figure 2-15). In an effort to help maintain the upstream viewshed of Tellico Reservoir for the many visitors who frequent the recreation area, the paved walkway located on top of Segment T-2 would be raised by approximately 2 feet; essentially making the finished floodwall height from the walkway, 2.8 feet.

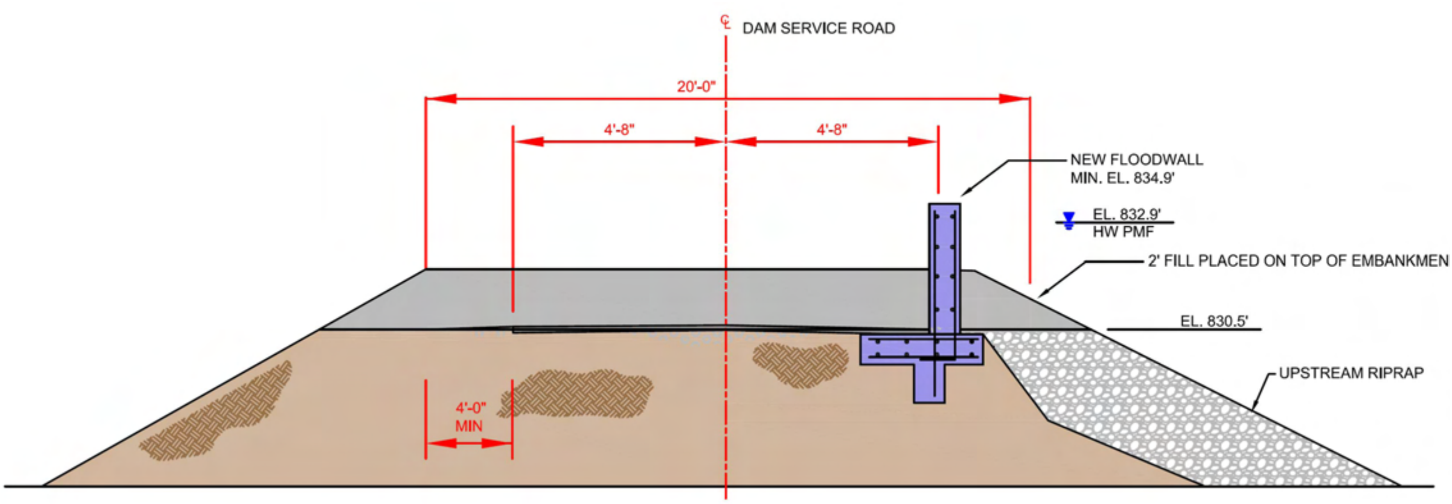

Figure 2-15. Tellico Dam – PMF Floodwall Concept for Segment T-2 (Main Embankment)

An additional permanent modification at Tellico Segment T-2a, would also be included as part of Alternative B. Segment T-2a refers to the right non-overflow portion (monoliths 1 through 6) at the Tellico concrete dam. Work at this segment would include construction of a 250-foot long, 5.2-foot tall concrete parapet wall located along the upstream face of the right non-overflow portion.

The third and fourth segments of Tellico Dam are referred to as Saddle Dam No. 2 (Segment T-3) and Saddle Dam No. 3 (Segment T-4). Proposed permanent modifications for these segments of flood protection would be a 650-foot-long raised earthen embankment at T-3 and a 400-foot-long concrete floodwall at T-4 (Figures 2-16 and 2-17). The proposed embankment and floodwall would raise the current height of T-3 and T-4 by 5.0 feet and 4.8 feet, respectively. The Segment T-3 embankment would be constructed on the upstream side of the existing crest and would tie into the existing trails on each end. It would require clearing some of the wooded area between the embankment and the reservoir, as well as at each end of the embankment, to accommodate the fill and construction equipment.

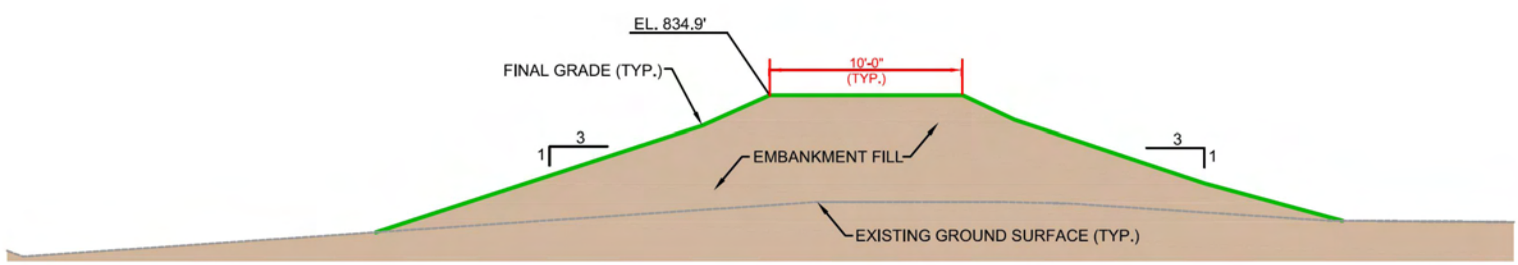

Figure 2-16. Tellico Dam – Raised Earthen Embankment Concept for Segment T-3 (Saddle Dam No. 2)

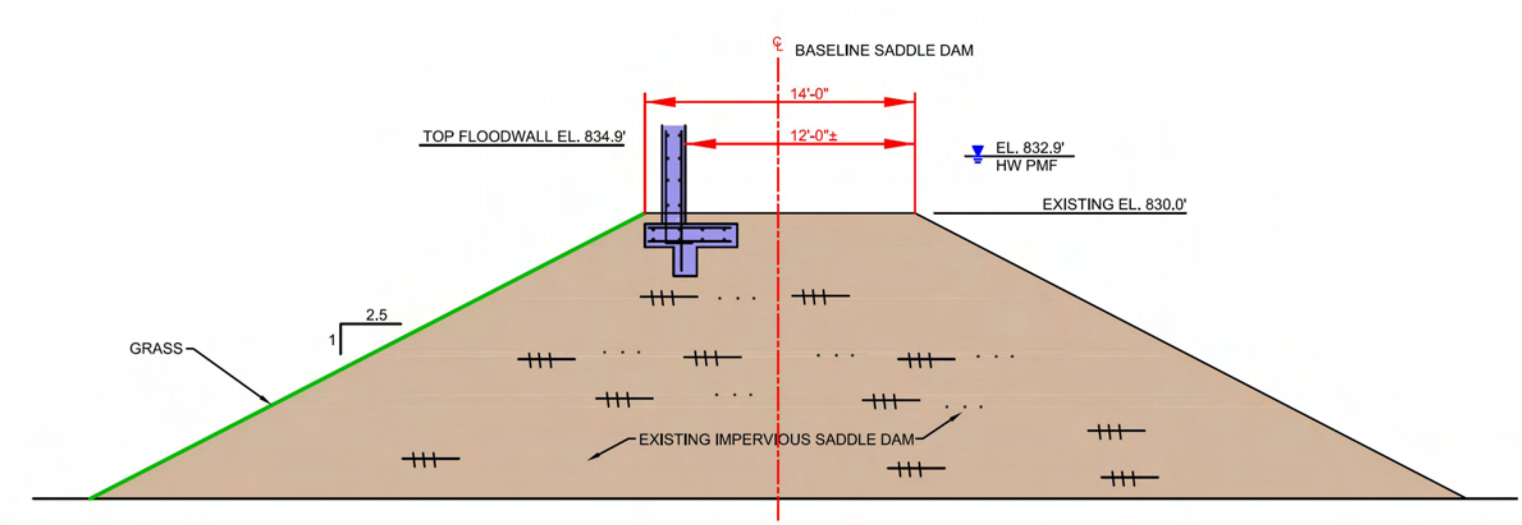

Figure 2-17. Tellico Dam – Concrete Floodwall Concept for Segment T-4 (Saddle Dam No. 3)

Construction staging and stockpile areas at Tellico Dam are illustrated on Figure 2-13. These areas would be used to store construction materials for the duration of the construction period for permanent modification work at Fort Loudoun and Tellico dams. The estimated quantities of construction materials for the floodwall and embankment work at Tellico Dam are provided below in Table 2-4. Concrete would be delivered by truck from existing commercial concrete. Potential concrete suppliers for Fort Loudoun and Tellico dams are listed in Table 2-1. The necessary fill material for Segments T-1 and T-3 would be obtained from a previously disturbed borrow area located in the southwest quadrant of the I-75/ U.S. Highway 321 interchange in Lenoir City (Figure 2-7).

Table 2-4.
Tellico Dam Construction Material Quantities* - Alternative B**

Earthen Design and Construction			**Flood Wall Design and Construction**		
Item Description	**Quantity**	**Units**	**Item Description**	**Quantity**	**Units**
SITE PREPARATIONS			**SITE PREPARATIONS**		
Asphalt Removal	1,305	SY	Construction Survey	1	LS
Asphalt Disposal	48	CY	Asphalt Removal	4,850	SY
Concrete Sidewalk Removal	170	SY	Asphalt Disposal	810	CY
Concrete Disposal	10	CY	Clearing and Grubbing	0.1	Ac
Utilities Relocation		LF	Traffic Control	1	LS
Traffic Control	1	LS	Chain Link Fence Removal	1,110	LF
HESCO Unit Removal	2,625	LF	Chain Link Fence Installation	1,110	LF
Chain Link Fence Installation	1,000	LS	Monitoring Well Abandon and Replace	2,000	LF
Clearing and Grubbing	9	Ac	Monitoring Well Retrofits	4	EA
Orange Safety Fence Installation	300	LF	Survey Monuments remove and Replace	8	EA
EMBANKMENT CONSTRUCTION			Electrical Box Retrofits	5	EA
Excavation to Construct Liner Subgrade	4,628	CY	**WALL CONSTRUCTION**		
Fill to Construct Liner Subgrade	4,628	CY	Fill Excavation	430	CY
Fill to Construct Final Grade	37,024	CY	Concrete Placement	3,160	CY
Borrow Material	37,024	CY	Steel	167,380	LB
Earth Stripping and Stockpile (on-site)	5,600	CY	Concrete Drilling (18” Depth)	500	EA
EROSION PREVENTION AND SEDIMENT CONTROL (EPSC) MEASURES			Epoxy Anchors	750	LF
North American Green-NAG DS150	52,000	CY	**EMBANKMENT CONSTRUCTION**		
Silt Fence with Wire Backing	7,100	LF	Earth Stripping and Stockpiling (on-site)	250	CY
Seeding	4	Ac	Borrow Material	2,520	CY
Rock Check Dam	2	EA	Fill Placement	2,520	CY
16OZ Geotextile Fabric	1,600	SY	**EPSC MEASURES**		
Catch Basin Protection	0	EA	Silt Fence with Wire Backing	9,600	LF
Class A-1 Riprap	60	CY	Seeding	1	Ac
No.57 Stone	200	CY	Riprap Material and Placement	15	CY
18” CMP (Temp. Const. Entrance)	100	LF	**PAVING**		
Class B Riprap	-	CY	Mineral Aggregate Base (2	1,340	Ton

Table 2-4.
Tellico Dam Construction Material Quantities* - Alternative B**

Earthen Design and Construction			Flood Wall Design and Construction		
Item Description	**Quantity**	**Units**	**Item Description**	**Quantity**	**Units**
			ton/cy)		
Mulch	50	CY	Asphalt Pavement (3" thick)	3,750	SY
Straw Waddles	2,700	LF			
PAVING					
Mineral Aggregate Base (2 ton/cy)	81	Ton			
Asphalt Pavement (6" thick)	2,180	SY			
Concrete Sidewalk (4" thick)	450	SF			

*based on 30% design
** This does not include the quantities of concrete and riprap required for the work on the concrete section of the dam

Watts Bar Dam

Under Alternative B, proposed permanent modifications at Watts Bar Dam would consist of two earthen embankments (Segments WB-1 and WB-2), strengthening of an existing floodwall segment (WB-3), and a raised roadway (Figure 2-18). These modifications would occur along the entire length of the Watts Bar Recreation Area where HESCO barriers are currently installed (approximately 1,650 feet total; Figure 1-5). The borrow area that would be used to provide fill material for the earthen work at Watts Bar is shown in Figure 2-19.

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Figure 2-18
Watts Bar Dam Proposed Action

Tennessee Valley Authority

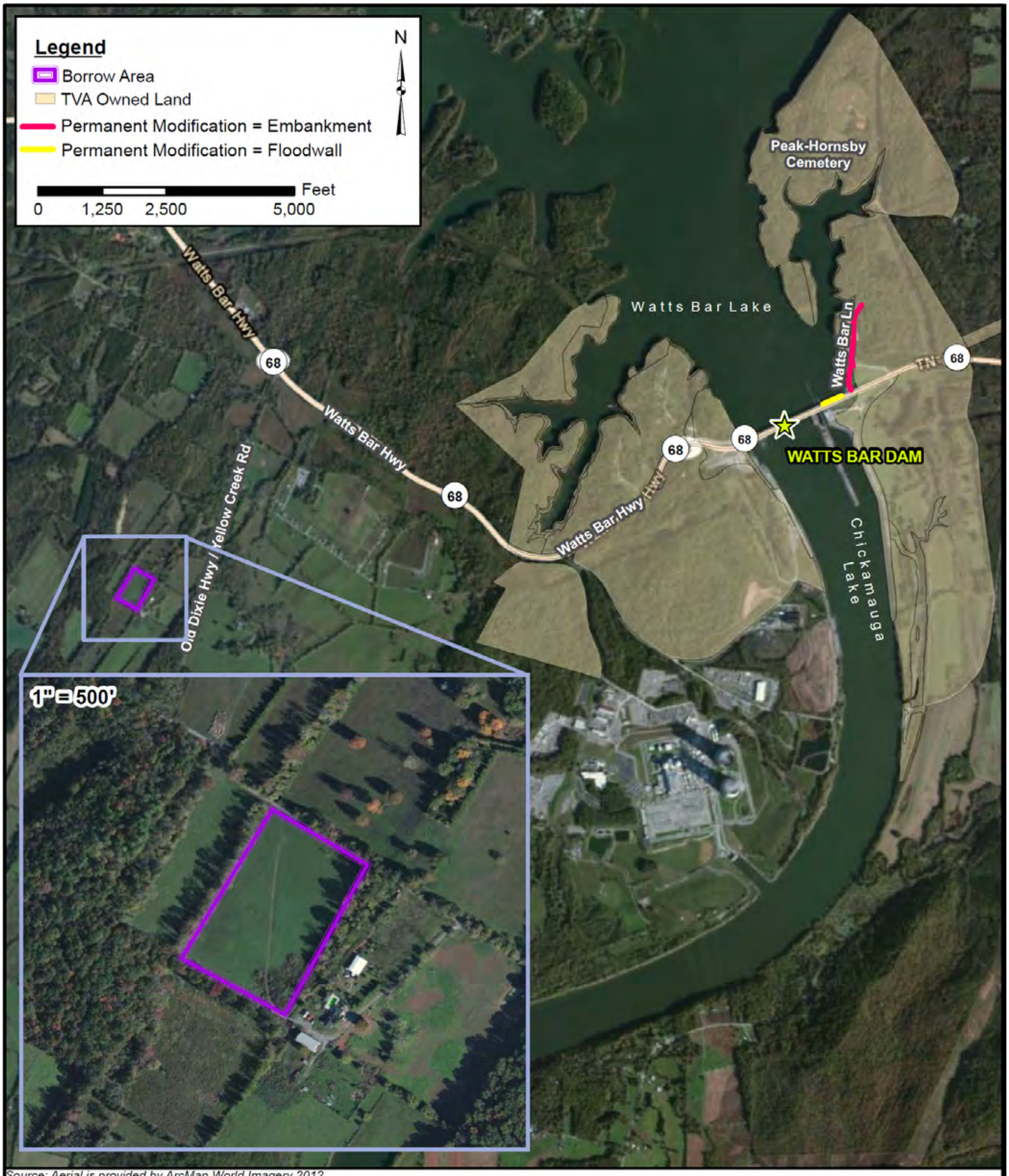

Figure 2-19
Watts Bar Borrow Area

Tennessee Valley Authority

Segment WB-1 begins at the northern end of the Watts Bar Recreation Area and runs for approximately 1,100 feet along the east side of the Recreation Area access road. Segment WB-2 (approximately 550 feet) continues south along the access road until it ties into the east end abutment of the Watts Bar Highway Bridge (Figure 2-18). These new permanent embankments built on the east side of the existing Watts Bar Lane, would increase the total height of the existing embankments by 3.5 feet (Figure 2-20). The WB-1 embankment alignment would permanently close the existing parking area located east of Watts Bar Lane (Figure 2-18); note that this parking area, as well as all the others within the recreation area, would be used for staging throughout the construction period.

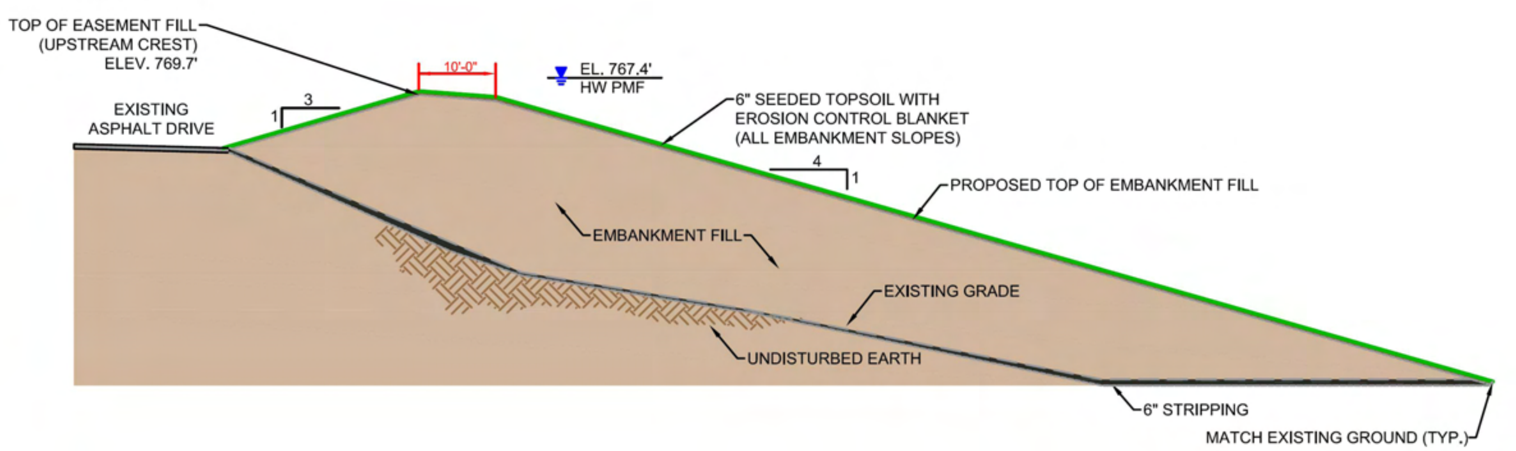

Figure 2-20. Watts Bar Dam – Raised Earthen Embankment Concept for Segments WB-1 and WB-2

The third segment (WB-3) is located under the bridge along the main Watts Bar embankment (Figure 2-18). Under Alternative B, this segment of existing concrete floodwall would be modified to maintain stability under new debris/impact loads. The wall height of Segment WB-3 would not increase, but this portion of floodwall would be strengthened by structural concrete and/or reinforcement.

An approximately 575-foot long portion of the Watts Bar Recreation Area entrance road would be raised 5 feet (Figure 2-21) and a new parking lot would be constructed (Figure 2-18). Construction of this new parking lot and raised roadbed would require the Watts Bar Recreation Area, including the bathrooms, boat ramp, walking trail parking lot, picnic area, and beach area to be temporarily closed to vehicle traffic for a period of approximately 3 days at the beginning of construction and 3 days at the end of construction. During this time, all facilities within the recreation area would remain open to public foot traffic. During construction under Alternative B at Watts Bar, a temporary access road would be built to allow public vehicle access of the boat ramp.

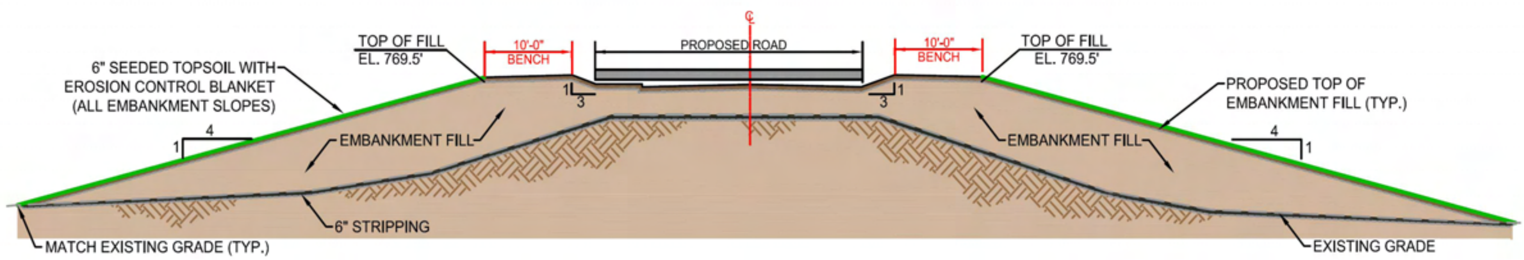

Figure 2-21. Watts Bar Dam – Raised Access Road Concept

The permanent concrete mat structure installed in the downstream embankment of Watts Bar Dam in 2009 would remain in place.

Potential construction staging areas associated with the Watts Bar Dam portion of the project area include the two large parking lots in the recreation area adjacent to the proposed embankments and an area downstream of the dam adjacent to the lock channel (Figure 2-18). The estimated quantities of construction materials for the floodwall and embankment work at Watts Bar Dam are provided below in Table 2-5. Concrete would be delivered by truck from existing commercial concrete plants; potential concrete suppliers for Watts Bar are listed in Table 2-1. The necessary fill material for Segments WB-1 and WB-2 would be obtained from a previously disturbed borrow area located slightly west of Yellow Creek Road (also labeled Old Dixie Highway on some maps), 0.9 miles south of SR68 (the highway that crosses Watts Bar Dam; Figure 2-19). The SR68/Yellow Creek Road intersection is approximately 2.3 road miles west of the dam.

Table 2-5.
Watts Bar Dam Construction Material Quantities* - Alternative B**

Earthen Design and Construction			Floodwall Design and Construction		
Item Description	**Quantity**	**Units**	**Item Description**	**Quantity**	**Units**
SITE PREPARATIONS			**SITE PREPARATIONS**		
Asphalt Removal	3,450	SY	Construction Survey	1	LS
Concrete Disposal	50	CY	Asphalt Removal	1,600	SY
Clearing and Grubbing	3	Ac	Asphalt Disposal	530	CY
HESCO Unit Removal	1,442	LF	Concrete Removal	215	CY
Chain Link Fence Installation	960	LF	Concrete Disposal	215	CY
DRAINAGE STRUCTURES			Traffic Control	1	LS
6" Perforated HDPE Pipe	300	LF	HESCO Unit Removal	460	LF
Vegetative Biofilter for Stormwater Outfall	1	LS	Chain Link Fence Removal	310	LF
EMBANKMENT CONSTRUCTION			Chain Link Fence Installation	310	LF
Earth Stripping and Stockpiling (on-site)	3,000	CY	Pull Box-Remove and Replace	2	EA
Borrow Material	19,100	CY	**WALL CONSTRUCTION**		
Fill Placement	19,100	CY	Fill Excavation	5,300	CY
Sand	110	CY	Concrete Placement	3,240	CY

**Table 2-5.
Watts Bar Dam Construction Material Quantities* - Alternative B****

Earthen Design and Construction			Floodwall Design and Construction		
Item Description	**Quantity**	**Units**	**Item Description**	**Quantity**	**Units**
No. 57 Stone	120	CY	Steel	111,420	LB
No. 2 Stone	1,045	CY	**EMBANKMENT CONSTRUCTION**		
EROSION PREVENTION AND SEDIMENT CONTROL (EPSC) MEASURES			Earth Stripping and Stockpiling (on-site)	530	CY
Silt Fence with Wire Backing	5,660	LF	Borrow Material	1,670	CY
Culvert Protection	1	EA	Fill Placement	1,670	CY
Seeding	3	Ac	**EPSC MEASURES**		
Erosion Control Blanket	26,210	SY	Silt Fence with Wire Backing	670	LF
PAVING			Catch Basin Protection	1	EA
Mineral Aggregate Base (2 ton/cy)	885	Ton	Erosion Control Blanket	2,150	SY
Asphalt Pavement (6” thick)	2,100	SY	Seeding	1	Ac
Concrete Sidewalk (4” thick)	2,740	SF	**PAVING**		
No. 2 Stone	50	CY	Concrete Sidewalk (4”thk)	400	SF
DGA	50	CY	Mineral Aggregate Base (2 ton/cy)	710	Ton
Handicap Access Ramp	16	LF	Asphalt Pavement (6” thick)	1,600	SY
6” Cast in Place Curb	215	LF			

*based on 30% design
** This does not include the quantities of concrete and riprap required for the work on the concrete section of the dam

Removal of the temporary HESCO baskets could require the use of the following construction equipment: tracked excavators (to pull pins and lift baskets), front end loaders (to load crushed stone into trucks), dump trucks (to haul the stone to disposal/stockpile areas), and sweeper trucks (to clean remaining stone off of road). Construction of the earthen embankments could require the use of the following equipment: tracked excavators (at the borrow areas), dump trucks (to haul fill), bulldozers (to spread fill and shape slopes), Sheepsfoot compactors (to compact fill), and concrete trucks (for reconstructing paved walkways). Construction of the concrete floodwalls could require the following equipment: excavator to remove asphalt and dig foundation area, concrete forms, and equipment for forming the shaping and assembling the steel reinforcements.

2.1.3. Alternative C – Permanent Modifications of Dam Structures: All Concrete Floodwalls

Under Alternative C, the HESCO barriers would be removed, and permanent dam modifications consisting entirely of concrete floodwalls and gap closure barriers would be constructed at each dam; no borrow areas would be required for this alternative. The concrete would either be provided by commercial concrete suppliers (Table 2-1) or by onsite concrete batch plants. The permanent concrete mat structure in the downstream embankment of Watts Bar Dam would remain in place. Under this alternative, the potential for failure due to overtopping of the dams during a PMF event would be prevented. This would ensure that the integrity of the embankments would be maintained, thereby increasing the public safety of downstream residents and the safety of TVA's critical nuclear facilities.

Cherokee Dam

Under Alternative C, floodwalls were selected as the permanent modification type for Cherokee Dam main embankment Segments C-1 and C-2 (totaling approximately 6,085 feet; see Figure 2-22). A total of approximately 1,285 feet of concrete floodwall would also be constructed along the downstream (north) side of the TVA access road from Parking Area 3, across Saddle Dam 1, to Parking Area 5 (Segments C-3 through C-5 on Figure 2-22). Approximately 200 feet of concrete floodwall would be constructed at Segment C-3. At Segment C-4, the concrete floodwall would begin at Parking Area 3 and extend along the downstream (north) side of the access road across Saddle Dam No. 1 for approximately 860 feet. The permanent concrete floodwall could also be constructed on the upstream side of the access road; the HESCO barriers currently in place for this segment are located on the upstream side of the access road. A fifth segment (Segment C-5) of concrete floodwalls would extend from west of Parking Area 5 for 225 feet to just east of the Visitor's Building parking area. The final segment (Segment C-6) runs south of the Visitor's Building, along the west side of the parking lot located adjacent to the boat ramp parking area, extending 600 feet, terminating at elevation at the boat ramp access road (Figure 2-22).

All temporary measures at Cherokee Dam would be permanently replaced with concrete floodwalls constructed to a height of approximately 6.6 feet (Figure 2-23).

At Cherokee Dam, two gap closure barriers would be required in order to provide continuous flood protection under Alternative C: 1) located between segments C-2 and C-3, at the southern end of the south embankment (see 'Gate Location' on Figure 2-22), and 2) connecting segment C-5 with the existing elevation at the east corner of the Visitor's Building (Figure 2-22). The exact gap closure barrier type is not known at this time; however, TVA has identified two potential barrier types: (1) Automatic floodgates, and (2) Removable floodwall systems. Automatic floodgates, such as FloodBreak® Automatic Floodgates, would automatically rise during a flood event. Removable floodwall systems, such as the Invincible Flood Control Wall™, would be permanently installed with concrete foundations and steel post anchors. When a flood threatens, vertical support posts are installed and then planks are set in place between the posts. Construction and installation efforts are similar between the two barrier types, as both would require excavating the area where they would be installed and pouring concrete foundations. In addition, both barrier types would require periodic inspections. The automatic floodgates may require periodic maintenance to clear debris, while the removable floodwall system would require nearby staging areas for the support posts and planks. Personnel would be required to install support posts and planks in the removable floodwall system prior to potential flood events.

Source: Aerial is provided by ArcMap World Imagery 2012

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Figure 2-22
Cherokee Dam Alternative C

Tennessee Valley Authority

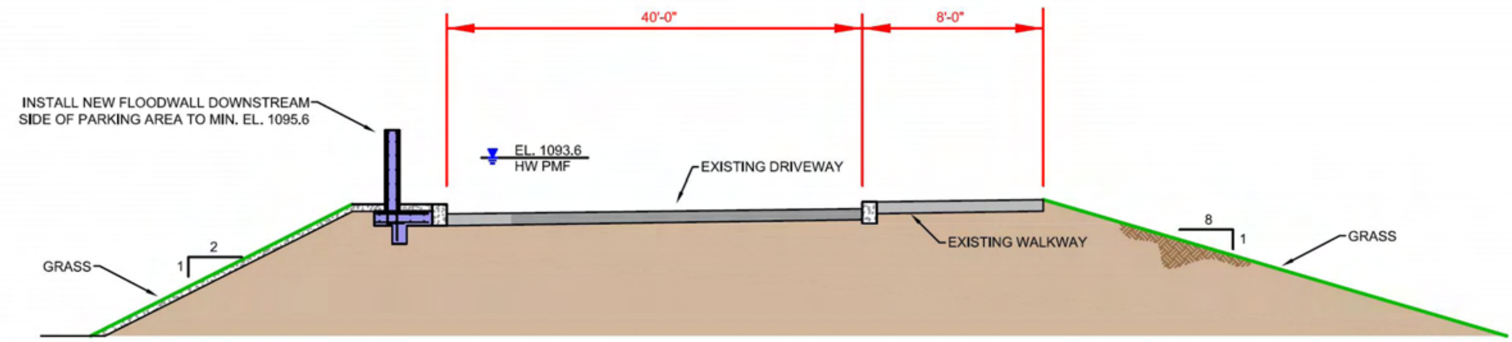

Figure 2-23. Cherokee Dam – Concrete Floodwall Concept for All Segments

Fort Loudoun Dam

At Fort Loudoun Dam, there are three existing segments where concrete floodwalls would replace the temporary HESCO barriers (Figure 1-3). Permanent modifications at Fort Loudoun Dam and the potential construction staging areas are illustrated in Figure 2-24.

The first segment (FTL-1) is located at the north saddle dam near Fort Loudon Marina. The proposed permanent modification for FTL-1 is a concrete floodwall (Figure 2-9) built to a height of 5.8 feet (Figure 2-25). Construction details of concrete floodwall Segments FTL-2 and FTL-3 would be the same as described under Alternative B (Figures 2-9 and 2-10).

Under Alternative C, a gap closure barrier would be required in order to provide continuous flood protection at the connection point between FTL-3 and Tellico Segment T-1 (intersection of Fort Loudoun and Tellico dams near the Tellico Recreation Area; Figure 2-24). As described for Cherokee Dam, the exact barrier type is not known at this time; however, TVA has identified two potential gap closure barrier types: (1) Automatic floodgates, and (2) Removable floodwall systems, described above in the Cherokee Dam section.

Three existing parking lots would be used as temporary construction staging areas during the construction of permanent modifications at Fort Loudoun Dam (Figure 2-24); one of these is adjacent to the north saddle dam near the Fort Loudon Marina. The other two potential staging areas, which would also serve as staging areas for work at Tellico Dam, are located in the Tellico Recreation Area adjacent to: (1) the parking lot near the entrance, and (2) the boat ramp parking lot at the west end of the canal. These areas would be used to store construction materials for the duration of the construction period for permanent modification work at Fort Loudoun and Tellico dams. Approximately 1,295 cubic yards (yds^3) of concrete would be required to construct the floodwalls. This concrete would be delivered by truck from existing commercial concrete plants or from an onsite concrete batch plant serving both Fort Loudoun and Tellico Dams. Potential concrete suppliers for Fort Loudoun and Tellico dams are listed in Table 2-1.

Figure 2-24
Fort Loudoun Dam Alternative C

Tennessee Valley Authority

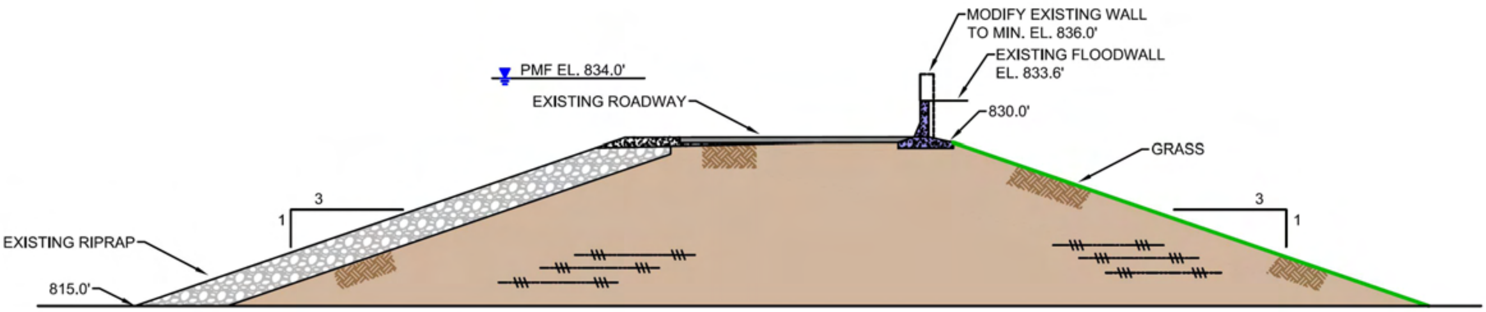

Figure 2-25. Fort Loudoun Dam – Concrete Floodwall Concept for Segment FTL-1 (North Saddle Dam near Marina)

Tellico Dam

Under Alternative C for Tellico Dam, four segments of concrete floodwalls built to a height of 4.8 feet would be installed and no raised embankments would be constructed (Figure 2-26). The first segment, T-1, would likely run southwest for 300 feet along the downstream (west) side of the access road and then northwest/west along the Canal Saddle Dam for 1,900 feet to the Tellico Dam access road and main dam embankment for a total concrete floodwall length of 2,200 feet (Figure 2-26). The permanent modification for Segment T-2 would remain a concrete floodwall on the upstream side of the main embankment, as described under Alternative B. Under Alternative C, permanent modifications to Tellico Segments T-3 and T-4 (Saddle Dams No. 2 and No. 3) would consist of a 525-foot-long concrete floodwall for T-3 and a 300-foot concrete floodwall for T-4 (Figure 2-17). These floodwalls would likely be built on the downstream (west) side of the saddle dams and would be 4.8 feet in height.

As previously discussed under Fort Loudoun Dam, a gap closure barrier would be required in order to provide continuous flood protection at the connection point between FTL-3 and Tellico Segment T-1 (intersection of Fort Loudoun and Tellico dams near the Tellico Recreation Area, Figures 2-24 and 2-26). Additionally, the connection point between Segments T-1 and T-2 at the intersection of the Tellico Dam Access Road would also require a gap closure barrier in order to provide continuous flood protection (Figure 2-26). As described above for Cherokee Dam, the exact barrier type is not known at this time; however, TVA has identified two potential barrier types: (1) Automatic floodgates, and (2) Removable floodwall systems.

Construction staging areas at Tellico Dam are illustrated in Figure 2-26. Approximately 1,990 yds^3 of concrete would be required for the floodwalls. Concrete would be delivered to the project area by truck from existing commercial concrete plants or produced at an onsite concrete batch plant serving both Fort Loudoun and Tellico dams. Potential concrete suppliers for Tellico Dam are listed in Table 2-1.

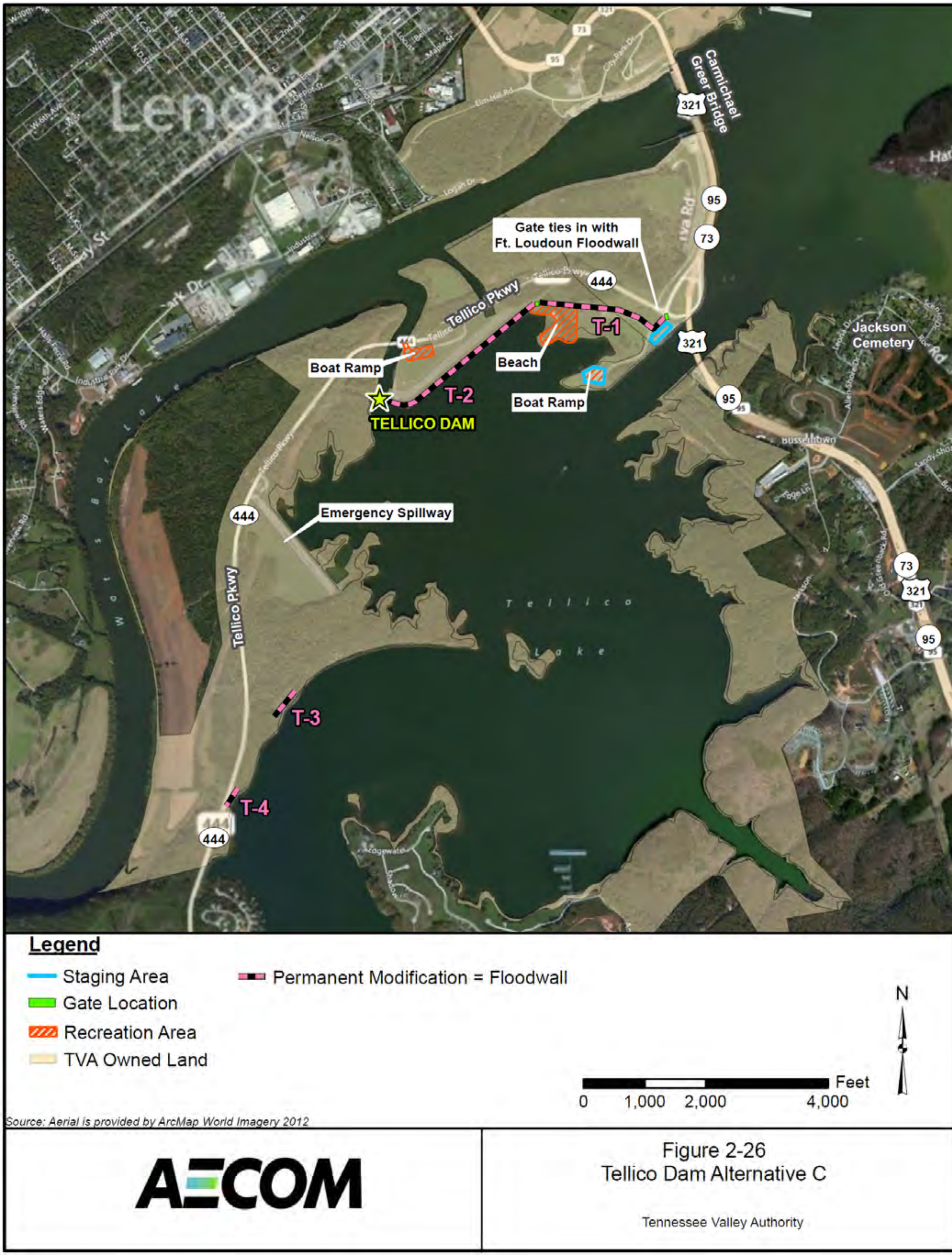

Figure 2-26
Tellico Dam Alternative C

Tennessee Valley Authority

Watts Bar Dam

Under Alternative C, permanent modifications at Watts Bar Dam include five different wall segments (WB-1 through WB-5) varying in length from approximately 300 to 500 feet (Figure 2-27). Concrete floodwalls would be built 2.3 feet tall, likely on the east shoulder of the east embankment road tying into the south embankment of the dam and running north to the campground for a total length of approximately 1,600 feet (Figure 2-27). As opposed to Alternative B, under which the temporary measures at Segments WB-1 through WB-4 were permanently replaced by embankments, Alternative C involves the replacement of temporary measures with concrete floodwalls at these four segments. Approximately 440 yds^3 of concrete would be required to construct the floodwalls. This concrete would be delivered by truck from existing commercial concrete plants. Information on potential concrete suppliers is provided in Table 2-1.

Three gap closure barriers would be required to provide continuous flood protection and maintain existing roadways under the permanent modifications at Watts Bar Dam. The first gap closure barrier structure would be located between segments WB-1 and WB-2, at the opening to an access road (Figure 2-28). The second gap closure barrier would connect Segments WB-2 and WB-3; this gap closure barrier is located at the only entrance to a parking lot that will be used as a construction staging area; therefore, this barrier is potentially unnecessary should TVA decide to permanently close off that parking lot following construction, when it is no longer needed for staging. The third gap closure barrier would be required to maintain Watts Bar Lane as the main roadway into the Watts Bar Dam Recreation Area. Specifically, this barrier would be located between Segments WB-3 and WB-4. As described above for Cherokee Dam, the exact barrier type is not known at this time; however, TVA has identified two potential barrier types: (1) Automatic floodgates, and (2) Removable floodwall systems.

Potential construction staging areas associated with the Watts Bar Dam portion of the Alternative C project area include the two large parking lots in the recreation area adjacent to the proposed floodwalls and an area downstream of the dam adjacent to the lock channel (Figure 2-27).

Legend

- Gate Location
- Permanent Modification = Floodwall
- Staging Area
- Recreational Area
- TVA Owned Land

0 250 500 1,000 Feet

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Source: Aerial is provided by ArcMap World Imagery 2012

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Figure 2-27
Watts Bar Dam Alternative C

Tennessee Valley Authority

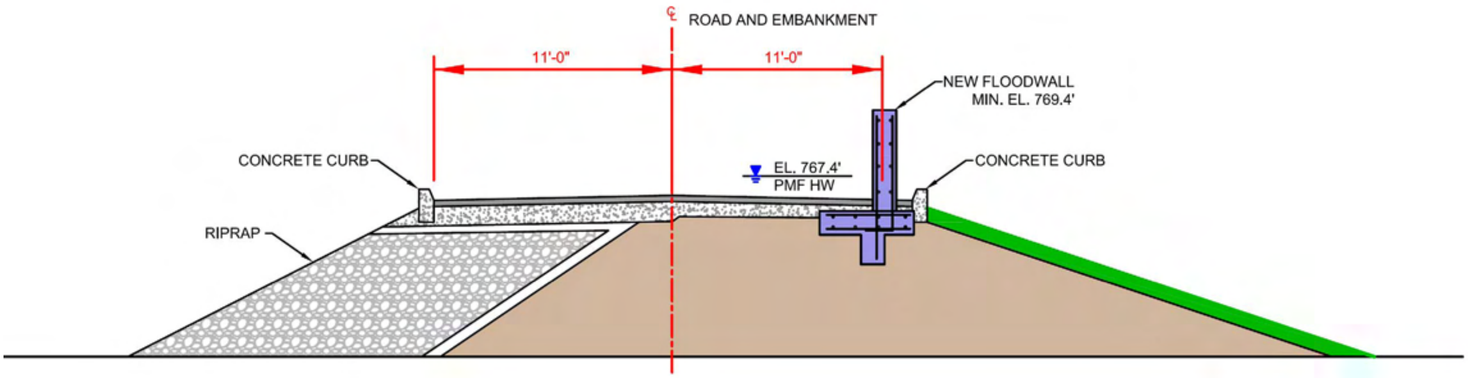


Figure 2-28. Watts Bar Dam – Concrete Floodwall Concept for Segments WB-1 through WB-4

2.1.4. Alternatives Considered but Eliminated From Further Discussion

Several potential alternatives to minimize the potential for failure of Cherokee, Fort Loudoun, Tellico, and Watts Bar dams due to overtopping during the PMF, and which would prevent an increase in flooding at downstream locations including TVA's Watts Bar, Sequoyah, and Browns Ferry Nuclear Plants during the PMF, were evaluated and eliminated from further consideration. These potential alternatives are described below.

Increase Spillway Capacity

Various modifications to one or more of the dams to provide additional capacity for passing water during the PMF were considered. These modifications included:

- Lengthening the existing emergency spillway at Tellico Dam;
- Constructing new emergency spillways at one or more dams;
- Adding spillway gates at one or more dams; and
- Constructing fuse plugs[1] in earthen embankments at one or more dams.

All of these modifications would be major construction projects with the potential for adverse environmental impacts. While they would eliminate the potential overtopping and failure of the dams, they would allow more water to pass the dam during the PMF and increase flood elevations at downstream nuclear plants, as well as other downstream locations. Because they would not prevent an increase in flooding at downstream locations including TVA's nuclear plants, these approaches to increase spillway capacity do not meet the purpose and need of the project.

Change Reservoir Operations

TVA could conceivably revise its reservoir operations policy to provide additional storage that

[1] A fuse plug is a collapsible section of a dam. During all but certain defined, extreme flood conditions, the dam would operate normally with floodwaters passing through the dam's spillway. During the defined extreme flood, the fuse plug section of the dam would wash out to pass floodwaters without further damage to the dam.

would prevent the potential overtopping and failure of the four dams during a PMF. This policy revision would require TVA to permanently lower the pool levels not only at these four projects, but at other projects upstream of Watts Bar Dam to provide the total additional flood storage necessary. This change would forego most of the multiple-purpose benefits currently provided by the dams and reservoirs. In addition, the policy would require higher discharge rates earlier in storm events, which would severely decrease TVA's ability to provide significant flood reduction in lesser events, such as the 10-, 50-, 100- and 500-year flood events. This would result in hundreds of millions of dollars of reduced flood control benefits as well as significantly alter designated floodplains below tributary dams.

TVA's current reservoir operating policy was adopted in 2004 following completion of the Reservoir Operations Study (ROS) and associated Final Programmatic EIS (TVA 2004). During the ROS, TVA conducted an initial screening of 65 policy alternatives for operating the reservoir system. These were screened, narrowed, and condensed to a final set of eight policy alternatives, which were comprehensively analyzed. Each of these "was required to be capable of adjusting the balance of operating objectives in response to expressed public values; continuing basic reservoir system benefits of flood control, navigation, and power production; and being environmentally, economically, and technically feasible" (ROS Executive Summary, TVA 2004: page ES-6). The motivation for the ROS was largely from public pressure to raise pool levels on TVA reservoirs, and none of the policy alternatives considered in detail the lower pool levels and overall increases in flood storage capacity of the magnitude necessary to accommodate the PMF without modifying the dams. One of the early policy alternatives included lower pool levels and increases in flood storage capacity. Even though these changes would have been considerably less than those necessary to accommodate the PMF, TVA rejected this policy alternative because of its unacceptable impacts to other operating purposes. Since the recently completed ROS considered and rejected alternatives which were much less restrictive than a policy designed solely to provide additional flood protection at critical dams and facilities, changing reservoir operations is not a reasonable alternative.

Armor Earthen Embankments

One way to allow water to safely pass through and over Fort Loudoun, Tellico, Watts Bar and Cherokee dams during a PMF without the subsequent failure of the dams would be to armor the earthen embankments at each dam. This would be done by placing concrete, riprap, or other material on the tops of the embankments to protect them from being eroded by floodwaters flowing over them. Although this alternative would prevent the potential failure of the dams, it would allow more water to be passed through and over the dams during the PMF which would increase flood elevations at downstream nuclear plants, as well as other downstream locations. Because they would not prevent an increase in flooding at downstream locations, including TVA's nuclear plants, this alternative does not meet the purpose and need of the project.

Floodproof Watts Bar and Sequoyah Nuclear Plants

During the public scoping for this project, some respondents recommended that TVA consider the alternative of floodproofing the nuclear plants to protect them from increased PMF flood levels instead of modifying the dams. While the construction of walls or levees around the nuclear plants could protect them from flooding during a PMF, this alternative would not prevent the potential overtopping and failure of the four dams during the PMF.

Based on recent cost estimates, floodproofing the three nuclear plants by constructing walls or levees could cost about $1 billion. This alternative would cost much more than the Action

Alternatives, and would not meet the purpose and need of the project because it would not ensure that the dams could safely pass the PMF without failure.

Develop and Implement a Flood Emergency Preparedness Plan

During the public scoping for this project, some respondents recommended that TVA consider the alternative of developing and implementing a flood emergency preparedness plan to prevent damages and loss of life at the nuclear plants and other locations downstream of the four dams during a PMF. TVA already has notification procedures in place that are designed to alert TVA facilities and other agencies of potential flooding. In addition, TVA has developed Emergency Action Plans (EAPs) for all of the TVA dams that are provided to local emergency management agencies. These EAPs provide inundation mapping and other information related to a PMF, and are consistent with the Emergency Action Planning for Dam Owners (FEMA 64) provisions in Federal Guidelines for Dam Safety (FEMA 2004).

While this alternative could reduce some downstream flood damages, it would not significantly reduce the potential for overtopping and failure of the four dams or prevent an increase in flooding at downstream locations, including TVA's nuclear plants during a PMF. Therefore, this alternative would not be consistent with the Federal Guidelines for Dam Safety or the Nuclear Licensing agreements for TVA's operating nuclear plants. This alternative would not meet the purpose and need of the project.

Remove the HESCO Barriers and Return the Dams to Pre-Modification Conditions

Some comments during the public scoping for this project stated that TVA should remove the HESCO barriers and return the dams to their pre-modification conditions. This alternative would not minimize the potential for overtopping and failure of the dams or prevent an increase in flooding at downstream locations, including TVA's nuclear plants during a PMF. It would also be inconsistent with the Federal Guidelines for Dam Safety (FEMA 2004) and the Nuclear Licensing agreements for TVA's operating nuclear plants. This alternative would not meet the purpose and need of the project.

Construct Removable or Hidden Floodwalls

In response to comments received during public scoping, TVA considered constructing removable or hideaway floodwalls that would be deployed when a PMF were to occur. Floodwalls of this type include:

1. Pop-up barriers that are installed along the embankment roadways or access roads and deployed by the force of water moving into the barrier chamber.
2. A wall system consisting of support anchors and bases pre-installed in the embankments with the wall columns and wall planks stored at the dams. In a flood, personnel would be required to install the columns and walls.
3. Inflatable air or water bladders.

These floodwall systems have all been tested and shown to be effective in providing flood protection. However, there are several potential problems in their deployment at the four dams. In the event of a PMF, there would likely be a limited time period between identification of the potential for floodwaters to overtop the dams and when the overtopping would occur. This time period could be inadequate for deploying the floodwalls, given that the shortest total length of deployable floodwalls at one of the dams is 1,100 feet and both Cherokee and Tellico dams would have over a mile of floodwalls. Transporting work crews to the dams would be logistically difficult and once on site, personnel would be working under extreme weather conditions in confined working environments on top of the embankments. Optimal deployment of such systems would more than likely require collaboration with local National Guard units.

Additionally, the cost of installing removable or hidden floodwalls would be substantially greater than Alternatives B and C. The costs of the wall column and plank system described above range from $360,000 for a 100-foot long by 3-foot tall wall to $720,000 for a 100-foot long by 7-foot tall wall as required at Fort Loudoun. These costs do not include installation. For these reasons, removable or hidden floodwalls have been eliminated from further consideration.

Construct Interlocking Block Floodwalls

This potential alternative consists of the construction of floodwalls in the locations described for Alternative B using interlocking solid concrete blocks such as those often used for constructing retaining walls. Although these blocks have previously been used for floodwalls, this is not a common practice and is a relatively untested application of the blocks. Additionally, there are construction and maintenance concerns regarding the joints between the blocks. Mortar would need to be placed between the joints along the full length of the wall to create the watertight barrier. These joints would need periodic inspection and maintenance. For these reasons, this potential alternative was eliminated from further consideration.

2.2. Comparison of Alternatives

Table ES-1 provides a comparison of impacts associated with the No Action Alternative and the action alternatives, Alternative B and Alternative C.

2.3. Identification of Mitigation Measures

TVA would use appropriate best management practices (BMPs) during all phases of construction and maintenance associated with the proposed action. TVA would also establish the necessary traffic controls such as use of warning signs, flagmen, and lane closures during construction and maintenance activities in order to minimize traffic and safety impacts. Under Alternative B, TVA would comply with the terms of the proposed Memorandum of Agreement (MOA) with the USFWS to mitigate impacts to the endangered Indiana bat, as well as any additional terms identified in the final MOA. These terms include delaying the removal of suitable roost trees where feasible until after July 31, surveying for the presence of the bats before removing suitable roost trees prior to July 31, and the mitigation payment of $13,986 to the Indiana Bat Conservation Fund.

2.4. The Preferred Alternative

Throughout the duration of this project, the TVA has continued to improve the engineering design plans at each of the four dams. In April 2013, details from the 65 percent design plan sets for Cherokee, Fort Loudoun, Tellico, and Watts Bar dams became available for inclusion into the final EIS. These updated designs include revisions and new features which were proposed by the TVA, in part, in response to comments received during the 45-day public comment period. Specifically, the TVA has proposed earthen embankments in place of concrete floodwalls at several segments, and proposed raising the pedestrian walkways on top of the main embankments at Cherokee and Tellico, in an effort to reduce impacts to recreation and visual resources.

TVA has identified Alternative B – Permanent Modifications of Dam Structures: *Combination of Concrete Floodwalls and Earthen Embankments* as the Preferred Alternative. This alternative would result in fewer visual impacts at Cherokee, Tellico, and Watts Bar dams than would Alternative C – Permanent Modifications of Dam Structures: *All Concrete Floodwalls*. Alternative C would, however, result in fewer short-term impacts to recreation and visitor use at Cherokee, Tellico, and Watts Bar dams than would Alternative B. Construction costs for Alternative B, approximately $29.5 million, are slightly less than for Alternative C.

CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Chapter 3 - Affected Environment and Environmental Consequences - consists of 17 individual sections that describe the baseline conditions and environmental consequences of the environmental resource areas evaluated in this Dam Safety Modifications EIS. The specific resource areas were chosen to reflect:

- Operating objectives of the TVA flood protection system (e.g., flood control and public safety);
- Issues raised during the scoping process (see Section 1.5); and
- Typical NEPA review topics (e.g., solid and hazardous waste).

Information contained in this chapter establishes the baseline conditions against which the decision maker and the public can compare the potential effects of the alternatives under consideration. The Affected Environment discussion for each resource area identifies the issues of concern used to measure potential impacts on the resource, the study area (or boundaries) for the analysis, the regulatory programs and TVA management activities that govern the resource area, and the existing conditions and future trends for the resource area.

The Environmental Consequences of the Alternatives are also included in Chapter 3 and are broken down into the same 17 individual resource sections. The Environmental Consequences discussions describe the potential impacts of the proposed permanent dam safety modifications on each of the affected environmental resource areas.

Study Area

The general project area is the Tennessee River Valley (Figure 1-1). The study area for each resource area was tailored to the distribution of the resource in the vicinity of each of the four dams: Cherokee, Fort Loudoun, Tellico, and Watts Bar, and the potential effects of the permanent modification alternatives on the resource. For example, Water Resources focused on the reservoirs and tailwaters adjacent to the dams included in Alternative B. Cultural Resources focused on a different area of potential effect (APE) for each reservoir to ensure that the analysis included direct and indirect impacts resulting from the permanent modifications at each dam.

3.1. Geology and Soils

3.1.1. Affected Environment

The geology in East Tennessee includes a system of sedimentary sandstone, shale, and limestone formations and Paleozoic rock formations. The Appalachian Mountains are composed of compressed, folded, and faulted geologic units. Many of these units have been overturned. Thrust or reverse faults are common and result in repeating and overlapping units along each fault plane.

The project area is located in East Tennessee in the Valley and Ridge and Blue Ridge physiographic provinces of the Appalachian Mountains. The Appalachian mountain range includes a number of alternating north-south trending ridges and valleys including the Tennessee River Valley within which the project area is situated. The Valley and Ridge province is a complexly folded and faulted area composed of alternating valleys and ridges. The ridges are composed of more resistant geologic units (typically dolomites and resistant sandstones) ranging up to 3000 feet in elevation. The Valleys are formed by units more susceptible to erosion such as more soluble limestones and dolomites. Dominant soils in this province are residual clays and silts derived from weathering and erosion of the geologic units. Karst topography, including sinkholes, caves, underground drainage systems, and springs, are numerous throughout this province. These karst features are formed when groundwater dissolves the soluble carbonate rocks. The Valley and Ridge province extends 1,200 miles from the coastal plains of Alabama to the St. Lawrence Valley in New York. In eastern Tennessee, the Valley and Ridge province is approximately 40 miles wide (U.S. Army Aviation & Missile Command 2001).

The Blue Ridge province is a narrow belt of mountains trending north-south approximately 12 to 14 miles wide in East Tennessee. The Blue Ridge Mountains are formed of a large, eroded anticline that is overturned to the west. The core of this anticline is composed of igneous and metamorphic formations. The outer flanks of the anticline are younger volcanic and sedimentary units (U.S. Army Aviation & Missile Command 2001). Geologic units in this province include shales, sandstones, conglomerates, and slate. The geologic units generally range from Precambrian (from over a billion years) to Cambrian (about 500 million years) in age.

Cherokee Dam

The geologic units present in the immediate vicinity of Cherokee Dam are the Upper Cambrian part of the Conasauga Shale or Conasauga Group (composed primarily of shale and some limestone) and the Copper Ridge Dolomite (Rodgers 1953). Geologic units present in the vicinity of the Cherokee Dam borrow area include the Chepultepec Dolomite and the Longview Dolomite, both part of the Knox Group (Rodgers 1953).

Soil within the project area for each dam segment includes: Dewey-Etowah complex at dam segment C-1 and arents clays at the other dam segments at Cherokee Dam. Dewey-Etowah complex soils generally include silt loam in the first 0 to 10 inches, silty clay and/or silty clay loam from 10 to 42 inches depth, and silty clay and/or clay from 42 to 60 inches depth. These soils are well-drained. Arents clayey soils are found south of Cherokee Dam in the vicinity of the other dam segments. Depth to groundwater is more than 80 inches for each of these soils (National Resources Conservation Service [NRCS] 2012).

Dunmore silt loam makes up about 45 percent of the soil found in the Cherokee Dam borrow area. A typical soil profile is silt loam from 0 to 8 inches and clay from 8 to 80 inches. These are well-drained soils and the depth to groundwater is greater than 80 inches. Dewey silty clay loam makes up about 35 percent of soil found in the Cherokee Dam borrow area. Its typical soil profile is silty clay loam from 0 to 6 inches and clay from 6 to 72 inches. It is typically well-drained and the depth to groundwater is greater than 80 inches. Etowah silt loam makes about 9 percent of the area; its typical soil profile is silt loam from 0 to 7 inches and silty clay loam from 7 to 70 inches. It is well-drained and depth to groundwater is greater than 80 inches. Other types making up smaller areas are Hamblen silt loam, Greendale silt loam, Leadvale silt loam, Sequoia silty clay loam, and areas classified as urban land. The Greendale silt loam and Hamblen silt loam are classified as prime farmland and total about 12.5 acres (9 percent of the area). The Etowah silt loam, Leadvale silt loam, Dewey silty clay loam, and rolling areas of

Dunmore silt loam are classified as farmland of local importance (U.S. Department of Agriculture [USDA] 2013a). These areas total about 94 acres (67 percent of the area). Most of the site has been heavily disturbed by grading and borrow activities.

Fort Loudoun Dam

Two geologic units are present in the vicinity of Fort Loudoun Dam, the Holston Formation (includes several different rock types but largely limestone or lime-sandstone and significant amounts of hematite), and the Ottosee Shale (with some limestone lenses) (Rodgers 1953). Soil in the vicinity of Segment FTL-1 includes: Tellico clay loam and possibly Alcoa loam in addition to gullied land containing a variety of limestone materials, rockland, and made land. The majority of the project site is located within made land created from imported fill. The western side of the FTL-1 project site is in Tellico clay loam. It is possible a small portion of the project site may be in Alcoa loam to the north. This loam is likely found at the base of the slope where the construction would potentially occur and may or may not be actually within the construction zone. The Alcoa consists of a loam from 0 to 10 inches depth, clay loam from 10 to 21 inches depth, and clay from 21 to 60 inches depth on average. Both the Tellico clay loam and the Alcoa loam are well-drained and the depth to water table is more than 80 inches (NRCS 2013a).

All of the soil in the vicinity of Segment FTL-2 and the majority of the soil in the vicinity of Segment FTL-3 is made land formed from imported fill. Additional soil on the south and west sides of FTL-3 is Waynesboro loam. This soil consists generally of a loam from 0 to 11 inches depth, and a clay loam from 11 to 60 inches depth. The depth to groundwater is over 80 inches (NRCS 2013a).

The proposed Fort Loudoun and Tellico borrow area near the junction of I-75 and US 321 is composed of several soil types. The major types are Fullerton series of cherty silty clay loam, silt loam, and silty clay loam (29 percent of the area), Dewey silty clay loam and silty clay (22 percent), and Decatur silty clay loam (19 percent). A typical soil profile for the Fullerton silt loam is a silt loam from 0 to 14 inches, a silty clay loam from 14 to 18 inches, and clay from 18 to 65 inches. The Fullerton cherty silt loam typical soil profile that consists of a gravelly silt loam from 0 to 14 inches depth, a gravelly silty clay loam from 14 to 20 inches depth, and a gravelly clay from 20 to 60 inches depth. The Fullerton cherty silty clay loam typical soil profile is a gravelly silty clay loam from 0 to 20 inches and a gravelly clay from 20 to 60 inches. The Dewey silty clay loam is described above for the Cherokee Dam borrow area. The Dewey silty clay has a typical profile of 0 to 17 inches of silty clay and 17 to 60 inches of clay. The Decatur silty clay loam has a typical profile, depending on slope, of 0 to 7 inches of silty clay loam, 2 to 14 inches of silty clay, and 14 to 60 inches of clay. All of these major soil types are well-drained with depth to groundwater of over 80 inches (NRCS 2013a).

Other soil types on the borrow area, each comprising less than 6 percent of the area, are Emory silt loam, Farragut silty clay and silty clay loam, Heritage silt loam, Linside silt loam, Melvin silt loam, Minvale silt loam, Sequoia silty clay, and areas classified as gullied land with limestone or shale materials. The Melvin silt loam is poorly drained with depth to groundwater of 0 to 12 inches and the Linside silt loam is moderately well-drained with depth to groundwater of 18-36 inches. The other minor soil types are all well-drained with depth to groundwater of over 80 inches (NRCS 2013a).

The gently sloping phases of the Decatur silty clay loam, Dewey silty clay loam, Emory silt loam, Fullerton silt loam, Hermitage silt loam, Lindale silt loam, and Minvale silt loam are classified as prime farmland. These areas total about 31 acres or 22 percent of the area (NRCS 2013a).

Much of the site has already been heavily disturbed by ongoing borrow activities, and the site is the source of fill being used for the US 321 bridge relocation project.

Tellico Dam

The geologic units present at Tellico Dam are the Holston Formation and the Ottosee Shale, the same geologic units as described above for Fort Loudoun Dam. Three geologic units present in the vicinity of the Tellico Dam borrow area are the Conasauga Shale/Group, Copper Ridge Dolomite, and Chepultepec Dolomite. These are the same geologic units described in the area around Cherokee Dam and the Cherokee Dam borrow area above.

The soils in the vicinity of Segment T-1 from east to west include: Waynesboro loam (as described above in the vicinity of Segment FTL-3), Emory silt loam (similar to that described at the Tellico borrow area above), and Cumberland silty clay loam. Cumberland silty clay loam generally consists of a silty clay loam from 0 to 12 inches and a clay loam from 12 to 60 inches. These are all well-drained soils and the depth to groundwater averages 60 to 80 inches (NRCS 2013a).

Soils in the vicinity of Segment T-2 include: Etowah silt loam, Congaree loam, and Sequatchie loam. A typical soil profile for Etowah includes silt loam from 0 to 8 inches depth and silty clay loam from 8 to 60 inches depth. This is a well-drained soil and the depth to groundwater is more than 80 inches. A typical soil profile for Sequatchie loam includes a loam from 0 to 12 inches depth and a clay loam from 12 to 60 inches depth. These are all well- drained soils. The depth to groundwater ranges from 30 to 48 inches to more than 80 inches (NRCS 2013a).

Dam segments T-3 and T-4 soils include Bland silty clay, Cumberland silty clay (as described above in the vicinity of Segment T-1), and Fullerton silt loam. A typical profile for Bland soils is silty clay loam from 0 to 6 inches depth, silty clay from 6 to 20 inches depth, and unweathered bedrock at 20 to 40 inches depth. A typical Fullerton profile is silt loam from 0 to 14 inches, silty clay loam from 14 to 18 inches, and clay from 18 to 65 inches. These are well- drained soils and the depth to groundwater is more than 80 inches (NRCS 2013a).

The soils in the joint Fort Loudoun and Tellico borrow area are described above in the Fort Loudoun Dam subsection.

Watts Bar Dam

Two geologic units are present within the Watts Bar Dam project area, the Rome Formation (a mix of sandstone, shale, dolomite, and limestone) and the Conasauga Group (same as that described in the area around Cherokee Dam) (Rodgers 1953).

In the vicinity of the dam segments and Watts Bar staging areas, soils include Waynesboro gravelly loam (similar to that described above for the borrow area) and Udorthents-Urban land complex. Urban land makes up approximately 55 percent of these soils. No description was available for the Udorthents soils which comprise an additional 35 percent of this soil complex in this area. The depth to water table is more than 80 inches (NRCS 2013b).

About 62 percent of the Watts Bar borrow area is comprised of Colbert and Lyerly soils. These soils have a typical profile of 0 to 6 inches of silty clay loam, 6 to 63 inches of clay over bedrock. They are moderately well-drained with depth to groundwater of 24 to 63 inches. Capshaw silt loam makes up about 29 percent of the area, and the remainder is the steeply sloping Barfield-

Rock outcrop complex and Fullerton gravelly silt loam (NRCS 2013c). The Capshaw silt loam has a typical profile of 0 to 4 inches of silt loam, 4 to 24 inches of silty clay loam, 24 to 36 inches of clay, and 36 to 72 inches of silty clay. It is moderately well-drained with depth to groundwater of 24 to 42 inches. The Capshaw silt loam is the only soil type on the proposed borrow area that is classified as prime farmland; it occurs on about 2.3 acres of the 8-acre borrow area (NRCS 2013c).

3.1.2. Environmental Consequences

This section discusses the potential impacts to soils and geologic resources under the three project alternatives for all four project areas.

3.1.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, the existing HESCO barriers would be maintained and replaced as required. There would be no adverse direct, indirect, or cumulative impacts to soils or geologic resources within the project area or at the borrow sites beyond what already occurs during ongoing maintenance activities or borrow activities.

3.1.2.2. Alternative B – Combination Floodwalls and Embankment/Berms

Construction of the floodwalls and berms would have similar and minor impacts on the geology and soils at each of the dam segment locations. Construction activities would disturb existing soils and could extend into the upper portions of underlying geologic units at each dam segment. Impacts to the soils would be minor and temporary. Soils around the project area and underlying berms would be potentially disturbed during the construction process. Use of BMPs for control of dust mobilization such as application of water to control dust and periodic street sweeping and/or wetting down of paved surfaces would aid in preventing fugitive dust from becoming airborne. Construction activities would be phased across the project area minimizing potential dust activation. Following completion of project construction, sod would be repaired as needed in areas that were disturbed. For soils underlying newly constructed berms, some compaction would occur; however, the soils themselves would remain intact. Overall, impacts to soils would be minor and could range from short-term to long-term.

Impacts to geologic units at the dam segment project sites would be minor; construction activities could potentially disturb a few square feet of rock depending on how deep floodwall components were installed. Though disturbed rock would be permanently displaced, the amount of material disturbed would be minor and the disturbances would be concealed by the permanent presence of the floodwall. Overall, potential impacts to geologic resources are anticipated to be minor.

Use of soil from the three designated borrow areas would adversely impact the soils located within those borrows through permanent removal of those soil resources. The Cherokee and Fort Loudoun/Tellico areas are currently being used as borrow areas for construction projects; therefore, though adverse, these impacts would be commensurate with the existing impacts at these locations independent of Alternative B. Most of the areas of prime farmland and farmland of local importance on the Cherokee Dam borrow area have already been recently disturbed by borrow and site development activities, and the use of the site as a borrow area by TVA would result in little to no additional impacts on farmland soils. The use of the Watts Bar borrow area would affect about 2.3 acres of prime farmland; given the amount of prime farmland in the surrounding area, the effects of this would be insignificant.

3.1.2.3. Alternative C – All Floodwalls

Potential impacts to geology in association with the implementation of the floodwalls only Alternative C action would be similar to those described for Alternative B for all dams. Impacts to soils would be restricted to the minor impacts resulting from excavation and construction of the floodwall foundations.

3.2. Water Resources

This section describes an overview of conditions at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams, the water resources associated with these reservoirs, and the impacts on water resources from the No Action and Action alternatives. Components of water resources that are analyzed include surface water, groundwater, and water quality.

3.2.1. Affected Environment

TVA reservoirs affect the quality of valley waters by changing the thermal characteristics, residence times (length of time water spends in a reservoir), oxygen consumption and re-aeration, particle settling, algal growth, and cycling of nutrients and other substances (TVA 1978). Extended dry periods during the last 15 years have heightened public awareness of water as a finite resource and have raised questions concerning the availability of surface water and groundwater resources in the Tennessee River watershed. Increasingly, water is seen as a scarce resource that must be protected and managed. Groundwater supplies are limited in many areas of the watershed and some are of poor quality, but groundwater use has been in decline for the past 10 years and is anticipated to remain constant over the next 30 years (Bohac and Koroa 2004).

Groundwater supplies in the Tennessee River watershed are used for industry, public and domestic supplies, and irrigation. The median daily public use of groundwater in the Tennessee River watershed during the past 35 years is 245 mgd and the daily public use range is 170 mgd to 305 mgd (Bohac and Koroa 2004). The greatest groundwater withdrawals occur near the major population centers of the Tennessee Valley region.

3.2.1.1. Surface Water

The water quality in TVA's Reservoir System is affected by many factors such as the quality of water in streams flowing into the reservoirs, land use practices on lands along the reservoirs, point and nonpoint source discharges into the reservoirs and TVA's operation of the many dams in the reservoir system. TVA monitors the health of its reservoirs through the Vital Signs Monitoring Program (VSMP). This program was initiated by TVA in 1990 and monitoring is typically on a two-year cycle. Reservoirs throughout the Tennessee Valley are monitored for physical and chemical characteristics of water, sediment contaminants, benthic macroinvertebrates (bottom-dwelling animals such as worms, mollusks, insects, and snails living in or on the sediments) and fish community assemblage. Five key indicators (dissolved oxygen [DO], chlorophyll, fish, bottom life, and sediment contaminants) are monitored and contribute to a final rating that describes the "health" and integrity of an aquatic ecosystem.

TDEC has established water quality standards and designated uses for streams and lakes across the state and issues periodic reports on water bodies not meeting these standards and uses (the 303(d) list, TDEC 2010b). This section describes the water quality in the vicinity of Cherokee, Fort Loudoun, Tellico, and Watts Bar dams based on VSMP results and TDEC reports. VSMP results for fish and bottom life are described in the aquatic ecology section.

Since the 1980s, TVA has worked through its Lake Improvement Plan and Reservoir Releases Improvement (RRI) program to improve water quality in its reservoirs and in the tailwaters below its dams. TVA has installed equipment at many dams, including Cherokee, Fort Loudoun, and

Watts Bar, to increase DO levels in tailwaters and has made operational changes to maintain minimum flows below dams when hydroelectric generators are not operating.

Cherokee Dam

Cherokee is a relatively deep storage impoundment with a long retention time and plentiful nutrient inputs, resulting in low DO levels, high chlorophyll levels, and strong vertical stratification during summer months. Due in large part to these factors, the overall VSMP rating for Cherokee Reservoir for 2010 was poor. The majority of the previous overall ratings have been poor except for 1995 and 2008, when the rating was fair (TVA 2012a). At the forebay monitoring location (a short distance upstream of the dam) in 2010, DO rated poor, chlorophyll rated good, and sediment rated fair. TVA has installed a turbine venting system, and in the forebay area, surface water pump and oxygen diffuser systems to improve DO conditions in the forebay and in the Holston River downstream of the dam. The fair rating for sediment is due to slightly elevated concentrations of copper. Chlordane, a pesticide previously used to control termites and crop pests, has been found in previous years at the forebay site and has been a factor in previous sediment ratings.

Designated use classifications for Cherokee Reservoir and the Holston River downstream of the dam are domestic and industrial water supply, fish and aquatic life, recreation, livestock watering, wildlife, and irrigation (TDEC 2007). While the upper portion of Cherokee Reservoir is listed as impaired due to mercury contamination from atmospheric deposition and upstream sources, the lower portion of Cherokee Reservoir is considered to meet water quality criteria for designated uses. Mossy Creek, a tributary to the reservoir located a short distance upstream of the dam, is listed as impaired due the presence of zinc and *E. coli* bacteria, and the loss of biological integrity due to siltation. Sources of these pollutants are mining, the failure of wastewater collection systems, and municipal stormwater discharges (TDEC 2010b).

The Holston River downstream of Cherokee Dam is listed on the 2010 303(d) list as impaired due to low DO and habitat loss due to stream flow alteration; both impairments are suspected to have resulted from the impoundment of the river by the dam (TDEC 2010b).

Borrow and Staging Areas

The two proposed construction staging areas are located on established, impervious surface parking areas. Stormwater run-off from the staging area near the north embankment would most likely flow via sheet or channel run-off into established drainage ditches on the dam reservation and would eventually enter the river downstream of the dam. The south embankment staging area drains north into the tailwater because the elevation at the south staging area is lower than the crest of the dam on the downstream side.

The proposed borrow area is an established borrow site in a developing commercial and industrial area mostly within the city limits of Morristown (Figure 2-2). Stormwater drainage from this area is to the south to tributaries of Cedar Creek and Sinking Creek. These creeks empty into Long Creek which flows to the east to the Nolichucky River. Stormwater management facilities including drainways and sediment ponds are already established on the borrow area.

Fort Loudoun Dam

The overall TVA VSMP rating for Fort Loudoun Reservoir for 2009 was poor, largely due to low ratings for chlorophyll and bottom life (TVA 2012a). Previous overall ratings have most often been poor with occasional ratings of fair. Ratings at the forebay location in 2009 were poor for DO and chlorophyll, and good for sediment (TVA 2012a). TVA has installed an oxygen-injection system to improve DO conditions in the forebay area and downstream tailwater.

Designated uses for Fort Loudoun Reservoir and the Tennessee River downstream of the dam are domestic and industrial water supply, fish and aquatic life, recreation, livestock watering, wildlife, irrigation, and navigation (TDEC 2007). Fort Loudoun Reservoir is included on the State of Tennessee's Section 303(d) list as impaired due to sediment contamination by polychlorinated biphenyls (PCBs) (TDEC 2010b). Additionally, a precautionary fish consumption advisory for Fort Loudoun Reservoir is in place due to PCB contamination. Commercial fishing for catfish is prohibited by the Tennessee Wildlife Resources Agency (TWRA). Several tributary streams to Fort Loudoun Reservoir are listed as impaired for causes including siltation, habitat loss due to alteration of the substrate and stream-side vegetative cover, and the presence of *E. coli* bacteria (TDEC 2010a). The Fort Loudoun tailwater is listed as impaired due to sediment contaminated with PCBs and low DO resulting from the upstream impoundment.

Borrow and Staging Areas

The two of the three potential construction staging areas are located within established impervious surface parking areas. The third area identified for construction staging is located just north of the saddle dam near Fort Loudon Marina (Segment FTL-1). This staging area would be located on TVA-owned land, in a grassed field adjacent to agricultural land. The FTL-1 staging area is drained by sheet flow and ditches to Muddy Creek, which flows southwest into the river a short distance downstream of Fort Loudoun Dam. The other two areas, which would also serve as construction staging areas for work at Tellico Dam, drain via sheet flow to Tellico Reservoir.

The proposed joint Fort Loudoun and Tellico borrow area is an established borrow site in a developing commercial and industrial area within the city limits of Lenoir City (Figure 2-7). The site is drained by Town Creek which crosses the site and flows south into the Fort Loudoun Dam tailwater. Sedimentation controls including drainways, stream buffers, and a sediment pond are established on the site.

Tellico Dam

Most of the water in Tellico Reservoir flows through the canal connecting to Fort Loudoun Reservoir, and the exchange of water through the canal affects water quality within Tellico Reservoir. The canal is 20 to 25 feet deep, while the depth of Tellico Reservoir at the forebay is about 80 feet. Therefore, only the warmer surface layers are discharged, and water below about 25 feet is trapped in the forebay by thermal stratification and becomes anoxic (oxygen deprived) during much of the summer (TVA 2003). Water released from Tellico Dam enters the Fort Loudoun tailwater, described above.

The overall TVA VSMP rating for Tellico Reservoir for 2009 was poor (TVA 2012a). Tellico has rated either poor or at the low end of the fair range, except in 1994 when it scored high in the fair range. Ratings at the forebay location in 2009 were poor for DO and chlorophyll, and good for sediment. Forebay dissolved oxygen ratings have historically fluctuated between good and poor due to weather-related changes in reservoir flows. Previous forebay ratings for chlorophyll and sediment have typically been poor and good, respectively.

Designated uses for lower Tellico Reservoir are domestic and industrial water supply, fish and aquatic life, recreation, livestock watering, wildlife, irrigation, and navigation (TDEC 2007). Tellico Reservoir is included on the state Section 303(d) list as impaired due to sediment contamination by PCBs and the presence of mercury from atmospheric deposition (TDEC 2010b). The State of Tennessee has issued fish consumption advisories due to the PCBs and mercury. There were no swimming advisories for bacterial contamination on Tellico Reservoir as of 2010 (TDEC 2010a).

Borrow and Staging Areas

The two potential construction staging areas are established impervious surface parking areas (Figure 2-13). These areas drain via sheet flow to Tellico Reservoir. The borrow area is described above in the Fort Loudoun section.

<u>Watts Bar Dam</u>

The overall VSMP rating for Watts Bar Reservoir for 2010 was poor (TVA 2012a). Previous ratings have fluctuated between poor and fair based on weather-related flow conditions. Forebay ratings for 2010 were poor for DO and chlorophyll and fair for sediment. Forebay DO ratings have historically fluctuated between poor and good, primarily due to reservoir flows. TVA has installed an oxygen diffuser system in the forebay to increase DO levels in the forebay and tailwater. Forebay chlorophyll concentrations have historically fluctuated with no overall trend. While sediment quality rated fair, sampling since 1994 has periodically detected elevated amounts of arsenic, low levels of PCBs and the insecticide Chlordane and in 2006 the insecticide Lindane (TVA 2012a).

Designated uses for Watts Bar Reservoir and its tailwater are domestic and industrial water supply, fish and aquatic life, recreation, livestock watering, wildlife, irrigation, and navigation (TDEC 2007). Watts Bar Reservoir is included on the state (of Tennessee) Section 303(d) list as impaired due to sediment contamination by PCBs (TDEC 2010b). The State of Tennessee has issued fish consumption advisories due to the PCBs.

Borrow and Staging Areas

One of the potential construction staging areas is located in the recreation area and would utilize an impervious surface parking area. Stormwater run-off from this area flows via sheet or drainage ditches to Watts Bar Reservoir. The other potential construction staging area is an area of mowed lawn downstream of the dam and adjacent to the lock canal. Stormwater run-off from this area flows via sheet and/or ditches into the Tennessee River (Figure 2-18).

The proposed borrow area is located is an open field bordered by a tributary to Yellow Creek. Yellow Creek flows to the southeast into the Watts Bar tailwater (Figure 2-19).

3.2.1.2. Groundwater

The project area is located in the Valley and Ridge Physiographic Province and is underlain by Cambrian aged rocks of the Conasauga Group and Ordovician aged rocks of the Knox group.

The Valley and Ridge aquifer consists of folded and faulted carbonate, sandstone, and shale. Soluble carbonate rocks and some easily eroded shales underlie the valleys in the province, and more erosion-resistant siltstone, sandstone, and cherty dolomite underlie ridges. The arrangement of the northeast-trending valleys and ridges are the result of a combination of folding, thrust faulting, and erosion. Compressive forces from the southeast have caused these rocks to yield, first by folding and subsequently by repeatedly breaking along a series of thrust faults. The result of the faulting is that geologic formations are repeated several times across the region. Carbonate-rock aquifers in the Chickamauga, the Knox, and the Conasauga Groups are repeated throughout the Valley and Ridge Physiographic Province (Lloyd and Lyke, 1995).

The general hydrogeologic characteristics of the entire Valley and Ridge Province are fairly consistent. However, unique characteristics can be attributed to local differences in rock type and geologic structure. Groundwater movement in the Valley and Ridge Province is localized, restricted by the repeating lithology created by thrust faulting. Older rocks, primarily the Conasauga Group and the Rome Formation, have been displaced upward over the top of younger rocks (the Chickamauga and the Knox Groups) along thrust fault planes thus forming a repeating sequence of permeable and less permeable hydrogeologic units. The repeating sequence, coupled with the stream network, divides the area into a series of adjacent, isolated, shallow groundwater flow systems. The water moves from the ridges where the water levels are high, toward lower water levels adjacent to major streams that flow parallel to the long axes of the valleys. Most of the groundwater is discharged directly to local springs or streams (Lloyd and Lyke 1995).

Yields of wells completed in the principal Valley and Ridge aquifers range from about 1 to 2,500 gallons per minute (gpm). The largest yields (2,500 gpm) are reported for wells completed in the Honaker Dolomite of the Conasauga Group. Large yields also are reported for wells completed in limestone or dolomite of the middle and lower parts of the Chickamauga Group, the Knox Group, and the Shady Dolomite (all about 500 gpm). The median yields of wells completed in the principal aquifers range from about 11 to 350 gpm; the largest median yields are for wells in the Shady Dolomite (350 gpm), the middle part of the Conasauga Group (100 gpm), and the Newman Limestone (55 gpm) (Lloyd and Lyke 1995).

The discharges of springs that issue from the principal Valley and Ridge aquifers in eastern Tennessee vary greatly; measured discharges range from about 1 to 5,000 gpm. The largest springs issue from the Newman Limestone and the Lenoir Limestone of the Chickamauga Group. Springs that issue from the Knox Group discharge as much as 4,000 gpm. The median discharges of springs that issue from the principal aquifers range from 20 to 175 gpm. The largest median discharges are from springs that issue from the Shady Dolomite (175 gpm), the Knox Group (50 gpm), and the upper part of the Conasauga Group (40 gpm). Many springs discharge as much as 10 times more water during periods of abundant rainfall than during extended periods of little or no rainfall (United States Geological Survey [USGS] 1995).

The chemical quality of water in the freshwater parts of the Valley and Ridge aquifers is similar for shallow wells and springs. The water is hard, of a calcium magnesium bicarbonate type, and typically has a dissolved-solids concentration of 170 milligrams per liter (mg/L) or less. The ranges of concentrations are thought to be indicators of the depth and rate at which groundwater flows through the carbonate-rock aquifers. In general, the smaller values for a constituent represent water that is moving rapidly along shallow, short flow paths from recharge areas to points of discharge. This water has been in the aquifers for a short time and has accordingly dissolved only small quantities of aquifer material. Conversely, the larger values represent water that is moving more slowly along deep, long flow paths. Such water has been in contact with aquifer minerals for a longer time and thus has had greater opportunity to dissolve the minerals (USGS 1995).

In places where the residuum that overlies the carbonate rocks is thin, the Valley and Ridge aquifers are susceptible to contamination by human activities. The complex network of fractures, bedding planes, and solution openings developed in the carbonate rocks allows rapid local groundwater movement. The natural groundwater quality is subject to degradation in places where landfills and other waste-disposal sites, underground storage tanks, and septic tank systems are located (USGS 1995).

Groundwater supplies in the Tennessee River watershed are used for industry, public and domestic water supplies, and irrigation. The median daily public use of groundwater in the Tennessee River watershed during the past 35 years is 245 mgd; the daily public use in 2000 was 215 mgd. Groundwater withdrawal rates for each reservoir include: Cherokee groundwater withdrawals of 13.64 mgd; Fort Loudoun groundwater withdrawals of 2.3 mgd, Tellico groundwater withdrawals of 0.27 mgd; and Watts Bar withdrawals of 0.99 mgd (TVA 2004). These rates are groundwater withdrawals from each reservoir hydrologic unit.

3.2.2. Environmental Consequences

This section contains an analysis of potential impacts to water resources under the No Action and Action Alternatives proposed at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams.

3.2.2.1. Alternative A – No Action Alternative

<u>Surface Water</u>

Under the No Action Alternative, TVA would continue to use the HESCO barriers as a solution to prevent flood overtopping and potential impacts to the dam embankments and possible dam failure. None of the HESCO barriers are located in water; therefore, no direct or indirect impacts to surface water at Cherokee Dam, Fort Loudoun Dam, Tellico Dam, or Watts Bar Dam would occur.

<u>Groundwater</u>

Under the No Action Alternative, TVA would continue to use the HESCO barriers as a solution to prevent flood overtopping and potential impacts to the dam embankments and possibly dam failure. No HESCO barriers were installed in water; therefore, no direct or indirect impacts to groundwater would occur.

3.2.2.2. Alternative B – Combination Floodwalls and Embankments

<u>Surface Water</u>

Under Alternative B, the HESCO barriers would be replaced with concrete floodwalls and, where feasible, raised earthen embankments or berms. Run-off of fine sediments and pollutants (such as gasoline and oil for construction machinery) could occur temporarily during construction. Elevated levels of suspended sediment in aquatic habitats are known to interfere with respiration, feeding, and reproduction in aquatic animals such as fish and mussels;

however, BMPs used during construction of the concrete floodwalls and earthen embankments (such as silt fencing and diking) would be implemented to prevent any pollutants or sediment from entering the surface water at the construction, staging and borrow areas. No construction would occur in the water; therefore, as no sediment or pollutant would enter surface waters, no direct or indirect impacts are anticipated at Cherokee Dam, Fort Loudoun Dam, Tellico Dam, or Watts Bar Dam under Alternative B. BMPs are established at the Cherokee and Fort Loudoun/Tellico borrow areas and would be upgraded as necessary to support the use of the areas by the TVA. The TVA and its construction contractor would use appropriate BMPs at the Watts Bar borrow areas. These measures would minimize sedimentation and other water quality impacts from the use of the borrow areas to an insignificant level.

Groundwater

No in-water construction would occur and Alternative B would not require any major excavation activities. Construction of the floodwalls would require excavation to a relatively shallow depth at the project sites, but it would not impact the water table. Under Alternative B, extraction of fill material from borrow areas for construction of earthen embankments/berms could affect the local water balance by the removal of saturated materials; however, no aquifers would be de-watered for excavation of fill material and BMPs would be implemented to prevent run-off of sediment and pollutants to surface water. Thus, no direct or indirect impacts to groundwater at any of the dam locations are anticipated.

3.2.2.3. Alternative C – All Floodwalls

Surface Water

Under Alternative C, the HESCO barriers would be replaced with permanent concrete floodwalls. No work would occur in the water. Under this alternative, there is less potential for sediment run-off into the forebays and tailwaters of the subject dams resulting from construction of the floodwalls alone compared to Alternative B, which includes earthen embankments and berms. Similar BMPs to those implemented under Alternative B would be in place. Therefore, no direct or indirect impacts to surface water are anticipated under Alternative C.

Groundwater

Under Alternative C, floodwalls would be constructed to raise the embankments. Similar BMPs to those implemented under Alternative B would be in place. Therefore, no direct or indirect impacts to groundwater under Alternative C would be anticipated at any of the dams.

3.3. Air Quality and Greenhouse Gas Emissions

3.3.1. Affected Environment

Air Quality

Through its passage of the Clean Air Act of 1963 (CAA) and its amendments, Congress has mandated the protection and enhancement of our nation's air quality. The U.S. Environmental Protection Agency (USEPA) has established the National Ambient Air Quality Standards (NAAQS) for the following criteria pollutants to protect the public health and welfare:

- sulfur dioxide;
- ozone;
- nitrogen dioxide;
- particulate matter whose particles are <= 10 micrometers (PM_{10})
- particulate matter whose particles are <= 2.5 micrometers ($PM_{2.5}$)
- carbon monoxide; and
- lead.

The primary NAAQS were promulgated to protect public health, and the secondary NAAQS were promulgated to protect public welfare (e.g., visibility, crops, forests, soils and materials) from any known or anticipated adverse effects of air pollutants. Areas in violation of the NAAQS are designated as nonattainment areas, and new sources being located in or near these areas may be subject to more stringent air permitting requirements. Nonattainment areas are usually defined by county. In the vicinity of some large metropolitan areas, a group of counties can be designated as being in nonattainment. In some cases, a portion of a county impacted by a large emission source can be designated as a partial nonattainment area. National standards (Table 3.3-1), other than annual standards, are not to be exceeded more than once per year (except where noted).

Table 3.3-1.
National Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Time
Carbon Monoxide	9 ppm	8-hour	None	
	35 ppm	1-hour		
Lead	0.15 μg/m^3	Rolling 3-month average	Same as Primary	
	1.5 μg/m^3	Quarterly average	Same as Primary	
Nitrogen Dioxide	0.053 ppm	Annual (arithmetic average)	Same as Primary	
	0.100 ppm	1-hour	None	
Particulate Matter	150 μg/m^3	24-hour	Same as Primary	

Table 3.3-1.
National Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Time
(PM_{10})				
Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3	Annual (arithmetic average)	Same as Primary	
	35 µg/m^3	24-hour	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour	Same as Primary	
	0.08 ppm (1997 std)	8-hour	Same as Primary	
	0.12 ppm	1-hour	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (arithmetic average)	0.5 ppm	3-hour
	0.14 ppm	24-hour	None	
	75 ppb	1-hour	None	

Source: USEPA NAAQS http://www.epa.gov/air/criteria.html ppm = parts per million, ppb = parts per billion, µg/m^3 = micrograms per cubic meter

Air quality in the vicinity of the four dams is generally good. Rhea and Meigs County, which are connected by Watts Bar Dam, are in attainment for all air pollutants. The other counties in which the dams are located, Jefferson and Grainger, are in attainment for all pollutants (USEPA 2012a, USEPA 2012b, and USEPA 2012c).

Greenhouse Gas Emissions

Gases which trap heat in the atmosphere are called Greenhouse Gas (GHGs) and most have both natural and anthropogenic sources. These compounds trap and convert sunlight into infrared heat. In this way, GHGs act as insulation in the stratosphere and contribute to the maintenance of global temperatures. As the levels of greenhouse gases increase at ground level, the result is an increase in temperature on earth, commonly known as global warming. The climate change associated with global warming is predicted to produce negative economic and social consequences across the globe through changes in weather (e.g., more intense hurricanes, greater risk of forest fires, flooding).

The most common GHGs emitted from natural processes and human activities include carbon dioxide, methane, and nitrous oxide. The primary GHGs emitted by human activities in the U.S. is carbon dioxide, representing approximately 85 percent of total GHG emissions. The largest source of carbon dioxide and of overall GHG emissions is fossil fuel combustion. Emissions of methane, which have declined from 1990 levels, result primarily from enteric fermentation (digestion) associated with domestic livestock, decomposition of wastes in landfills, and natural gas systems. Agricultural soil management and mobile source fuel combustion are the major sources of nitrous oxide emissions in the U.S. (USEPA 2012c).

The final USEPA mandatory GHG reporting rule was published on 30 October 2009 and became effective on 29 December 2009. The rule requires GHG emissions (in metric tons/year) to be evaluated at the facility level for facilities emitting at least 25,000 metric tons/year. Beginning 1 January 2010, ongoing annual emissions must be calculated and submitted in an electronic report to the USEPA by March 31st of each year, with the first year being 2011. The report must describe the methodology used to calculate the GHG emissions. This rule would apply to the various power plants TVA operates in the Tennessee Valley.

3.3.2. Environmental Consequences

The section presents the potential direct, indirect, and cumulative impacts on air quality and GHG emissions associated with the project alternatives.

3.3.2.1. Alternative A – No Action Alternative

<u>Air Quality</u>

Under the No Action Alternative, the existing HESCO barriers would be maintained and replaced as required. Maintenance of the HESCO barriers would require periodic replacement of portions of the barriers if they become damaged or as they begin to age. The modification of these barriers would have associated transient air pollutant emissions. In addition to fugitive dust emissions from the removal and recycling of HESCO barriers, there will be fugitive emissions associated with the hauling of the barriers and the gravel they contain using trucks driven over paved and unpaved surfaces. Finally, there will be pollutant emissions from the exhaust of internal combustion engines powering the machinery used for removal of existing structures and installation of replacement HESCO barriers. It should be noted that the fugitive emissions associate with material hauling is not from the materials in the trucks but from the silt on paved and unpaved surfaces that haul trucks are driven over.

Fugitive emissions from demolition and replacement activities will produce particles that will primarily be deposited near the site of the dams. Ninety-five percent (by weight) of fugitive emissions from vehicular traffic over paved roads will also be comprised mainly of particles that will be deposited near the roadways (AP-42 Paved Road emission factors). The remaining fraction of the dust would be subject to transport beyond the property boundaries or roadway ROWs. A large fraction of fugitive emissions from vehicle traffic in unpaved areas would also be deposited near the unpaved areas. If necessary, emissions from construction areas, paved, and unpaved roads will be mitigated using BMPs including wet suppression. From roadways and unpaved areas, wet suppression can reduce fugitive dust emissions by as much as 95 percent.

Combustion of gasoline and diesel fuels by internal combustion engines (haul trucks and off-road vehicles) would generate local emissions of particulate matter, nitrogen oxides, carbon monoxide, volatile organic compounds (VOCs), and sulfur dioxide. The total amount of these emissions would be small and would result in minimal off-site impacts.

Air quality impacts from HESCO barrier replacements would be temporary and dependent on both manmade factors (e.g., intensity of activity, control measures) and natural factors (e.g., wind speed, wind direction, soil moisture). However, even under unusually adverse conditions, these emissions would have, at most, a minor, transient impact on offsite air quality and be well below the applicable ambient air quality standard. Overall, the air quality impact of maintenance activities for the HESCO barriers under the no action alternative would not be significant.

<u>GHG Emissions</u>

Under the No Action Alternative, the existing HESCO barriers would be maintained and replaced as required. Maintenance of the HESCO barriers would require periodic replacement of portions of the barriers if they become damaged or as they begin to age. The modification of these barriers would have associated transient GHG emissions due to the combustion of fossil fuels by the required equipment. The GHG impacts from HESCO barrier replacement or routine maintenance activities would be temporary and minimal given the size of other local GHG sources.

3.3.2.2. Alternative B – Combination Floodwalls and Embankments

<u>Air Quality</u>

The modification of these dams would have associated transient air pollutant emissions similar to those described above for the No Action Alternative. In addition to fugitive dust emissions from the removal and recycling of HESCO barriers and the removal of existing roadbeds and sidewalks, there would be fugitive emissions associated with the hauling of concrete, the excavation of earthen fill, and with placement of the borrow material for modifying the dams. As described above, use of wet suppression or other BMPs for fugitive dust control would minimize the potential adverse air quality impacts associated with construction of the dam modifications. However, excavation of fill material from the Watts Bar Dam borrow area, which is located immediately adjacent to the landowner's private property (Figure 2-19), could result in significant, temporary adverse impacts to air quality if dust control measures are not implemented.

Air quality impacts from dam modifications would be temporary and dependent on both manmade factors (e.g., intensity of activity, control measures, etc.) and natural factors (e.g., wind speed, wind direction, soil moisture, etc.). However, even under unusually adverse conditions, these emissions would have, at most, a minor, transient impact on offsite air quality and be well below the applicable ambient air quality standard. Overall, the air quality impact of construction-related activities for these projects would not be significant.

<u>GHG Emissions</u>

The modification of these dams would have associated transient GHG emissions similar to those described above for the no action alternative. Due to the longer time period necessary for construction in comparison to maintenance, the GHG emissions associated with Alternative B would be larger than those associated with the no action alternative. The GHG impacts from dam modifications would still be considered minimal and temporary in relation to other local GHG sources.

3.3.2.3. Alternative C – All Floodwalls

<u>Air Quality</u>

The impacts to air quality under Alternative C would be similar to those described for the No Action Alternative and Alternative B. Because this alternative consists of the construction of floodwalls only, fewer impacts to air quality would be expected given that there would be less particulate matter with the potential to mobilize than compared with Alternative B. Similarly to the No Action Alternative and Proposed Action, the use of BMPs, such as wet suppression, would minimize any potential impacts associated with the construction activities. Overall, air quality impacts associated with implementation of Alternative C would be short-term and minor.

GHG Emissions

The impacts to GHG emissions under Alternative C would be similar to those described for Alternative B. Construction duration would likely be slightly shorter, so this alternative could have slightly smaller GHG emissions. Overall however, GHG emissions would still be minimal in relation to other GHG sources nearby.

3.4. Flooding and Floodplains

This section describes the regulations and baseline conditions associated with flooding and floodplains in the vicinity of Cherokee, Fort Loudoun, Tellico, and Watts Bar dams, and the potential impacts on flooding and floodplains from the No Action and Action alternatives.

3.4.1. Affected Environment

A floodplain is the relatively level land area along a stream or river that is subjected to periodic flooding. The area subject to a one-percent annual chance of flooding (100-year flood) in any given year is normally called the 100-year floodplain. Executive Order (EO) 11988, Floodplain Management directs federal agencies to evaluate their proposed development projects in the 100-year floodplain to ensure that they are consistent with the requirements of the EO. Delineation of the 100-year floodplain is also important for the regulation of development by communities participating in the National Flood Insurance Program[2] (NFIP). For certain “Critical Actions,” the minimum floodplain of concern is the area subject to inundation from a 500-year (0.2 percent annual chance) flood. “Critical Actions” are those for which even a slight chance of flooding would be too great.

TVA developed the Flood Risk Profile (FRP) for the mainstem Tennessee River reservoirs. The FRP is the elevation of the 500-year flood that has been adjusted for surcharge at the dam. Surcharge is the ability to raise the water level behind the dam above the top-of-gates elevation (defined with the gates in the closed position) without causing damage to the project. A similar analysis was never completed for the tributary dams. TVA uses the FRP to control flood damageable development for TVA projects and on TVA lands along the mainstem reservoirs, and uses the 500-year flood elevation to control development on tributary reservoirs such as Cherokee. Also, due to the nature of the permanent dam modifications project, it is necessary to evaluate the flood risk associated with the PMF elevation for all alternatives. The relevant floodplain elevations for the four dams are listed in Table 3.4.1. All of the staging areas and the Watts Bar borrow area are located outside of the 100-year floodplain. Portions of the Cherokee and Fort Loudoun-Tellico borrow areas are located within the 100-year floodplain.

All of the counties in which the four dams are located (Jefferson and Grainger for Cherokee, Loudon for Fort Loudoun and Tellico, Meigs and Rhea for Watts Bar) participate in the NFIP and any development must be consistent with NFIP regulations. The 100-year flood elevation is typically used to delineate flood hazard areas subject to NFIP regulations.

[2] The National Flood Insurance Program is a program created by the U. S. Congress in 1968 through the National Flood Insurance Act of 1968 (Public Law [P. L.] 90-448). The program enables property owners in participating communities to purchase insurance protection from the government against losses from flooding.

Table 3.4-1.
Flood Elevations in Feet above Mean Sea Level*

Dam	100-year	500-year	FRP	PMF
Cherokee	1075.0	1075.0	not applicable	1093.6
Fort Loudoun	816.0	817.0	817.0	835.6
Tellico	816.2	817.0	817.0	833.3
Watts Bar	746.5	746.8	747.0	768.1

* All elevations are based on the National Geodetic Vertical Datum (NGVD) of 1929

3.4.2. Environmental Consequences

As a Federal agency, TVA is subject to the requirements of EO 11988. The objective of EO 11988 is "…to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" (U.S. Water Resources Council [WRC] 1978). The EO is not intended to prohibit floodplain development in all cases, but rather to create a consistent government policy against such development under most circumstances. The EO requires that agencies avoid the 100-year floodplain unless there is no practicable alternative. For certain "Critical Actions," the minimum floodplain of concern is the area subject to inundation from a 500-year (0.2 percent annual chance) flood. Also, due to the nature of this Proposed Action, it is necessary to evaluate the flood risk associated with the PMF elevations for all alternatives.

3.4.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, the existing HESCO barriers that currently raise the heights of the earthen embankments at Fort Loudoun, Tellico, Watts Bar and Cherokee dams to prevent overtopping during the PMF would remain in place. The concrete mat installed on the downstream embankment of Watts Bar Dam would also remain in place. The barriers and the concrete mat are located outside of the 100-year floodplain and well above the 500-year and TVA FRP elevations. Therefore, there would be no changes to the pre-project 100-year, 500-year, and FRP flood elevations at any of dams. As there would be no change from the current condition, no direct or indirect impacts to flooding or floodplains would occur under the No Action Alternative.

3.4.2.2. Alternative B – Combination Floodwalls and Embankments

Under Alternative B, the HESCO barriers at the four dams would be replaced with concrete floodwalls and raised earthen embankments. Under this alternative, overtopping of each dam during a PMF event would be prevented by construction of the floodwalls and raising the earthen embankments to the same height or higher than the existing HESCO barriers.

At Cherokee, Fort Loudoun, and Tellico dams, the floodwalls would be located outside of the 100-year floodplain and well above the 500-year flood elevation, which would be consistent with EO 11988. Portions of the fill for the raised earthen embankments at Cherokee, Tellico, and Watts Bar dams would be located within the 100-year floodplain. Under EO 11988, the placement of fill within the 100-year floodplain for raising an existing berm is not considered to be a repetitive action in the 100-year floodplain. As stated in Section 2.1.1, TVA has evaluated alternatives to the fill and the selection of this alternative would support a determination of "No Practicable Alternative" to the placement of the fill in the 100-year floodplain. The fill would also be located below the 500-year or FRP elevation and would therefore displace flood control storage. Consistent with TVA's Flood Control Storage Loss Guideline, the amount of lost flood control storage would be minimized while achieving the project objectives. At all of the dams, the current 100-year flood, 500-year flood, FRP, and PMF elevations would not change and there would be no increase in flood risk.

At all dam locations, beneficial impacts are anticipated as the floodwalls and berms would reduce the risk of downstream flooding in the event of a PMF.

Use of the proposed Watts Bar borrow area would not affect floodplains. TVA would not obtain fill material from those portions of the Cherokee and Fort Loudoun-Tellico borrow area located within the 100-year floodplain.

3.4.2.3. Alternative C – All Floodwalls

Under Alternative C, overtopping of each dam during a PMF event would be prevented by the construction of floodwalls on the earthen embankments. At Cherokee, Fort Loudoun, Tellico, and Watts Bar dams, floodwalls would be constructed along the existing embankments to the same height or higher than the existing HESCO barriers. The walls would be located outside of the 100-year floodplain and well above the 500-year flood elevation which would be consistent with EO 11988. Under this alternative, the current 100-year flood, 500-year flood, FRP, and PMF elevations would not change and there would be no increase in flood risk.

Beneficial impacts are anticipated under Alternative C since the floodwalls would reduce the risk of downstream flooding in the event of a PMF.

3.5. Wetlands

Wetlands are lands where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin et al. 1979). Wetlands exist within and adjacent to TVA reservoirs and tailwaters, and are influenced by surface water and groundwater connections to the water levels in these reservoirs and tailwaters. Wetlands depend on the timing and duration of the presence of water; consequently, they may be affected by reservoir operations.

3.5.1. Affected Environment

Wetlands are highly productive and biologically diverse ecosystems that provide multiple public benefits such as flood control, shoreline stabilization, improved water quality, and habitat for fish and wildlife resources.

EO 11990 (Protection of Wetlands) directs Federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In addition, activities in wetlands are regulated under the authority of the Federal Clean Water Act (CWA) and state laws and regulations. Wetlands can be defined as areas inundated by surface or groundwater with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, mud flats, and natural ponds.

The types and acreages of potentially affected wetlands were estimated based on data selected from the National Wetlands Inventory (NWI). The NWI data include information on the type of vegetation, water regime, and setting. The wetlands included, as potentially affected in this EIS, meet the wetland definition used by the USFWS (Cowardin et al. 1979). This definition is the national standard for wetland mapping, monitoring, and data reporting as determined by the Federal Geographic Data Committee. The NWI data were compiled using high-altitude aerial photography with limited field verification. Some of the data are now over 15 years old. Because of their age and manner of acquisition, the data were not strictly interpreted in terms of changes in acreage.

All of the dams proposed for modifications are within the Ridge and Valley ecoregion. Wetlands within this region occupy a relatively small percent of the landscape relative to uplands; land use/land cover data compiled from satellite data indicates wetlands occupy less than 0.1 percent of the total landscape (Friesen and Stier 2008). This ecoregion is marked by relatively steep topography and deeply incised stream channels; wetlands are typically small and isolated or linear and associated with the floodplain areas of streams, rivers, and creeks (Hefner et al. 1994).

Field surveys were conducted to determine if wetlands were present within the immediate project area at each dam. No wetlands were found within the site specific areas where permanent dam modifications are proposed. Additional evaluation of the proposed construction staging areas indicates no wetlands are present within these areas. Wetlands within the floodplain areas of Fort Loudoun, Tellico, Cherokee, and Watts Bar reservoirs and their tributaries are primarily forested wetlands. Small scrub-shrub and emergent wetlands occur along some nearby reservoir shorelines or within coves and embayments.

NWI data do not indicate the presence of wetlands on the Cherokee borrow area, which has been recently altered by site development and borrow activities. About 6 acres of forested wetlands associated with Town Creek occur within the boundaries of the Fort Loudoun-Tellico borrow area. These wetlands have not been disturbed by the ongoing removal of fill by TDOT. NWI data do not indicate the presence of wetlands on or in the immediate vicinity of the Watts Bar borrow area.

3.5.2. Environmental Consequences

Based on a survey of the NWI, there are no wetlands in, or immediately adjacent to areas on the dam reservations. There is a small freshwater emergent wetland near the Fort Loudoun Segment FTL-1 embankment, approximately 0.25 miles from the embankment. There is a small forested wetland approximately 0.75 miles southeast of the Watts Bar Dam project area. Tellico Dam and Cherokee Dam do not have any wetlands within an approximately 1-mile radius (USFWS 2012a).

Given the absence of wetlands within the construction areas on the four dam reservations, no direct or indirect impacts would result from the No Action or Action alternatives.

Under the No Action Alternative, no construction would occur and the HESCO barriers would remain in place and existing maintenance activities would continue to have no effect on wetlands. Similarly, all construction activities associated with the project areas under Alternatives B and C would occur entirely on uplands, as TVA and its construction contractor would not remove fill material from the wetlands portion of the Fort Loudoun-Tellico borrow area. Therefore, Alternatives B and C would have no impact on wetlands.

3.6. Aquatic Ecology

3.6.1. Affected Environment

TVA systematically monitors the ecological conditions of its reservoirs through the VSMP described in Section 3.2.1. VSMP monitoring activities focused on aquatic life include benthic macroinvertebrate community sampling and fish assemblage sampling (Dycus and Baker 2001; TVA 2012a). Data from these sampling efforts were used to characterize the aquatic community near each of the proposed project sites. Other relevant VSMP results are described in Section 3.2-1.

Benthic macroinvertebrates are bottom-dwelling invertebrates large enough to be seen with the naked eye, and include animals such as crayfish, mussels and snails, and larvae of aquatic insects. They are included in aquatic monitoring programs because of their importance to the aquatic food chain and because they have limited capability of movement, thereby preventing them from avoiding undesirable conditions. Sampling and data analysis were based on seven parameters that include species diversity, presence of selected taxa that are indicative of good water quality, occurrence of long-lived organisms, total abundance of all organisms except those indicative of poor water quality, proportion of total abundance comprised by pollution-tolerant oligochaetes (segmented worms), proportion of total abundance comprised by the two most abundant taxa, and proportion of samples with no organisms present.

The fish assemblage is monitored by electrofishing and gill netting to determine the diversity and health of the fish community. Fish are included in aquatic monitoring programs because they are important to the aquatic food chain and because they have a long life cycle which allows them to reflect conditions over time. Fish are also important to the public for aesthetic, recreational, and commercial reasons. Monitoring results for each sampling station are analyzed to arrive at a Reservoir Fish Assemblage Index (RFAI) rating, which is based primarily on fish community structure and function. Also considered in the rating are the percentage of the sample represented by omnivores and insectivores, overall number of fish collected, and the occurrence of fish with anomalies such as diseases, lesions, parasites, and deformities (Dycus and Baker 2001).

TVA monitors the quality of sport fishing with the Sport Fishing Index (SFI; Hickman 2000). The SFI is based on the results of fish population sampling by TVA and state resource agencies and, when available, results of angler success as measured by state resource agencies (i.e., bass tournament results and creel surveys).

Cherokee Dam

The benthic community in the Cherokee Reservoir forebay has consistently rated as poor to fair since 2000 with the exception of 2004 when it rated good. It rated poor in 2010 monitoring. The fish assemblage rated fair from 2000 through 2004 and rated good from 2006 through 2010.

Cherokee Reservoir provides many opportunities for sport anglers. In 2008, SFI ratings for Cherokee were better than average for largemouth bass and striped bass and below average for black basses, channel catfish, smallmouth bass, spotted bass, and walleye (Table 3.6-1; TVA 2012b). There are no fish consumption advisories in effect for Cherokee Reservoir.

Table 3.6-1.
SFI Scores for Selected Sport Fish Species in Cherokee Reservoir, 2008

Fish Species	2008 Score	2008 Valley wide Average
Black Basses	35	37
Black Crappie	31	31
Channel Catfish	32	34
Largemouth Bass	40	35
Smallmouth Bass	24	31
Spotted Bass	28	33
Striped Bass	44	35
Walleye	28	38

TVA conducted a bioassessment of the tailwater of the Holston River at mile 51.1, 1.2 miles below Cherokee Dam. Fish were sampled from 2003 to 2009 following TVA's Index of Biological Integrity (IBI) protocol based on Karr et al. (1986). Benthic macroinvertebrates were sampled from 2005-2009 following TVA's Benthic Index for Biotic Integrity (Kerans and Karr 1994). Results of these sampling efforts are combined to produce IBI indices and classifications (TVA 2009b). The annual fish IBI ratings were "Very Poor" or "Poor" and the annual benthic IBI ratings were "Poor" or "Fair."

Fort Loudoun Dam

The benthic community in the Fort Loudoun Reservoir forebay consistently rated poor or very poor during annual monitoring from 2000 through 2007, and poor in 2009. With the exception of 2005, when it rated fair, the forebay fish assemblage rated good from 2000 through 2007, and in 2009. Neither the benthic community nor the fish assemblage was sampled in 2008.

In 2008, Fort Loudoun rated better than average for largemouth bass and smallmouth bass; the SFI rating was below average for black basses, crappie, and white crappie (Table 3.6-2).

Table 3.6-2.
SFI Scores for Selected Sport Fish Species in Fort Loudoun Reservoir, 2008

Fish Species	2008 Score	2008 Valley wide Average
Black Basses	33	37
Black Crappie	30	31
Crappie	28	31
Largemouth Bass	38	35
Smallmouth Bass	35	31
White Crappie	31	33

TVA has also sampled the fish assemblage and benthic community at Tennessee River mile 601.0 in the Fort Loudoun and Tellico tailwater a short distance downstream of the junction with the Little Tennessee River. The fish assemblage was consistently rated good and the benthic community was consistently rated poor at this location in biennial sampling from 2000 through 2010.

Tellico Dam

The benthic community in the Tellico Reservoir forebay rated very poor in biennial sampling between 2001 and 2009. The forebay fish assemblage rated good or fair during this same period. In 2008, Tellico rated below average for black basses, largemouth basses, smallmouth basses, spotted bass, and white crappie (Table 3.6-3).

Table 3.6-3.
SFI Scores for Selected Sport Fish Species in Tellico Reservoir, 2008

Fish Species	2008 Score	2008 Valley wide Average
Black Basses	29	37
Largemouth Bass	26	35
Smallmouth Bass	22	31
Spotted Bass	22	33
White Crappie	22	33

Watts Bar Dam

The benthic community in the Watts Bar Reservoir forebay, sampled two miles upstream of the dam, has consistently rated poor during biennial monitoring from 2000 through 2010. The forebay fish assemblage has rated fair or good during this same time period. In 2008, Watts Bar rated better than average for largemouth bass, black crappie, and spotted bass; the SFI rating was below average for black basses, channel catfish, crappie, smallmouth bass, striped bass, white bass, and white crappie (Table 3.6-4).

Table 3.6-4.
SFI Scores for Selected Sport Fish Species in Watts Bar Reservoir, 2008

Fish Species	2008 Score	2008 Valley wide Average
Black Basses	30	37
Black Crappie	33	31
Channel Catfish	26	34
Crappie	28	31
Largemouth Bass	40	35
Smallmouth Bass	26	31

Table 3.6-4.
SFI Scores for Selected Sport Fish Species in Watts Bar Reservoir, 2008

Fish Species	2008 Score	2008 Valley wide Average
Spotted Bass	40	33
Striped Bass	24	35
White Bass	36	40
White Crappie	31	33

Both the benthic community and the fish assemblage in the Watts Bar tailwater have consistently rated good during biennial monitoring from 2000 through 2010.

The Watts Bar tailwater has a relatively diverse population of mussels. The 10-mile stretch of Watts Bar tailwater from the dam downstream to Tennessee River Mile 520.0 is designated as the Chickamauga Reservoir State Mussel Sanctuary due to the high diversity of mussels in the river. This designation prohibits the taking of mussels for commercial harvesting and the destruction of their habitat. The mussel fauna in mainstem Tennessee River has greatly changed over the last century, with many species disappearing or becoming greatly reduced in range and distribution. Some other mussel species, more tolerant of reservoir conditions, have increased in numbers on overbank habitats (i.e., inundated areas on former floodplains outside of the original river channel). The Watts Bar tailwater is one of the few areas on the mainstem of the Tennessee River in the eastern Tennessee Valley where a relatively diverse mussel population persists.

3.6.2. Environmental Consequences

This section contains an analysis of potential direct and indirect impacts that could occur if any of the alternatives were implemented.

3.6.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, TVA would continue to use the HESCO barriers as a solution to prevent flood overtopping and potential impacts to the dam embankments and possibly dam failure. Longer term use (greater than five years) would require maintenance and/or replacement to continue their effectiveness. None of the HESCO barriers occur in water or would require stream disturbance. Therefore, no direct or indirect impacts to aquatic ecology would occur with the adoption of the No Action Alternative.

3.6.2.2. Alternative B – Combination Floodwalls and Embankments/Berms

Under Alternative B, the HESCO barriers would be replaced with concrete floodwalls and raised earthen embankments. Runoff of fine sediments and pollutants (such as gasoline and oil for construction machinery) could occur temporarily during construction. Elevated levels of suspended sediment in aquatic habitats are known to interfere with respiration, feeding, and reproduction in aquatic animals; however, BMPs used during construction would minimize any significant run-off of sediment or pollutants. No direct or indirect impacts to listed aquatic ecology are anticipated under Alternative B.

3.6.2.3. Alternative C – All Floodwalls

Under Alternative C, the HESCO barriers would be replaced with concrete floodwalls. No work would occur in the water. Under this alternative, there is less potential for sediment run-off into the forebays and tailwaters of the subject dams resulting from construction of the floodwalls alone compared to Alternative B, which includes earthen embankments or berms. However, with the use of BMPs the difference in potential impacts associated with run-off compared to Alternative B would be negligible. No direct or indirect impacts on listed aquatic species are anticipated under Alternative C.

3.7. Terrestrial Ecology

3.7.1. Affected Environment

Project area field surveys were conducted in May 2011 and January 2013 to assess the vegetative community structure, wildlife habitat, and plant and animal species on the four dam reservations. All four dams occur in the Southern Limestone/Dolomite Valleys and Low Rolling Hill subdivision of the Ridge and Valley Ecoregion (Griffith et al. 1998). The Southern Limestone/Dolomite Valleys and Low Rolling Hills form a heterogeneous region composed predominantly of limestone and cherty dolomite. Ridges are typically forested and valleys are typically a mixture of agriculture and urban/suburban land uses interspersed with patches of forest. Because they are in the same ecoregion and subdivision, the terrestrial ecology of the four dam reservations has much in common and is described below. This is followed by descriptions of features specific to each dam.

Fields are a major habitat type at all four dams. These include extensive frequently mowed lawns dominated by tall fescue and somewhat more diverse hayfields with tall fescue, brome grass, orchard grass, several clover species, buttercups, garden vetch, sheep sorrel, and ragwort. The diversity of wildlife using these fields is low. Mammals likely present include eastern cottontail, woodchuck, white-tailed deer, eastern mole, white-footed mouse, and prairie vole. Birds present include Canada goose, eastern kingbird, American robin, eastern bluebird, northern mockingbird, savannah sparrow, eastern meadowlark, and red-winged blackbird. Reptiles likely present include black racer, black rat snake, and common garter snake. Scattered brushy areas and fencerows are present and support northern cardinals, indigo buntings, blue grosbeaks, and field and song sparrows. Coyotes, red foxes, red-tailed hawks, and American kestrels hunt the fields and brushy areas. Invasive plants in these areas include autumn olive, Bradford pear, bush honeysuckle, mimosa, and tree-of-heaven.

Varying amounts of forest are present. These are primarily mixed deciduous forests dominated by black, southern red, chestnut and white oaks, and tulip poplar. Other trees present include red and sugar maples, dogwood, red bud, hackberry, sweetgum, American sycamore, eastern red cedar, white ash, hickory, shortleaf and white pine, and planted loblolly pine. Invasive plants are common in the understory and include bush honeysuckle, Chinese privet, Japanese honeysuckle, Japanese stiltgrass, and multiflora rose. Wildlife present in the forested habitats likely includes white-tailed deer, eastern gray squirrel, raccoon, wild turkey, downy pileated, and red-bellied woodpeckers, American crow, blue jay, white-breasted nuthatch, Carolina chickadee, eastern tufted titmouse, America robin, several Neotropical migrant birds such as red-eyed and yellow-throated vireo, wood thrush, and yellow-throated and black-and-white warblers, and eastern box turtle and ring-necked snake.

Several species of water birds occur in the vicinity of each dam. Canada geese and mallards are present throughout the year. Migratory waterfowl such as redheads and lesser scaup are often present in the reservoir forebay area during the late fall, winter, and early spring. Also present at this time are common loons, pied-billed and horned grebes, and American coots. Large numbers of ring-billed and Bonaparte's gulls and small numbers of herring gulls use both the forebay and tailwater areas from fall through spring. Double-crested cormorants, great blue herons, and black-crowned night-herons are present throughout the year and most numerous in summer and fall. Killdeer occur throughout the year along the reservoir shorelines and on mowed lawns, and small numbers of other shorebirds, most commonly spotted and solitary sandpipers, may occur along the reservoir shorelines in spring and fall.

Cherokee Dam

At Cherokee Dam, the majority of the current HESCO barriers are placed on earthen embankments topped with a paved or gravel road and covered with rock riprap on the upstream reservoir side and with either grass or riprap on the downstream side. Little other vegetation occurs in the immediate vicinity of these embankments. The remainder of the dam reservation is mowed lawns and fields and fragmented deciduous woodlands.

No caves, wading bird (i.e., heron and egret) colonies, or other unusual or sensitive wildlife habitats or populations are known from the immediate vicinity of Cherokee Dam. The proposed borrow area is heavily disturbed by recent development and borrow activities. It is sparsely vegetated with common early successional species and supports few wildlife species.

Fort Loudoun Dam

The embankment near Fort Loudon Marina is faced with riprap on the downstream side and vegetated with a mix of native and non-native grasses and forbs on the upstream side. This area is periodically mowed. The west end of the embankment is adjacent to a narrow roadside strip of forest. A small area of mixed deciduous-coniferous forest adjoins the east end of the embankment. The HESCO barriers along U.S. Highway 321 south of the dam are built on the sparsely vegetated road shoulder. The adjacent embankment slope is covered with riprap and, towards the southern end of the embankment, regularly mowed lawn.

A small cedar barren, approximately 1.5 acres in size, occurs near the parking area west of the embankment. The area is dominated by eastern red cedar, redbud and winged elm. Several species of native grasses and sedges are present along with ebony spleenwort. A small depressional pond is located in a woodland downstream of the dam, adjacent to the tailwater access parking lot. This pond area contains several ferns and wetland species including adder's tongue fern, broad beech fern, ebony spleenwort, netted chain fern, rattlesnake fern, sensitive fern, button-bush, silky dogwood, soft rush, and several *Carex* sedges. The pond and associated woodland provide suitable habitat for several amphibians including green frog, spring peeper, and green and gray tree frogs.

Aside from the pond described above, no caves, wading bird colonies, or other unusual or sensitive wildlife habitats or populations are known from the immediate vicinity of Fort Loudoun Dam. The nearest known heron colony is about one mile upstream of the dam and the nearest reported cave is about 1.7 miles from the dam. Ospreys nest within about three miles of the dam.

Much of the proposed borrow area for Fort Loudoun and Tellico is heavily disturbed by ongoing grading and removal of fill; consequently, it is sparsely vegetated and supports few wildlife species. The forested wetland area along Town Creek is vegetated with common species such as sweetgum and red maple with an understory dominated by invasive species such as privet. It is bisected by power lines and due to its size and urban location, is unlikely to support unusual or sensitive wildlife populations.

Tellico Dam

The saddle dam extending to the east of the main Tellico Dam is covered with riprap on the upstream slope. On the downstream slope, the upper portion of the downstream slope is regularly mowed lawn and the lower portion is riprap. Saddle Dam No. 2, located southwest of the main Tellico Dam, is forested on part of its upstream slope and covered with regularly mowed lawn on the remainder of the upstream slope on the downstream slope. Saddle Dam No. 3 is covered with riprap on the upstream slope and regularly mowed lawn on the downstream slope.

The 65-acre Hall Bend TVA Habitat Protection Area is located 0.6 miles south of Tellico Dam and adjacent to Saddle Dam No. 1. This area was established to protect an uncommon limestone bluff and associated barrens plant community. Characteristic barrens plants include little bluestem, side-oat gramma grass, orange coneflower*,* yucca*,* and eastern red cedar.

No caves, wading bird colonies, or other unusual or sensitive wildlife habitats or populations other than the habitat protection area are known from the immediate vicinity of Tellico Dam.

Watts Bar Dam

The existing HESCO barriers are constructed along a roadside adjacent to regularly mowed lawns. A portion of the proposed permanent modifications would extend north of the existing HESCO barriers into an upland hardwood forest. Common overstory tree species include American beech, black gum, hickories, and black, southern red, and white oaks; all of which are common and representative of the region. Numerous invasive plants are present in the understory. The wooded area to be cleared under Alternative B, located northeast of the main access road, is mostly sapling to pole-sized forest, composed of loblolly pine, sweetgum, American sycamore, boxelder, black cherry, tulip poplar, and eastern red cedar. Japanese honeysuckle and Chinese privet are abundant in the understory. Very few trees greater than 5 inches in diameter breast height are present.

No caves, wading bird colonies, or other unusual or sensitive wildlife habitats or populations are known from the immediate vicinity of the HESCO barriers. The closest heron colony is about 0.25 miles from the dam and ospreys nest a short distance downstream of the dam.

Fill for the earthen structures will be obtained from a borrow area a short distance west-southwest of the dam. The proposed borrow area has been managed for pasture and hay production and is vegetated by a mix of non-native and native grasses and forbs. Typical wildlife species present are eastern meadowlark, red-winged blackbird, and woodchuck. No unusual plants or wildlife are likely to be present.

Staging Areas

Both Alternatives B and C would require the use of material staging areas during the construction period. Staging areas for Cherokee, Fort Loudoun, Tellico, and Watts Bar dams are shown in Figures 2-1, 2-6, 2-13, and 2-18, respectively. Most of the potential staging areas identified by TVA are located within existing parking lots (impervious surfaces). The southernmost staging area at Watts Bar dam is a regularly mowed lawn, and a staging area and access road located on hayfields are under consideration at Fort Loudoun Dam.

3.7.2. Environmental Consequences

This section contains an analysis of potential direct and indirect impacts to terrestrial ecology if any of the alternatives are implemented.

3.7.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, TVA would continue to use the HESCO barriers at each of the four dams. No construction would occur; therefore, there would be no need for any borrow material or staging areas and no terrestrial habitats would be disturbed. No direct or indirect impacts to terrestrial ecology are anticipated under this alternative.

3.7.2.2. Alternative B – Combination Floodwalls and Embankments

Under Alternative B, the HESCO barriers would be replaced with a combination of floodwalls and, where feasible, raised earthen berms. Runoff of fine sediments and pollutants (such as gasoline and oil associated with construction equipment) could occur temporarily during construction. This runoff could affect plants and wildlife inhabiting any areas where sediment and pollutants are deposited, as well as any species dependent on aquatic habitats receiving the runoff. Elevated levels of suspended sediment in aquatic habitats are known to interfere with respiration, feeding, and reproduction in aquatic animals such as fish and mussels; BMPs used during construction would minimize any significant run-off of sediment or pollutants that could be mobilized during construction. Construction noise and movement of vehicles could disturb wildlife in the area, resulting in a negative indirect impact. Additional potential indirect impacts to terrestrial habitat could include damage to adjacent areas or loss of habitat integrity or connectivity. All construction would take place within the existing TVA ROW; no impacts to terrestrial ecology are anticipated outside of this area.

Cherokee Dam

In general at Cherokee Dam reservation, little vegetation other than regularly mowed grass exists in the immediate vicinity of the existing flood control structures. Mowed grass does not represent a habitat that would support a diverse species assemblage. Minor, permanent negative impacts to wooded and grassy areas would occur near Segment C-3 from construction of the earthen embankment. Portions of two small wooded areas on the downstream (north) side of TVA Parkway opposite the C-4 and C-5 HESCO barrier segments (Figure 1-2), as well as a few large trees near the restroom/visitor building, would be cleared for construction of the embankments. This would result in insignificant impacts to vegetation and wildlife. The vegetation communities found in and around Cherokee Dam are common and representative of the region.

Areas of raised embankments that are not covered with an asphalt or concrete surface would be revegetated with perennial grasses and maintained by regular mowing. Other areas disturbed during construction would be revegetated and restored to their previous condition, which for most of the dam reservation is regularly mowed fields. During construction, noise and equipment would disturb resident wildlife in the area; this indirect negative impact would be minor and temporary, as wildlife would be expected to return once construction is complete. Impacts to vegetation and wildlife both during construction and post-construction would be insignificant and result in little long-term effect on the overall terrestrial ecology of the area.

Fort Loudoun Dam

At Fort Loudoun Dam, earthen embankments were selected as the permanent modification type for Segments FTL-1 and FTL-4, and concrete floodwalls were the chosen modification type at Segments FTL-2 and FTL-3. Construction of the concrete floodwalls at FTL-2 and FTL-3 would have little to no effect on vegetation and wildlife.

The embankment with HESCO barriers near Fort Loudon Marina is currently faced with riprap on the downstream side and vegetated with a mix of native and non-native grasses and forbs on the upstream side. A 6-ft-tall embankment would be built just slightly off-set of the original embankment alignment at the Fort Loudoun Saddle Dam Segment FTL-1. The west end of the existing embankment is adjacent to a narrow roadside strip of forest. Construction of the FTL-1 embankment would result in the clearing of a small (less than 1/4 acre) area of the adjacent woodland; the remainder of the construction activities would be on regularly mowed fields. The impacts to vegetation and wildlife in these areas, both during and after construction, would be minor. BMPs would be used in order to protect both the nearby small cedar barren and adjacent pond from run-off of sediment and pollution and prevent physical damage. No adverse impacts to these unusual habitats are anticipated.

Segment FTL-4 would consist of a small portion of embankment (4.8 feet tall) constructed within the grassy field out front of the Tellico Recreation Area entrance. Grassy areas and a few acres of wooded area would be permanently impacted by the adjacent work at Tellico, but tree removal would not be specifically required for any part of the permanent modifications at Fort Loudoun Dam.

Tellico Dam

The construction of the T-1, T-2, and T-4 permanent modifications would result in some disturbance to vegetation (primarily regularly mowed areas) and wildlife, but little to no long-term impacts. Construction of the T-3 embankment on Saddle Dam No. 2 would result in the clearing of approximately 2 acres of forest between the saddle dam and the reservoir and along the access road from Highway 444. Following the completion of construction, the embankment would be maintained by periodic mowing. Construction of the T-3 embankment would result in adverse, but very localized, impacts to vegetation and wildlife. The Hall Bend TVA Habitat Protection Area would not be affected. Overall impacts to vegetation and wildlife at Tellico Dam would be insignificant.

Watts Bar Dam

At Watts Bar Dam, the existing HESCO barriers are constructed along a roadside adjacent to regularly mowed lawns. Under this alternative, permanent modification to Segments WB-1 and WB-2 would be accomplished by constructing earthen embankments, connected by a short section of elevated roadway. The areas adjacent to the alignment of these embankments are comprised of primarily grassy fields and wooded areas. Vegetation within the ROW of the embankment work would result in similar impacts to those at Cherokee and Tellico dams where berms would be constructed; minor permanent adverse impacts to terrestrial ecology. Berm construction requires a large footprint; however, it is expected that upon completion of the berms, the berms would be re-seeded and returned to their current condition. Therefore, for the areas adjacent to the road, minor temporary impacts to terrestrial ecology could occur, but no permanent impacts are anticipated.

A portion of the proposed permanent modifications would extend north of the existing HESCO barriers into an upland hardwood forest. Placement of a parking lot just north and then east of the entrance to Watts Bar Dam would permanently convert approximately 0.8 acres of the forest present to non-vegetated habitat. These areas of forest that would be removed would experience moderate negative direct impacts due to permanent loss of habitat. These areas are small in size; however, it is not a unique habitat in the area. Overall, the loss of habitat would be very small and easily recovered as wildlife impacted would simply move to another forested area nearby.

Overall, under Alternative B, minor negative impacts to terrestrial ecology would occur during construction. Some potential direct negative impacts could be avoided by the use of specially designed BMPs. A minor loss of terrestrial habitat could occur at all dams, especially at Watts Bar Dam; however, these losses would be very minor in relation to the surrounding existing similar undisturbed habitat. Minor and temporary indirect negative impacts could occur during construction to nearby wildlife. Wildlife is expected to return to the area once construction is complete.

Staging and Borrow Areas

Under Alternative B, borrow areas would be required to provide fill material for the earthen berms. Two of the three proposed borrow areas have been disturbed by recent site development and/or removal of fill. The third borrow area is pasture. Impacts to plant communities and wildlife populations would be insignificant.

All proposed staging areas are located within existing parking lots (impervious surfaces) in the vicinity of the dams, with the exception of a small, grassy area (low quality habitat) south of Watts Bar Dam (Figure 2-18). No direct or indirect impacts to terrestrial resources would occur at any of the borrow or staging areas identified under Alternative B.

3.7.2.3. Alternative C – All Floodwalls

Under Alternative C, the HESCO barriers would be replaced by permanent concrete floodwalls at each segment for all four dams; no in-water work would occur. Under this alternative, there is less potential for sediment run-off into the forebays and tailwaters of the subject dams resulting from construction of the floodwalls alone compared to Alternative B, which includes earthen embankments. Potential direct impacts to terrestrial ecology include permanent loss of habitat if needed for the foundations of the floodwalls or additional riprap. Construction noise and movement of vehicles could disturb wildlife in the area, resulting in a negative indirect impact. Additional potential indirect impacts to terrestrial habitat could include damage to adjacent areas or loss of habitat integrity or connectivity.

The direct and indirect impacts to terrestrial ecology would be similar, but considerably smaller than those experienced under Alternative B. Floodwalls require a smaller area for foundation; therefore, fewer habitats would be lost or temporarily affected during construction. Conversely, existing habitat at the dams is primarily characterized by existing berms, floodwalls, mowed grass, and paved roadways. Potential direct and indirect impacts to terrestrial resources under Alternative C would be minor.

Staging and Borrow Areas

All proposed staging areas would be located within existing parking lots in the vicinity of the dams. Under Alternative C, no borrow material would be required; therefore, no direct or indirect impacts to terrestrial ecology associated with borrow and/or staging areas would occur.

3.8. Threatened and Endangered Species

Threatened and endangered species are regulated by a number of federal and state laws. The federal laws relevant to Alternative B include:

- The ESA (16 U.S. Code [U.S.C.] §§ 1531-1544, December 28, 1973, as amended 1976-1982, 1984, and 1988); and
- The Bald and Golden Eagle Protection Act (BGEPA) (1940).

Endangered Species Act (ESA)

As discussed above, Section 7 of the ESA requires Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of species listed as endangered or threatened or impact critical habitats. If listed species are present (or likely to be present) in the project area, then the action agency must determine whether the project would affect them. If so, consultation is required with USFWS. If it is determined that the project is not likely to adversely affect any listed species or critical habitat, informal consultation can be concluded with concurrence from the USFWS. If the effects are likely to be adverse, the action agency formally consults with the USFWS. Formal consultation is typically concluded with the issuance of a Biological Opinion and incidental take permit by USFWS. The incidental take statement authorizes the Federal Agency to proceed with the action while taking measures to reduce and/or mitigate the effects on the listed species.

Bald and Golden Eagle Protection Act (BGEPA)

The BGEPA, enacted in 1940 and amended several times since then, prohibits anyone without a permit issued by the Secretary of the Interior from "taking" bald eagles, including their parts, nests, or eggs. The BGEPA provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, transport, export or import, at any time or any manner, any bald eagle [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The BGEPA defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

For purposes of these guidelines, "disturb" means “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle; (2) a decrease in its productivity by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." This definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death, or nest abandonment.

3.8.1. Affected Environment

3.8.1.1. Aquatic Fauna

Aquatic fauna that are endangered, threatened, or of state concern (ETSC) and are known to occur within a 10-mile radius of one or more of the four dams include 23 species of fish, amphibians, and invertebrates. Of these, 11 are federally and state-listed as endangered, three are federally listed as threatened, one is state-listed as threatened, and 10 are of state concern and tracked by the Tennessee Natural Heritage Inventory Program or designated as in need of management by the Tennessee Wildlife Resources Agency (Table 3.8-1).

Table 3.8-1.
Threatened and Endangered Aquatic Fauna Known to Occur within a 10-mile radius of a Dam

Common Name	Scientific Name	Status[1]		Dam			
		State (Rank)[2]	Federal	Cherokee	Fort Loudoun	Tellico	Watts Bar
Fish							
Blotchside logperch	*Percina burtoni*	NMGT (S2)	-		X	X	
Blue sucker	*Cycleptus elongatus*	THR (S2)	-	X	X	X	
Flame chub	*Hemitremia flammea*	NMGT (S3)	-		X	X	X
Snail darter	*Percina tanasi*	THR (S2S3)	THR		X	X	X
Tangerine darter	*Percina aurantiaca*	NMGT (S3)	-		X	X	X
Mollusks							
Anthony's riversnail	*Athearnia anthonyi*	END (S1)	END		X	X	
Birdwing pearlymussel	*Lemiox rimosus*	END (S1)	END	X			
Dromedary pearlymussel	*Dromus dromas*	END (S1)	END				X
Fanshell	*Cyprogenia stegaria*	END (S1)	END		X	X	X
Fine-rayed pigtoe	*Fusconaia cuneolus*	END (S1)	END		X	X	
Orange-foot pimpleback	*Plethobasus cooperianus*	END (S1)	END		X	X	X
Pink mucket	*Lampsilis abrupta*	END (S2)	END	X	X	X	X
Pyramid pigtoe	*Pleurobema rubrum*	TRKD (S2S3)	-				X
Ring pink	*Obovaria retusa*	END (S1)	END		X	X	
Rough pigtoe	*Pleurobema plenum*	END (S1)	END				X
Sheepnose	*Plethobasus cyphyus*	TRKD (S2S3)	END	X	X	X	
Shiny pigtoe pearlymussel	*Fusconaia cor*	END (S1)	END				X
Spectaclecase	*Cumberlandia monodonta*	TRKD (S2S3)	END	X			
Spiny riversnail	*Io fluvialis*	TRKD (S2)	-	X	X	X	
Tennessee clubshell	*Pleurobema oviforme*	TRKD (S2S3)	-		X	X	X
White wartyback	*Plethobasus cicatricosus*	END (S1)	END	X			

Table 3.8-1.
Threatened and Endangered Aquatic Fauna Known to Occur within a 10-mile radius of a Dam

Common Name	Scientific Name	Status[1]		Dam			
		State (Rank)[2]	Federal	Cherokee	Fort Loudoun	Tellico	Watts Bar
Insects							
Cherokee clubtail	*Gomphus consanguis*	TRKD (S1)	-				X
Salamanders							
Hellbender	*Cryptobranchus alleganiensis*	NMGT (S3)	-	X	X	X	

[1]Status Codes: END = Listed Endangered; PE = Proposed Listed Endangered; THR = Listed Threatened; NMGT = In Need of Management; TRKD = Tracked by Tennessee Natural Heritage Inventory Program due to conservation concern.

[2]State Ranks: S1 = Critically Imperiled; S2 = Imperiled; S3 = Vulnerable

No critical habitat has been designated in the project areas for any of the federally listed aquatic species. No listed aquatic animals are known or likely to occur on or in the immediate vicinity of the proposed borrow areas. Based on their habitat requirements, collection records, and population status, 12 of the species listed in Table 3.8-1 are known to occur or, based on records since the 1970s, likely to occur in the immediate vicinity of or in the upper tailwater downstream of one or more of the dams. These species are described in more detail below.

The **blue sucker** inhabits deep pools of large, free-flowing rivers with swift currents and gravel or other hard substrates. It was historically common throughout its range but has declined, possibly as a result of overfishing and impoundment and siltation of large rivers (Etnier and Starnes 1993; Boschung and Mayden 2004). Its abundance may be underestimated due to the difficulty of collecting it in its deep water habitat. Recent records of the blue sucker in the project area have been reported from the Holston River and from the Tennessee River below the Fort Loudoun and Watts Bar dams.

The **snail darter** was for many years only known from the lower Little Tennessee River and part of the adjacent Tennessee River (Hickman and Fitz 1978, USFWS 1984a). Although this population was eliminated by the closure of Tellico Dam, snail darters from this population were transplanted to other sites, including the lower Holston River, in the 1970s. Populations were subsequently found in other locations, and the species is generally considered 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 (Hickman and Fitz 1978; Etnier and Starnes 1993). 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 establish new populations in adjacent streams. Within the project area, snail darters occur in the Holston River about 20 miles downstream from Cherokee Dam, and in the tailwaters of the Fort Loudoun and Watts Bar dams.

The **dromedary pearlymussel** typically occurs in moderate- to fast-flowing current in clean-swept rubble, gravel, and sand substrates of both small and large rivers (USFWS 1984b). This once abundant species is presently restricted to a few river reaches in the Cumberland and Tennessee River systems. Likely causes of its decline include impoundments, siltation, and pollution. The only known recent occurrence within the project area is in the Watts Bar Dam tailwater, where it was observed in the late 1970s and early 1980s between 8 and 11 miles downstream of the dam (Gooch et al. 1979; TVA 1986b).

The **fanshell** formerly occurred in the Ohio, Wabash, Cumberland, and Tennessee River systems (USFWS 1991). Identified causes for its decline include the construction and operation of reservoirs and other impacts on water and substrate quality. Recent records of this species in the Tennessee River system are from the Clinch River in Tennessee and Virginia, and from the tailwaters of several mainstem dams, including Watts Bar. The Watts Bar records have been of single individuals between about 1 and 10 miles downstream of the dam. Typical fanshell habitat is gravel or cobble substrate in medium to large rivers (USFWS 1991).

The **orangefoot pimpleback** historically occurred in parts of the Ohio, Cumberland, Kanawha, Tennessee, and Wabash Rivers (USFWS 1984c). Since the early 1970s, it has been found in the lower Ohio River, in the middle reach of the Cumberland River, and in the tailwaters of mainstem dams on the Tennessee River (USFWS 1984c, Parmalee and Bogan 1998). Project area records include one in the late 1970s between 6 and 8 miles downstream of Fort Loudoun Dam, and one, also in the late 1970s, between 13 and 15 miles downstream of Watts Bar Dam. The reasons for the decline of this species are not totally understood but, due to its longevity and sedentary nature, it appears especially vulnerable to stream perturbations such as impoundment, siltation, and pollution (USFWS 1984c). The orangefoot pimpleback occurs in shoals in large rivers, typically in sand and coarse gravel.

The **pink mucket** 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, it has been found at locations scattered across the former range where suitable riverine habitat still exists. These locations extend from the Kanawha River in West Virginia west to the Gasconade River in Missouri, south to the Black River in Arkansas, and east to the Tennessee and Cumberland River basins (USFWS 1985). In many of these locations, the pink mucket is regularly encountered in low numbers that suggest relatively stable populations. Within the project area, there are multiple recent records of the pink mucket between 20 and 25 miles downstream of Cherokee Dam, at several locations within a few miles downstream of Fort Loudoun Dam, and at several locations within a few miles downstream of Watts Bar Dam, beginning about one mile below the dam (TVA unpublished records). The causes of the decline for this species are not totally understood but are likely related to impoundments, siltation, and pollution (USFWS 1985).

The **pyramid pigtoe** was once widespread in the Ohio, Cumberland, and Tennessee rivers and their larger tributaries, as well as into Kansas and Arkansas (Parmalee and Bogan 1998). Since the early 1970s, it has been found alive in the Barren and Green rivers in Kentucky, and in the Clinch, Cumberland, and Tennessee rivers in Tennessee (USFWS 1984d). Within the project area, it has been reported in recent years from the Watts Bar Dam tailwaters within about 1.5 miles downstream of the dam. 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 (USFWS 1984d). It typically occurs in large river habitats and is found in firmly packed mixtures of sand and gravel.

The **sheepnose** was added to the list of endangered species in 2012 due to its apparent range-wide decline likely due to impoundments, channelization, chemical contaminants, mining, and sedimentation (USFWS 2012b). It has recently been reported from scattered locations across its broad historic range that extends from Minnesota to Arkansas, Alabama, Virginia, and Pennsylvania. Within the project area, the sheepnose occurs in the Holston River between about 18 and 22 miles downstream of Cherokee Dam. It typically occurs in areas of large rivers with moderate to swift currents and sand and gravel substrates.

The historic range of the **shiny pigtoe** is the Tennessee River system upstream of Muscle Shoals (Parmalee and Bogan 1998). One historic record of the shiny pigtoe has been reported from the Watts Bar Dam tailwater; the species has not been recently reported in this area. The shiny pigtoe is typically found in riffle and shoal areas with moderate to fast currents in small to medium-sized rivers.

The **spectaclecase** historically occurred in numerous streams in the Mississippi, Ohio, and Missouri River basins, including the Cumberland and Tennessee River systems. Because of an apparent rangewide decline, it was added to the list of endangered species in 2012 (USFWS 2012b). The only project area record of the spectaclecase is from the 1960s, when it was reported from the Holston River within the first three miles downstream of Cherokee Dam. It occurs in medium to large rivers and in gravel, sand, and mud substrates (Parmalee and Bogan 1998).

The **white wartyback** historically occurred in the Cumberland, Ohio, Kanawha, Tennessee, and Wabash Rivers (Parmalee and Bogan 1998, USFWS 1984e). Its current populations appear restricted to the Tennessee River in the tailwaters of the Pickwick and Wilson dams. Like the spectaclecase, the only project area record of the white wartyback is from the 1960s, when it was reported from the Holston River within the first three miles downstream of Cherokee Dam. The white wartyback occurs in big rivers in shoals and riffle areas with sand and gravel substrate.

The **hellbender** occurs primarily in medium-sized to large free-flowing streams in the Tennessee and Cumberland River drainages. It is typically found under large rocks or logs in shallow rapids (NatureServe 2009). It was found in the lower Little Tennessee River prior to its impoundment by Tellico Dam; this population is likely extirpated. It could persist in tailwaters below the dams.

3.8.1.2. Terrestrial Fauna

No listed terrestrial fauna are known or likely to occur on or in the immediate vicinity of the four dams or the proposed borrow areas. No federally or state-listed terrestrial animal species were observed during field surveys of the project areas conducted in May 2011 and January 2013. The bald eagle (*Haliaeetus leucocephalus*) has been documented within three miles of one or more of the four dams. It was formerly on the Federal list of endangered species but was delisted in 2007 due to the recovery of its population. The bald eagle remains protected under the BGEPA and the Migratory Bird Treaty Act (MBTA) and it is designated by the State of Tennessee as In Need of Management. The gray bat (*Myotis grisescens*), federally listed as endangered, has been reported from other locations in Jefferson County (site of Cherokee Dam), from Meigs and Rhea Counties (site of Watts Bar Dam) and from Grainger County (site Cherokee Dam). The Indiana bat (*Myotis sodalis*), also federally listed as endangered, has been reported from other locations in Jefferson County. These species are described in more detail below.

Bald eagles nest in forested areas near large bodies of water, such as rivers and reservoirs, where they forage (Bryan et al. 2005; Thompson et al. 2005). Bald eagles nest in the counties where the dams are located (Grainger, Jefferson, Loudon, Meigs and Rhea). The closest documented active nest to Fort Loudoun and Tellico dams is approximately 1,400 feet from

Tellico Dam, at the junction of the Tennessee and Little Tennessee Rivers. In recent years, a pair of eagles has built two nests about a mile downstream of Cherokee Dam. All of the nests in Meigs and Rhea counties are more than three miles from Watts Bar Dam. With the exception of Tellico Saddle dams Nos. 2 and 3, located about 1.4 miles south of the main Tellico Dam, suitable forested perching and nesting habitat does not occur in the immediate vicinity of any of the sites where the proposed permanent modifications would occur. All of the reservoirs and their tailwaters provide suitable foraging habitat for bald eagles. None of the borrow areas provide suitable nesting or foraging habitat for the bald eagle.

Occurrence of the gray bat has been documented in Meigs and Rhea counties, where Watts Bar Dam is located, and Grainger and Jefferson counties, where Cherokee Dam is located. All records from these counties are greater than three miles from the dams. Gray bats inhabit caves throughout the year, migrating between summer roosts and winter hibernacula, and forage over streams, rivers, and reservoirs (Tuttle 1976). No caves were identified within the project area during field surveys. Reservoirs and tailwaters adjacent to each of the project areas provide suitable foraging habitat.

Indiana bats hibernate in caves during winter and roost in forested habitat during summer. Typical summer roosts are in the cracks and crevices of damaged trees or under sloughing bark on dead or live trees (Tuttle and Kennedy 2002; Harvey 2002). Wintering Indiana bats have been reported from a cave in Jefferson County and a cave in Grainger County. Both of these caves are more than three miles from Cherokee Dam. The use of the Grainger County cave by gray bats has not been documented in recent years. There are no summer records of Indiana bats from the immediate vicinity of any of the four dams or the borrow areas, and no suitable winter caves were identified during field surveys of the project areas.

Habitat assessments to determine presence of potentially suitable summer roosting and foraging habitat for Indiana bat resulted in identification of potentially suitable habitat within the project areas at Tellico Dam and Cherokee Dam. Two suitable snags were identified at Cherokee Dam within the wooded area proposed for clearing under Alternative B on the downstream side of the main access road opposite the picnic area parking lot. Suitable habitat also occurs near the Visitor Center building at Cherokee Dam. At Tellico Dam, high quality habitat in the form of snags and suitable live trees (e.g., white oak), is present in the wooded area proposed between Saddle Dam 2 (Segment T-3) and the reservoir. Two large live white oaks suitable for Indiana bats occur on the southern edge of the wooded area between the main embankment (Segment T-1) and Tellico Parkway within the area to be cleared under Alternative B. A total of 1.89 acres (4 individual trees at Cherokee and Tellico Dams totaling 0.36 acres, plus 1.53 acres of habitat at Tellico Dam) of potentially suitable summer habitat thus occurs within the combined project footprints at the two Dams. No suitable habitat was identified at Watts Bar or Fort Loudoun Dam.

No critical habitat has been designated in the project areas for the Bald eagle or the gray bat. Critical habitat for the Indiana bat has been established in Tennessee at the Whiteoak Sink Blowhole Cave in Blount County (USFWS 2007). The cave is located in the Great Smoky Mountains national park, approximately 40 to 50 miles from the project areas.

3.8.1.3. Aquatic and Terrestrial Flora

No federally-listed endangered, threatened, or candidate plant species are known to occur within the five counties where the dams are located. Three plant species state-listed in

Tennessee as threatened and three species of special concern have been reported as occurring within five miles of the four dams (Table 3.8-2).

Table 3.8-2.
Threatened and Endangered Plants Known to Occur within a Five-mile radius of each Dam

Common Name	Scientific Name	Status[1]		Dam			
		State (Rank)[2]	Federal	Cherokee	Fort Loudoun	Tellico	Watts Bar
Appalachian bugbane	*Cimicifuga rubifolia*	THR (S3)	-	X			
Large-leaf pondweed	*Potamogeton amplifolius*	THR (S1)	-			X	
Mountain honeysuckle	*Lonicera dioica*	SPCO (S2)	-		X	X	
Prairie goldenrod	*Solidago ptarmicoides*	SPCO (S1)	-				X
Slender blazing Star	*Liatris cylindracea*	THR (S2)	-				X
Spreading false-foxglove	*Aureolaria patula*	SPCO (S3)	-		X	X	X

[1]Status Codes: THR = Listed Threatened; SPCO - Special Concern.
[2]State Ranks: S1 = Critically Imperiled; S2 = Imperiled; S3 = Vulnerable

As no federally listed plant species are known to exist in the project area, no critical habitat has been designated for the flora listed in Table 3.8-2. No ETSC plants were found during field surveys of the dam reservations conducted in May 2011 and, based on the habitats present, none are likely to occur. Similarly, no listed plants are known or likely to occur on or in the immediate vicinity of the proposed borrow areas.

3.8.2. Environmental Consequences

This section contains an analysis describing any potential direct or indirect impacts that could occur to ETSC species as a result of the implementation of any of the Proposed Alternatives.

3.8.2.1. Alternative A – No Action Alternative

Aquatic Fauna

Under the No Action Alternative, TVA would continue to use the HESCO barriers as a solution to prevent flood overtopping and potential impacts to the dam embankments and possibly dam failure. Longer term use (greater than five years) would require maintenance and/or replacement to continue their effectiveness. None of the HESCO barriers occur in water or would require stream disturbance. Therefore, no direct or indirect impacts to aquatic ETSC species would occur under the No Action Alternative.

Terrestrial Fauna

Under the No Action Alternative, TVA would maintain the existing HESCO barriers and other facilities at each of the four dams. This would not affect the hellbender, bald eagle, gray bat, Indiana bat, or any other terrestrial ETSC species. The status and conservation of these species would continue to be determined by other actions and changes that would occur in the area over time, such as population trends; land use and development; quality of air/water/soil; recreational patterns; and cultural, ecological, and educational changes. Therefore, there would be no direct or indirect impacts on endangered and threatened species and their critical habitats under the No Action Alternative.

Aquatic and Terrestrial Flora

Under the No Action Alternative, the current modifications, using HESCO barriers to raise the height of the dams, Saddle dams, and embankments, at Cherokee, Fort Loudoun, Tellico and Watts Bar dams will remain in place with periodic maintenance needed to replace or repair damaged units. Since neither rare plants nor habitat to support those species were found in the areas of the dam reservations, embankments, and Saddle dams where HESCO barriers are currently placed, no direct or indirect impacts are anticipated to ETSC plant populations as a result of the No Action Alternative.

3.8.2.2. Alternative B – Combination Floodwalls and Embankments

Aquatic Fauna

Under Alternative B, the HESCO barriers would be replaced with concrete floodwalls and raised earthen embankments. Run-off of fine sediments and pollutants (such as gasoline and oil for construction machinery) could occur temporarily during construction. Elevated levels of suspended sediment in aquatic habitats are known to interfere with respiration, feeding, and reproduction in aquatic animals such as fish and mussels. However, BMPs used during construction would minimize any significant run-off of sediment or pollutants that could be mobilized during construction and the establishment of vegetation cover on the earthen berms would prevent erosion and run-off from these areas after construction. Therefore, no direct or indirect impacts to aquatic ETSC species are anticipated under Alternative B.

Terrestrial Fauna

Under Alternative B, the construction of earthen berms increases the potential for siltation into the adjacent reservoirs and tailwaters. The use of standard BMPs to control siltation during construction and the establishment of vegetation cover on the berms after construction would minimize adverse effects on fish and aquatic insects that are components of the food supply for potential terrestrial ETSC species in the vicinity of the dams. In addition, to protect the bald eagle in accordance with management guidelines under the BGEPA, TVA will resurvey the areas surrounding Tellico Saddle Dams No. 2 and No. 3 for eagle nests prior to scheduling the construction work. In the event that an active eagle nest is located within 660 feet of either site, TVA would schedule the work to avoid the December 16 to May 31 eagle nesting season. No impacts to the gray bat are anticipated.

A total of 1.89 acres (4 individual trees at Cherokee and Tellico Dams totaling 0.36 acres, plus 1.53 acres of habitat at Tellico Dam) of potentially suitable summer habitat would be cleared under Alternative B. Under normal circumstances, the TVA would conduct summer surveys for Indiana bat prior to implementing Alternative B in an effort to first avoid and then minimize impacts to endangered species. Given the safety concerns associated with failure of any of these dams; however, TVA is committed to implement the permanent dam modifications by late 2014 and thus is working under an accelerated implementation schedule. TVA therefore has proposed to compensate for the loss of this potential habitat by entering into a Conservation

Memorandum of Agreement with the USFWS. TVA would contribute to the Indiana Bat Conservation Fund established by the Tennessee Ecological Services office of USFWS in order to satisfy its ESA Section 7a (2). Based on the mitigation payment rate of $3,700 per acre, and the intent to clear the 1.89 acres between April 1 and August 15, which is associated with a mitigation factor of 2.0, the total mitigation cost would be $13,986.

Under the current implementation schedule, TVA would remove the potentially suitable habitat during the time period in which it could be occupied by Indiana bats (April 1 - August 15). To minimize direct impacts to any juveniles that may be present in trees identified as potentially suitable for summer roosting and that would not yet be able to fly (which typically is between June 1-July 31), TVA would remove the 4 individual trees (2 at Cherokee Dam and 2 at Tellico Dam) prior to June 1 and remove the 1.53-acre block of habitat at Tellico Saddle Dam 2 after July 31. Prior to removal of the 4 individual trees, TVA would conduct emergence counts at sunset to determine if bats are present, and would conduct acoustic surveys of the 1.53-acre habitat block between May 5 and July 31, in an effort to gain site-specific documentation regarding presence of the species. If Indiana bats are present in either individual roost trees or detected in the block of habitat, TVA would notify the Tennessee USFWS office. However, trees would still be removed as proposed. Alternative B, therefore, would affect potential Indiana bat summer habitat and potentially adversely affect any Indiana bats that may be roosting in trees to be removed by causing those individuals to flush from those trees at the time of removal. These effects would be mitigated by actions carried out as part of the Memorandum of Agreement.

TVA has submitted the Conservation Memorandum of Agreement to the USFWS as part of its ESA Section 7 consultation requirements (Appendix C). With the adoption of the measures described above, no adverse direct or indirect impacts to terrestrial ETSC fauna and bald eagles are anticipated to result from Alternative B.

Aquatic and Terrestrial Flora

Neither ETSC plants nor their habitats occur in the areas of the dam reservations, embankments, and saddle dams where HESCO barriers would be replaced by floodwalls and berms. Consequently, no direct or indirect impacts to ETSC plants are anticipated under Alternative B.

3.8.2.3. Alternative C – All Floodwalls

Aquatic Fauna

Under Alternative C, the HESCO barriers would be replaced with permanent concrete floodwalls. No work would occur in the water. Under this alternative, there is less potential for sediment run-off into the forebays and tailwaters of the subject dams resulting from construction of the flood-walls alone compared to Alternative B, which includes earthen embankments. Therefore, no direct or indirect impacts on aquatic ETSC species are anticipated under Alternative C.

Terrestrial Fauna

Suitable habitat was not identified in the project area for the gray bat. Although potentially suitable summer habitat for Indiana bats occurs on the Cherokee and Tellico reservations, it would not be affected by implementation of Alternative C. Potentially suitable nesting habitat for the bald eagle is available in woodlands adjacent to Tellico Saddle dams Nos. 2 and 3. In accordance with management guidelines under the BGEPA, TVA will resurvey these areas for eagle nests prior to scheduling the construction work. In the event that an active eagle nest is located within 660 feet of either site, TVA would schedule the work to avoid the December 16 to May 31 eagle nesting season. With the adoption of this measure, no direct or indirect impacts to terrestrial ETSC animals are anticipated to result from Alternative C.

Aquatic and Terrestrial Flora

Neither ETSC plants nor their habitats occur in the areas of the dam reservations, embankments, and saddle dams where HESCO barriers would be replaced by floodwalls. Consequently, no direct or indirect impacts to ETSC plants are anticipated under Alternative C.

3.9. Land Use

Shoreline development along TVA reservoirs is managed in accordance with the Shoreline Management Policy (SMP) established by the 1999 Shoreline Management Initiative (SMI; TVA 1999); TVA Reservoir Land Management Plans (RLMPs) for individual reservoirs (see Section 1.7); and applicable Federal, state, county, and municipal regulations. TVA also manages reservoir shoreline development through the Section 26a permitting process, which regulates the construction of shoreline structures. TVA does not otherwise regulate private property, except as specifically provided for in individual property flowage easements or in deeds where TVA sold property but retained rights to protect flood control interests and manage certain construction activities. Flowage easements vary widely among reservoirs and provide TVA with varying levels of control over construction on and use of flowage easement shore lands (TVA 2004).

Section 26a of the TVA Act requires that TVA approve the construction, operation, and maintenance of any obstruction affecting navigation, flood control, or public lands—across, along, or in the Tennessee River or its tributaries—even when TVA has no land rights involved. NEPA, the National Historic Preservation Act of 1966 (NHPA), and the ESA indirectly affect implementation of Section 26a. These statutes require TVA to evaluate the environmental impacts of their proposed actions. This process leads to approval, denial, or revision of proposed project plans in order to avoid adverse environmental impacts. Once approved, permit recipients are required to follow the construction procedures and environmental protection measures specified. Coupled with these and other environmental requirements, Section 26a ensures that development along the Tennessee River and its tributaries receives adequate planning and review. The SMI indicated that 85 percent or more of all Section 26a permit approvals were for structures directly associated with shoreline residential property, such as private docks, piers, and boathouses (TVA 1999).

In the 1990s, TVA developed and implemented the SMI to better protect shoreline and aquatic resources while allowing adjacent residents reasonable access to the water due to growing public concern for potential effects on reservoir shoreline resources due to increasing shoreline residential development. Access rights to the water determine the geographical pattern for residential development around specific reservoirs. Specific standards for facility size and vegetation management were established in the SMI. The SMI also established a shoreline classification system wherein shoreline environmental constraints would be identified and appropriate management strategies implemented (TVA 1999).

The RLMPs designate reservoir lands into one of seven broad land use categories, including recreational, natural resource conservation, residential access, and industrial uses along TVA shorelines (TVA 2004). This zoning is established to minimize conflicting land uses and guides TVA decisions on selling reservoir lands, granting easements, issuing 26a permits, and other land management action. All of the reservoirs associated with the four dams that are the subject of this EIS have completed RLMPs except for Fort Loudoun.

Cherokee Dam

The RLMP for Cherokee Dam designates the project area as 'Zone 2 – Project Operations' (TVA 2001). Land uses within this category include:

- 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, transmission facilities, and ROWs;
- Dam reservation land—Areas used for developed and dispersed 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 day boards 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);
- Highways adjusted due to the development of the Tellico Project— Includes highways that were relocated or elevated to a location or an elevation that would allow continued use during normal flood events; and
- Land planned for any of the above uses in the future (TVA 2000).

The definition for this land use is the same as that for Tellico and Watts Bar Reservoirs. This operations zone encompasses the entire project area for Cherokee Dam (Figure 3.9-3).

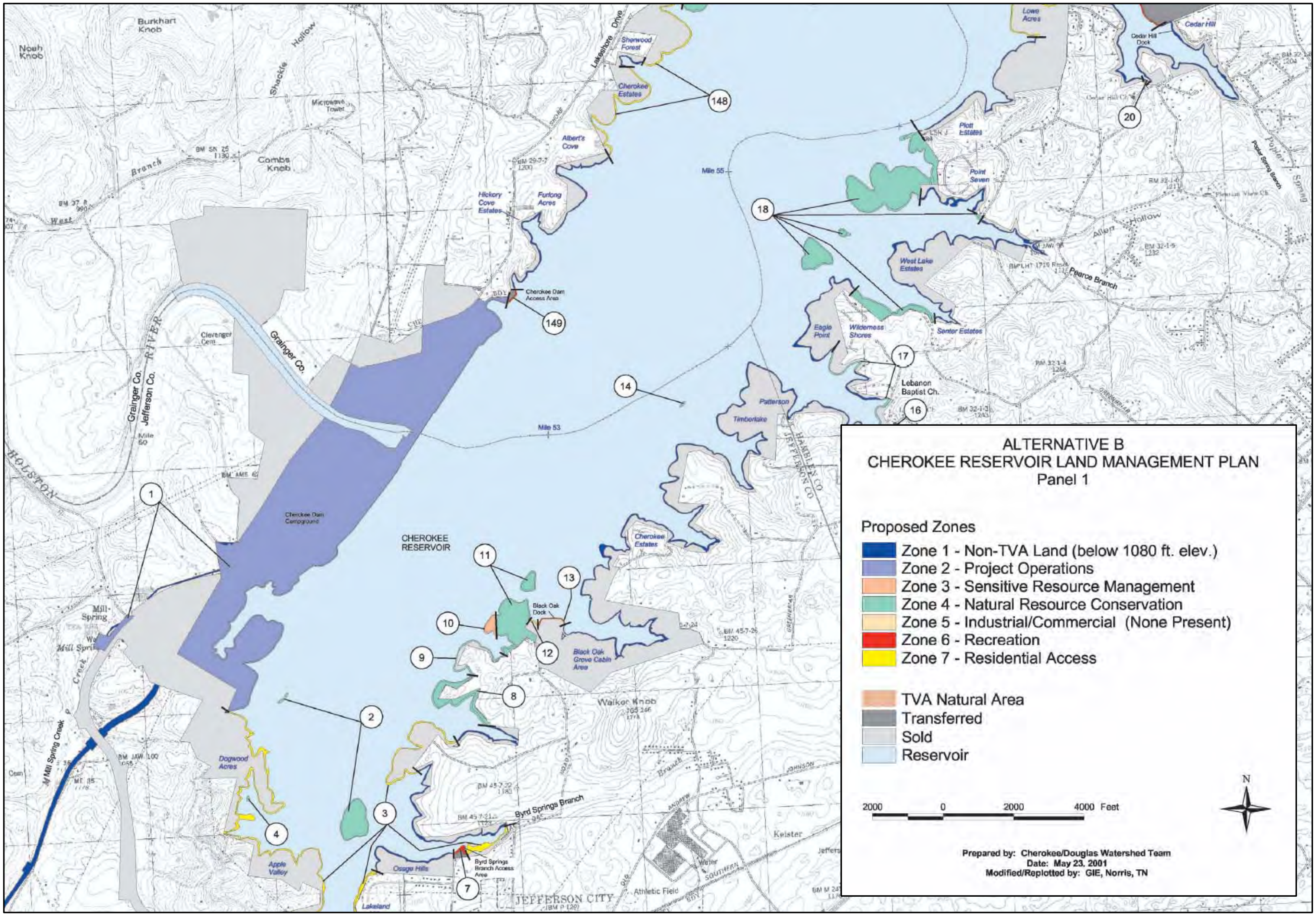


Figure 3.9-1. Cherokee Reservoir Land Use Designations (TVA 2001)

Fort Loudoun Dam

TVA does not have a formal reservoir land management plan for Fort Loudoun. The TVA-owned lands in the immediate vicinity of the dam and the proposed floodwalls are managed as if they had the formal Zone 2 – Project Operations allocation. Deed and/or lease restrictions specify that the tract where the nearby Fort Loudon Marina is located be used for commercial recreation, and the nearby Lenoir City Park be used for public recreation (personal communication, TVA 2012c).

Tellico Dam

The Tellico RLMP designates the land surrounding Tellico Dam under Zone 2, the 'TVA Project Operations' category. The parcel containing Tellico Dam and the adjacent flood control structures is described as follows:

- "Parcel 1 (614.2 acres [248.56 hectares]) hydraulic unit (HUC) Nos. TN-06010201-130; TN-06010201-140; and TN-06010204-140. Zone 2, TVA Project Operations
- Public Access Ramp
- Tellico Dam and Spillways
- Navigation Safety Landing
- Canal Daybeacon - Mile 0.61"

Parcel 1 begins at Little Tennessee River mile 0 on both sides of the inter-reservoir canal and then stretches up the left (descending) bank to approximately River mile 3.6. On the Tennessee River side of this parcel, it reaches from the Fort Loudoun Dam down the left descending bank to Tennessee River mile 598.6" (TVA 2000). Figure 3.9-2 shows the land use designations for the Tellico Dam area.

The RLMP further describes the purpose of the land use designation at Tellico; this description should apply to all other dams and their reservations. The primary purpose of this land designation is to manage the property for protection of the integrity of the dam and associated switchyards and power lines. Secondarily, this property contains amenities and facilities that are designed for use by the general public for a variety of recreational purposes (TVA 2000).

Watts Bar Dam

The Watts Bar RLMP also designates all the land surrounding the dam as 'TVA Project Operations' (Figure 3.9-3) (TVA 2009a). The definition associated with this land use at Tellico Dam also applies here. The parcels surrounding the dam have been retained in their current use after the ROD for the Final EIS for the RLMP was published (TVA 2009a).

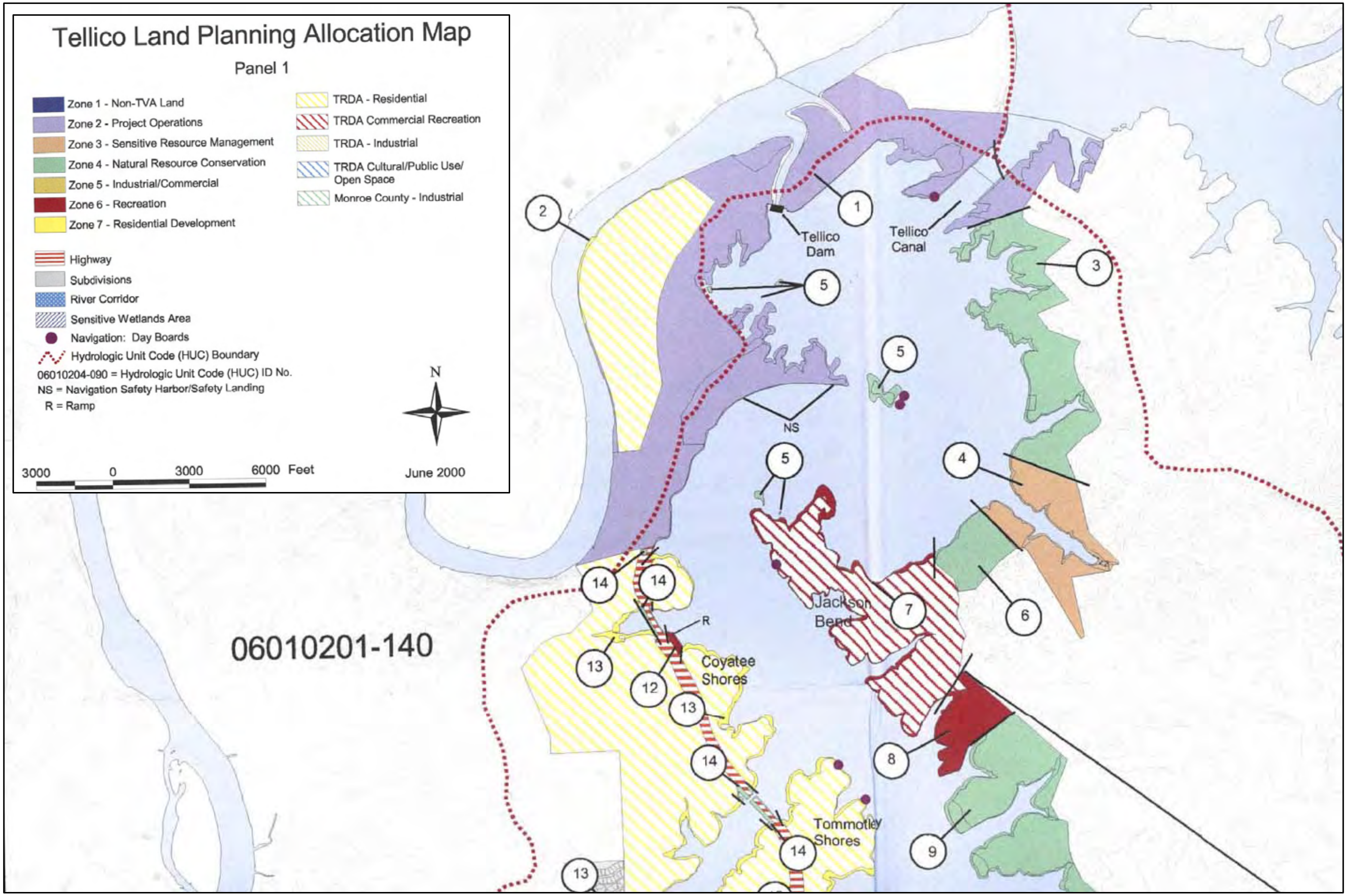


Figure 3.9-2. Tellico Dam Area Land Use Designations (TVA 2000)

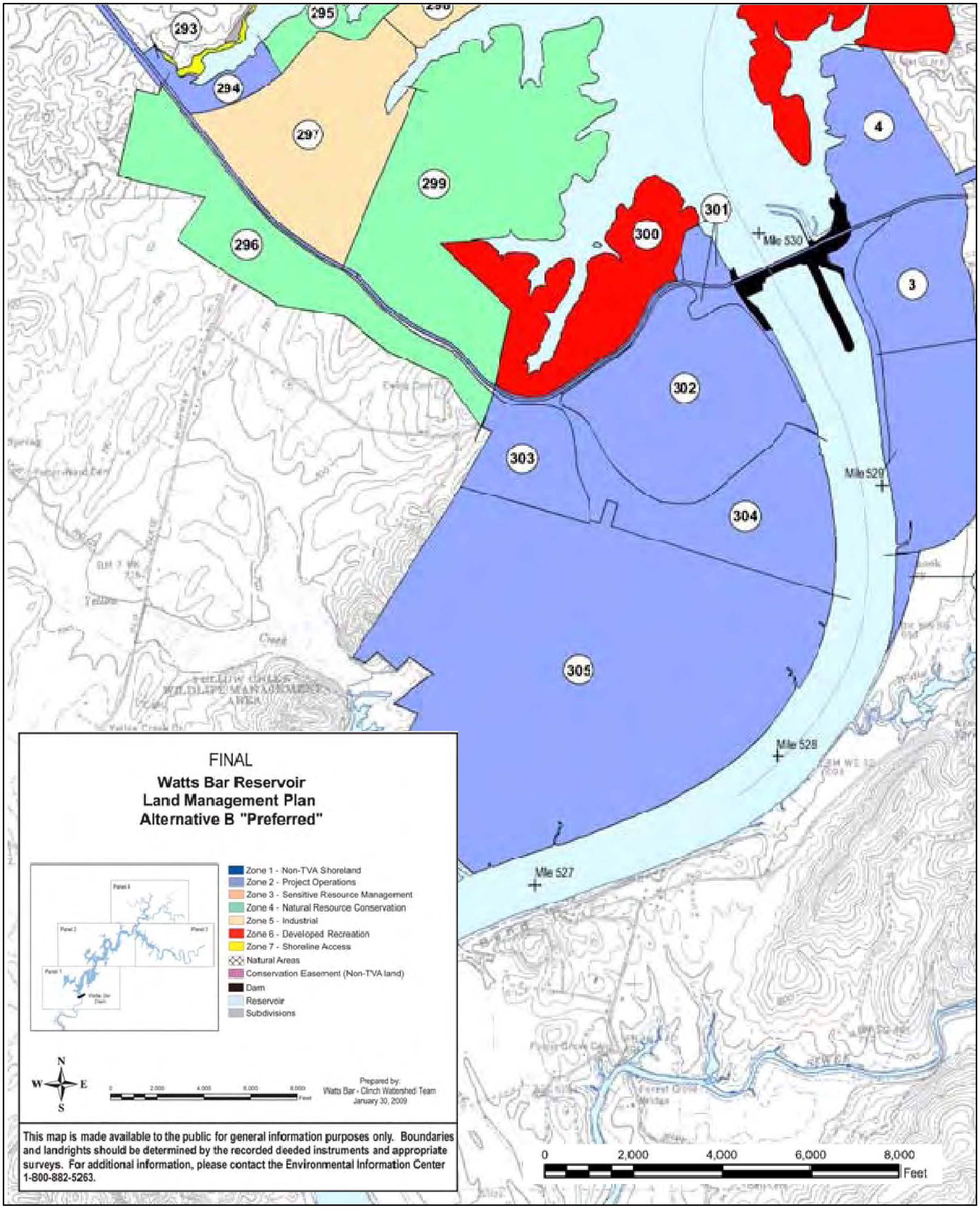


Figure 3.9-3. Watts Bar Dam LMP Designations near Watts Bar Dam

3.9.1. Affected Environment

Alternative B of replacing the HESCO barriers with permanent floodwalls and/or embankments would affect land use primarily at the shoreline immediately adjacent to the existing flood control structures. Therefore, the analysis of land use impacts is focused on shoreline land use in the immediate vicinity of TVA shorelines adjacent to the four dams.

A total of approximately four shoreline miles comprise the four project areas (1.2 miles at Cherokee; 0.75 miles at Fort Loudoun; 1.75 miles at Tellico; and 0.3 miles at Watts Bar). This land use analysis does not include any residential development in the area, as any changes in land use would be within the immediate vicinity of the existing dams and levees. Types of land use within this area would be associated with the existing levees and dams and recreation areas.

Alternative B would install permanent structures on top of approximately 18,460 linear feet of existing dam, levee and floodwall structures. All construction would be on TVA property at each dam. The existing dams and floodwalls are composed of reinforced concrete; levees are generally earthen embankments with varying amounts of concrete hardening and riprap.

Cherokee Dam is 175 feet high and 6,760 feet long. The dam consists of a 2,150-foot long north earthen embankment, a central 1,697-foot long concrete portion containing the spillway and penstock intakes, and a 2,913-foot long south earthen embankment. Three separate earth-fill saddle dams, totaling 1,770 feet in length, are located to the south of the main dam. Fort Loudoun Dam is 122 feet high and 4,190 feet long. The 1,550-foot long concrete portion of the dam, containing the spillway, lock and penstock intakes, is located on the north side against a rock bluff. The remainder of the dam to the south is an earthen embankment faced with rock. A separate saddle dam about 550-feet long spans a low area near Fort Loudon Marina, about 3/4 mile northeast of the main dam. Tellico Dam is 129 feet high and 3,238 feet long. The main concrete portion, approximately 538 feet long and containing the spillway, is located at the west end of the dam. The remainder of the dam is earthen fill faced with rock. Three separate earthen fill saddle dams totaling 2,980 feet in length are located to the south of the main dam. Watts Bar Dam is 112 feet high and 2,960 feet long. The concrete portion of the dam adjoins a rock bluff on the west side of the river. It is 1,726 feet long and includes the penstock intakes, spillway, and lock. A 1,234-foot long earthen embankment faced with stone extends east from the concrete portion of the dam. All four dams and associated flood control structures currently have gravel-filled HESCO barriers on them in order to increase the height of the dams to prevent overtopping and failure in the event of a PMF.

<u>**Recreation Areas**</u>

TVA has developed recreation facilities on all four dam reservations. These facilities include parking areas, visitor overlooks, restrooms, picnic areas, and boat launching ramps above and below the dams. These facilities are normally open and used by the public year-round. This discussion focuses on areas which could be potentially impacted by Alternative B. In terms of land use designation, all recreation facilities potentially impacted by Alternative B are designated as ‘TVA Project Operations’ areas. The recreation facilities on the four dam reservations are described in more detail below in Section 3.15 – Recreation.

At Cherokee Dam, recreation facilities are concentrated on the south side of the dam. A paved sidewalk extends from the south end of the south main dam embankment for approximately

2,275 feet. Due to the installation of temporary HESCO barriers on a portion of this walkway, an over 700-foot section does not presently meet Americans with Disabilities Act (ADA) guidelines. This trail is accessible from the south overlook and day use area parking lots. There is also a day use area parking lot and a tailwater parking lot to the south of the dam. Recreation facilities on the south bank below the dam include boat launching ramps that provide access to the Holston River tailwater and to the reservoir, parking lots at the base of the dam, open space areas with a trail as described above, a concrete stairway that provides pedestrian access to the top of Cherokee dam, walking trail, swimming beach, picnic area, restroom building, and campground.

At Fort Loudoun Dam, recreation facilities include a parking area and a tailwater fishing berm on the south bank below the dam. Additional parking areas, restrooms, tailwater fishing berms, and a boat ramp are located on the north bank below the dam. TVA also maintains a parking area, visitor overlook, and picnic area on the north bank upstream of the dam. Fort Loudon Marina is located in a cove immediately east of the dam reservation. Facilities include boat ramps, covered and uncovered boat slips, dry boat storage, fuel pumps, boat rentals, and restaurants.

At Tellico Dam, TVA maintains several recreation facilities. Immediately south of the junction of Tellico Parkway and U.S. Highway 321/State Route 95 is a parking area, restroom building, and ADA-accessible fishing area along the canal connecting Fort Loudoun and Tellico reservoirs. To the west of this is a large boat ramp and parking area, and a separate day use area with swim beaches, restrooms, picnic area, and a paved, ADA-accessible walking trail. A separate boat launch ramp and parking area is located on the east bank below the dam. A parking area adjacent to Tellico Parkway on the side of the dam provides access to a five-mile-long trail system that runs through the Hall Bend Habitat Protection Area.

At Watts Bar Dam, the TVA day use area on the east bank of the reservoir above the dam is one of the most heavily used recreation areas on the reservoir. Facilities include parking areas, a swimming beach, playground, picnic area with group pavilion, restrooms with showers, and a boat ramp. An overlook and parking area are located on the west bank immediately upstream of the dam. TVA maintains parking lots, fishing berms, and a boat launching ramp on the east bank downstream of the dam.

Roads

Some of the existing dams and flood control structures are immediately adjacent to roads. At Cherokee Dam, approximately 6,685 feet of the existing embankment has a road either on top of it, or immediately adjacent. At Fort Loudoun Dam, approximately 3,800 feet of embankment have a road either on or adjacent to it. Additionally, approximately 3,300 feet of embankment is adjacent to U.S. Highway 321. At Tellico Dam, approximately 4,625 feet of embankment have a road either on top of or immediately adjacent. At Watts Bar Dam, approximately 1,600 feet of embankment have a road on or immediately adjacent. Portions of the roads at Cherokee, Fort Loudoun, and Tellico Dams are used for project operations and maintenance access and closed to public vehicular access. The public can walk or bicycle most of these access roads.

Undeveloped - Shrubs and Trees

A small area adjacent to Alternative B project areas consists of shrubby or treed areas. At Watts Bar Dam, a portion of the proposed permanent modifications would extend north of the existing HESCO barriers into an upland hardwood forest (350 feet at WB-1). At Fort Loudoun, woodland adjoins the north end of Segment FTL-1. At Tellico Dam, a portion of the project area near Saddle dams Nos. 2 (525 feet at T-3) and 3 (300 feet at T-4) is forested or shrubby. Common overstory tree species include American beech, black gum, hickories, and black, southern red, and white oaks. Several invasive plants are present in the understory.

3.9.2. Environmental Consequences

3.9.2.1. Alternative A - No Action Alternative

Under the No Action Alternative, the HESCO barriers would remain in place, to be maintained by TVA as necessary. The dams and other flood control structures are currently part of the existing flood protection system and would continue to be so designated. Therefore, no direct or indirect impacts to the existing land use on the dams, levees and floodwalls would occur under the No Action Alternative.

Recreation Areas

Under the No Action Alternative, the HESCO barriers would remain in place, to be maintained by TVA as necessary. No construction would occur. Therefore, no direct impacts to the recreation areas would occur. Indirect impacts may occur if TVA requires additional land area to maintain the HESCO barriers over time, or if currently existing recreation areas are deemed unsafe or otherwise unusable in the current configuration. A minor loss of recreation area could occur as an indirect impact under the No Action Alternative.

Roads

Under the No Action Alternative, the HESCO barriers would remain in place, to be maintained by TVA as necessary. No construction would occur. Therefore, no direct impacts to the public roads on or adjacent to the existing embankments would occur. Indirect impacts may occur if TVA requires additional land area to maintain the HESCO barriers over time, or if currently existing roads are deemed unsafe or otherwise unusable in the current configuration. A minor loss of road could occur as an indirect impact under the No Action Alternative.

Undeveloped - Shrubs and trees

Under the No Action Alternative, the HESCO barriers would remain in place, to be maintained by TVA as necessary. No construction would occur. Therefore, no direct impacts to the undeveloped areas would occur. Indirect impacts may occur if TVA requires additional land area to maintain the HESCO barriers over time, or if currently existing undeveloped areas are deemed unsafe or otherwise unusable in the current configuration. Additionally, undeveloped areas adjacent to the HESCO barriers could be designated undevelopable for safety reasons. A minor gain or loss of undeveloped area could occur as an indirect impact under the No Action Alternative. However, as all the land is designated as Project Operations, and would continue to be so designated, no direct or indirect impacts to land use would occur.

3.9.2.2. Alternative B – Combination Floodwalls and Embankments

Under Alternative B, TVA would permanent modify approximately 18,460 linear feet of existing flood containment structures. The dams and berms are currently part of the existing flood protection system and would continue to be so designated. Therefore, no direct or indirect impacts to the existing land use on the dams and/or embankments would occur under

Alternative B. The construction and operation of the permanent modifications would not result in changes in TVA's operation of the dams and reservoirs and would not affect land use or land rights, including flowage easements, on privately-owned and TVA-managed reservoir shorelands elsewhere on the reservoirs.

Recreation Areas

Under the combined Floodwall/Embankment Alternative, recreation areas could be directly negatively impacted. Earthen berms take up considerably more space than floodwalls. Berms would be constructed at one portion of Cherokee Dam (near the boat ramp), at no locations at Fort Loudoun Dam, and at all segments at Tellico Dam and Watts Bar Dam. At Cherokee Dam, a section of the walkway (over 700 feet in length) along the embankment is currently ADA-inaccessible due to the HESCO barriers. The construction of a floodwall in this area could lead to the return of this section of walkway to ADA-accessible status. This would constitute a minor positive direct impact to recreation areas at Cherokee Dam.

In areas where embankments would be constructed, large portions of existing recreational walkways, roads, parking lots, boat ramps, and fishing berms could be temporarily negatively impacted. Small portions of these areas would be permanently converted from recreational land use to flood control related land use. Walkways and other access points would be rebuilt atop the new embankments or adjacent to the new floodwalls. No indirect impacts are anticipated under the combined Floodwall/Embankment Alternative. All land in the vicinity of the dams would still be designated TVA Project Operations and all work would be conducted within the existing TVA ROW.

Roads

Most of the embankments at all four dams either have access roads or public roads either on top of them or immediately adjacent. Some of these roads are currently unsafe due to the positioning of the HESCO barriers. After construction, these roads would be considered safer both due to the removal of the obstructions. Thus, in some areas, depending on which side of the road the floodwalls are constructed, there would be a positive direct impact to roads due to an increase in public road safety.

Under Alternative B, direct, adverse impacts to public roads could occur during the construction period. These are described in more detail in Section 3.13.2.2. Indirect negative impacts could occur due to road damage from heavy equipment. All land in the vicinity of the dams would still be designated TVA Project Operations and all work would be conducted within the existing TVA ROW.

Undeveloped - Shrubs and Trees

Small areas of relatively undisturbed shrubs and trees and/or woodland would be directly, negatively impacted at each of the four dams due to clearing required for the construction of earthen embankments. This impact would be relatively minor. These areas would continue to be designated TVA Project Operations areas; however, no direct or indirect impacts to land use designations would occur.

3.9.2.3. Alternative C – All Floodwalls

Alternative C would raise existing flood containment structures on top of approximately 18,460 linear feet of existing dam, levee and floodwall structures. The dams are currently part of the existing flood protection system and would continue to be designated as TVA Project Operations areas. No direct or indirect impacts to the existing land use on the dams, levees and embankments would occur under the Floodwall Alternative. The construction and operation of the permanent modifications would not result in changes in TVA's operation of the dams and reservoirs and would not affect land use or land rights, including flowage easements, on privately-owned and TVA-managed reservoir shorelands elsewhere on the reservoirs.

Recreation Areas

Alternative B would raise existing flood containment structures on top of approximately 18,460 linear feet of existing dam, levee and floodwall structures. The construction of these floodwalls could directly impact some recreation areas immediately adjacent and near the existing flood control structures.

At all four dams, due to the location of the recreational walkways and parking lots, a minor temporary negative direct impact to recreation areas could occur during construction of the floodwalls. During construction, access to these areas could be limited because of safety reasons. After construction, these areas would be returned to recreational use. Additional minor and temporary direct impacts could occur due to the need for staging areas in parking lots near the dams. These lots would also be returned to recreational use when construction is complete. Under Alternative C, minor and temporary direct negative impacts to recreation areas are anticipated at all four dams; these impacts would be smaller than those anticipated under Alternative B.

Roads

During construction, public access to these roads would be restricted due to safety reasons. Therefore, a minor and temporary negative direct impact to roads could occur during construction. Roads would be returned to conditions that are compliant with all state and federal regulations. Indirect minor adverse impacts to public roads could occur due to damage from heavy equipment; however, fewer impacts to roads would occur under Alternative C than compared to Alternative B, due to the increased number of trucks required during the construction of earthen berms.

Overall, minor temporary negative impacts to public roads could occur during construction, but overall minor positive impacts could occur due to increased public safety. These areas would continue to be designated TVA Project Operations areas; however, no direct or indirect impacts to land use designations would occur.

Undeveloped - Shrubs and Trees

Under Alternative C, a small portion of the undeveloped area near Watts Bar Dam could be impacted. There would be little to no impacts to undeveloped areas at the other dams, and the land would still be designated TVA Project Operations area. Therefore, no direct or indirect impacts to land use designations would occur.

3.10. Socioeconomics and Environmental Justice

This section describes the socioeconomic resources in the vicinity of Cherokee, Fort Loudoun, Tellico, and Watts Bar dams, including the minority and poverty characteristics related to environmental justice and the impacts on social and economic resources and environmental justice from the Action and No Action alternatives. Components of socioeconomic resources that are analyzed include population, employment, and income; minority populations and poverty levels are analyzed in regard to environmental justice.

3.10.1. Affected Environment

The dams that would be affected by the proposed modifications are located along the Tennessee River and its tributaries in East Tennessee in Grainger, Jefferson, Loudon, Rhea, and Meigs Counties. These five counties are identified as the impact area for socioeconomic resources and environmental justice.

Socioeconomics

Population

The total population of the five-county impact area in 2010 was 166,182. As projected by the state of Tennessee, the total population of these counties would be about 199,407 by 2030. Population trends and projections are presented in Table 3.10-1.

Table 3.10-1.
Population, Impact Counties, 1990 – 2030

County	1990	2000	2010	Projection 2030	Percent Increase, 1990-2010	Percent Increase, 2010-2030
Grainger	17,095	20,659	22,657	25,922	32.5	14.4
Jefferson	33,016	44,294	51,407	65,990	55.7	28.4
Loudon	31,255	39,086	48,556	57,095	55.4	17.6
Meigs	8,033	11,086	11,753	13,148	46.3	11.9
Rhea	24,344	28,400	31,809	37,252	30.7	17.1
Total	113,743	143,525	166,182	199,407	46.1	20.0
Tennessee	4,877,185	5,689,283	6,346,105	7,451,677	30.1	17.4
U.S.	248,709,873	281,421,906	308,745,538	373,504,000	24.1	21.0

Source: Tennessee State Data Center (TSDC) 2012, U.S. Census Bureau (USCB) 1990, USCB 2000, USCB 2008, USCB 2010a.

Employment

Overall, the five impact counties have a total employment of about 64,360 jobs (Table 3.10-2). Approximately 6.3 percent are employed in farming, above both the national level of 0.6 percent and the state level of 2.2 percent. Manufacturing provides 16.0 percent of the jobs, more than the national share of 8.5 percent and the state share of 8.9 percent. Retail trade is similar to the state and national shares, while government employment is above the state share but lower than the national share. However, there are major differences among the counties. Grainger County has 14.5 percent of its jobs in farming and 14.4 percent in manufacturing. At the other extreme, Rhea County has only 3.1 percent of its jobs in farming and 23.9 percent in manufacturing. Retail trade accounts for a similar proportion of employment in the five counties. Government ranges from 8.4 percent in Meigs County to 20.6 percent in Rhea County.

Table 3.10-2.
Employment, 2010, Impact Counties

County	Total Employment	Percent Farm	Percent Manufacturing	Percent Retail Trade	Percent Government
Grainger	6,932	14.5	14.4	9.3	15.0
Jefferson	18,834	6.2	12.1	12.2	14.2
Loudon	18,692	6.0	15.4	11.5	12.1
Meigs	6,128	5.5	14.0	9.6	8.4
Rhea	13,774	3.1	23.9	10.1	20.6
Total	64,360	6.3	16.0	11.0	14.5
Tennessee	3,541,421	2.2	8.9	10.9	12.9
U.S.	136,341,000	0.6	8.5	10.8	18.3

Source: Bureau of Economic Analysis (BEA) 2012a, BEA 2012b.

Income

Per capita personal income in the impact area in 2010 was $29,024, 72.7 percent of the national average of $39,937 and less than the state average of $34,921 (Table 3.10-3). All of the counties in which the dams are located, with the exception of Loudon County, had per capita personal incomes levels 70 percent or less of the national average. In Loudon County, per capita personal income was 89.8 percent of the national average and higher than the state average.

Table 3.10-3.
Per Capita Personal Income, 2010, Impact Counties

County	Per Capita Personal Income (dollars)	Percent of U.S.
Grainger	27,966	70.0
Jefferson	27,680	69.3
Loudon	35,875	89.8
Meigs	27,502	68.9
Rhea	26,096	65.3
Total	29,024	72.7
Tennessee	34,921	87.4
U.S.	39,937	100.0

Source: BEA 2012c.

Environmental Justice

EO 12898 (59 FR 7629) directs Federal agencies to identify and address, as appropriate, potential disproportionately high and adverse human health and environmental impacts on minority and low-income populations. This section provides demographic information that characterizes the distribution of minority populations and low-income populations in the five-county impact area.

In identifying minority and low-income populations, the following Council of Environmental Quality (CEQ) (1997) definitions of minority individuals and populations and low-income populations were used:

Minority individuals. Individuals who identify themselves as members of the following population groups: American Indian or Alaskan Native, Asian, Native Hawaiian or Other Pacific Islander, Black, Hispanic, or two or more races.

Minority populations. Minority populations are identified where (1) the minority population of an affected area exceeds 50 percent or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

Low-income populations. Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau’s Current Population Reports, Series P-60, on Income and Poverty.

According to CEQ guidance (CEQ 1997), U.S. Census data are typically used to determine minority and low-income population percentages in the affected area of a project in order to conduct a quantitative assessment of potential environmental justice impacts.

<u>Minority Population</u>

Minorities constitute less than 10 percent of the total population in each of the five counties in the impact area, as of the 2010 U.S. Census of Population. The block groups and census tracts in the immediate vicinity of the four dams have a total minority population of 10.2 and 8.9 percent, respectively. These levels are slightly greater than the average of 7.4 percent in the five-county impact area, but well below the state average of 24.4 percent and the national average of 36.3 percent (Table 3.10-4). Every census tract and most of the block groups in the immediate vicinity of the four dams have a smaller share of minorities than does the state as a whole.

**Table 3.10-4.
Minority Population, Impact Counties, 2010**

County		Total Population	Minority Population	Percent Minority Population
Grainger		22,657	904	4.0
CT5003		6,337	435	6.9
	BG3	1,281	111	8.7
	BG4	852	13	1.5
Jefferson		51,407	3,669	7.1
CT703		7,239	1,081	14.9
	BG1	1,589	146	9.2
	BG2	1,357	217	16.0
	BG3	1,473	398	27.0
	BG4	1,278	178	13.9
	BG5	1,542	142	9.2
CT704		3,723	208	5.6
	BG1	1,808	106	5.9
Loudon		48,556	4,780	9.8
CT602.02		7,604	1,697	22.3
	BG1	2,219	333	15.0
	BG2	764	221	28.9
	BG3	1,063	289	27.2
	BG4	978	273	27.9
CT603.01		3,332	329	9.9
	BG2	1,454	218	15.0
CT603.02		6,201	305	4.9
	BG2	1,419	73	5.1
	BG3	903	65	7.2
	BG4	2,271	101	4.4
CT604		4,719	123	2.6
	BG1	898	14	1.6
	BG2	1,333	19	1.4
CT605.01		8,664	323	3.7
	BG3	1,682	27	1.6
Meigs		11,753	492	4.2
CT9601		3,155	179	5.7
	BG2	1,647	105	6.4
Rhea		31,809	2,506	7.9
CT9751		4,594	250	5.4

Table 3.10-4.
Minority Population, Impact Counties, 2010

County	Total Population	Minority Population	Percent Minority Population
BG1	1,899	107	5.6
BG2	1,886	73	3.9
5-County Total	**166,182**	**12,351**	**7.4**
CT Total	**55,568**	**4,930**	**8.9**
BG Total	**31,596**	**3,229**	**10.2**
Tennessee	6,346,105	1,545,323	24.4
U.S.	308,745,538	111,927,986	36.3

CT = census tract; BG = block group
Source: USCB 2010b

Poverty

The portion of the population in the impact counties that had income below the poverty level varied greatly among the counties during the period 2006 to 2010, ranging from 13.8 percent in Loudon County to 25.2 percent in Meigs County (Table 3.10-5). Four of the five counties in which the dams are located had poverty levels greater than 18 percent, the exception being Loudon County, in which Fort Loudoun and Tellico dams are located. The census tracts and block groups in the immediate vicinity of the four dams had a total of 17.5 and 17.8 percent, respectively, of the population living below the poverty level. This level is above the state and national average of 16.5 percent and 13.8 percent, respectively, but virtually the same as the average of 17.7 percent in the five-county impact area. Therefore, the five-county impact area and the census tracts and block groups near the dams are not considered low-income communities.

Table 3.10-5.
Poverty Levels, Impact Counties, 2006-2010

County	Total Population*	Persons Below Poverty Level*	Percent of Persons Below Poverty Level*
Grainger	21,819	4,085	18.7
CT5003	5,899	1,313	22.3
BG3	1,168	164	14.0
BG4	697	199	28.6
Jefferson	48,532	8,852	18.2
CT703	6,346	1,609	25.4
BG1	1,449	186	12.8
BG2	1,016	597	58.8
BG3	1,036	429	41.4
BG4	900	107	11.9

Table 3.10-5.
Poverty Levels, Impact Counties, 2006-2010

County	Total Population*	Persons Below Poverty Level*	Percent of Persons Below Poverty Level*
BG5	1,945	290	14.9
CT704	3,543	676	19.1
BG1	1,707	392	23.0
Loudon	46,707	6,467	13.8
CT602.02	7,712	2,707	35.1
BG1	2,153	797	37.0
BG2	919	263	28.6
BG3	1,148	90	7.8
BG4	948	211	22.3
CT603.01	3,178	301	9.5
BG2	1,452	285	19.6
CT603.02	5,951	253	4.3
BG2	1,225	41	3.4
BG3	800	0	0.0
BG4	2,365	72	3.0
CT604	4,333	582	13.4
BG1	728	63	8.7
BG2	1,281	144	11.2
CT605.01	8,051	435	5.4
BG3	1,699	20	1.2
Meigs	11,336	2,856	25.2
CT9601	3,556	792	22.3
BG2	1,869	600	32.1
Rhea	30,261	5,794	19.1
CT9751	4,309	568	13.2
BG1	2,045	376	18.4
BG2	1,740	75	4.3
5-County Total	158,655	28,054	17.7
CT Total	52,878	9,236	17.5
BG Total	30,290	5,401	17.8
Tennessee	6,075,066	1,002,467	16.5
U.S.	296,141,149	40,917,513	13.8

* Population for whom poverty status is determined.
CT = census tract; BG = block group
Source: USCB 2010c; USCB 2010d

3.10.2. Environmental Consequences

The following sections discuss the potential socioeconomic and environmental justice impacts associated with implementing the project alternatives.

Social and economic issues considered for evaluation within the impact area include change to current and projected population levels, change in expenditures for goods and services, and short-term or long-term impacts on employment and income.

EO 12898 (59 FR 7629) directs Federal agencies to identify and address, as appropriate, potential disproportionately high and adverse human health and environmental impacts on minority and low-income populations. According to the CEQ, adverse health effects to be evaluated within the context of environmental justice impacts may include bodily impairment, infirmity, illness, or death. Environmental effects may include ecological, cultural, human health, economic, or social impacts. Disproportionately high and adverse human health or environmental effects occur when the risk or rate of exposure to an environmental hazard or an impact or risk of an impact on the natural or physical environment for a minority or low-income population is significant (as defined by NEPA) and appreciably exceeds the impact level for the general population or for another appropriate comparison group (CEQ 1997).

3.10.2.1. Alternative A – No Action Alternative

Socioeconomics

Under the No Action Alternative, TVA would continue to use the HESCO barriers as a solution to prevent flood overtopping and potential impacts to the dam embankments and possibly dam failure. No construction would take place and no direct impacts to population levels, employment, or income would occur. However, the No Action Alternative could have adverse indirect impacts on the social and economic situation in downstream areas. The level of risk reduction under the No Action Alternative would be less than the level provided by the Action Alternatives. Downstream areas, including Watts Bar, Sequoyah, and Browns Ferry Nuclear Plants and other locations, could potentially experience a higher risk of flooding during a PMF along with a greater potential for associated property damage and personal injury.

Environmental Justice

Screening-level analyses of the census data from the project area were used to identify low-income and minority populations. If the affected area has a minority population and/or a low-income population meaningfully greater than those of the general population, it was identified as a potential concern for environmental justice issues. Based on the analysis presented in Section 3.10.1, residents of the five-county impact area and the census tracts near the dams are not considered minority populations or low-income communities. As described for other resources in Chapter 3, the No Action Alternative would not result in negative health or other environmental effects that could affect environmental justice populations. Therefore, there would be no disproportionately high and adverse direct or indirect impacts on minority or low-income populations resulting from the No Action Alternative.

3.10.2.2. Alternative B – Combination Floodwalls and Embankments

Socioeconomics

Under Alternative B, the HESCO barriers would be replaced with a combination of concrete floodwalls and raised earthen embankments or earthen berms at each of the four dam structures. Construction activities at the Cherokee, Fort Loudoun, Tellico, and Watts Bar dams would take approximately two years and an average crew of approximately 15 to 20 workers would be required per site for the earthen embankment work and up to 40 to 50 workers for concrete floodwall work. There would be short-term beneficial economic impacts from construction activities associated with this alternative, including the purchase of materials, equipment, and services and a temporary increase in employment and income. This increase would be local or regional, depending on where the goods, services, and workers were obtained. It is likely construction materials would be purchased locally in the five-county impact area, as well as some adjacent counties. Also, the relatively small construction workforce would likely be from local sources. The direct impact of Alternative B to the economy would be short-term and beneficial.

Implementation of Alternative B could have minor beneficial indirect impacts on population and long-term employment and income levels in the five-county impact area. The majority of the indirect employment and income impacts would be from expenditure of the wages earned by the workforce involved in construction activities, as well as the local workforce used to provide materials. Following completion of Alternative B, the potential for overtopping and failure of the four dams during a PMF event, with increased flooding at downstream locations, would be minimized. Downstream areas, including Watts Bar, Sequoyah, and Browns Ferry Nuclear Plants and other locations, would experience a lower risk of flooding along with a lower potential for associated property damage and personal injury. These indirect impacts of Alternative B to downstream socioeconomic resources would be beneficial.

Environmental Justice

Based on the analysis presented in Section 3.10.1, residents of the five-county impact area and the census tracts near the dams are not considered minority populations or low-income communities. Also, based on the analysis of impacts for all resource areas presented in this EIS, it was determined that there would be no significant adverse health impacts on members of the public or significant adverse environmental impacts on the physical environment (water, air, aquatic, and terrestrial resources) and socioeconomic conditions. Therefore, there would be no disproportionately high or any adverse direct or indirect impacts on minority or low-income populations due to human health or environmental effects resulting from Alternative B.

3.10.2.3. Alternative C – All Floodwalls

Socioeconomics

Under Alternative C, the HESCO barriers would be replaced with permanent concrete floodwalls. This alternative varies from Alternative B only in the types of dam structure used to prevent the potential for failure of the dams during overtopping and to prevent increased flooding at downstream locations during those events. Therefore, the direct impacts to the economy from construction activities associated with this alternative would be the same as those discussed for Alternative B (i.e., short-term and beneficial).

Indirect impacts on population and long-term employment and income levels in the five-county impact area associated with Alternative C would be the same as those described for Alternative B. The minimized potential for overtopping and failure of the four dams during a PMF event would result in lower risk of flooding in downstream areas and; therefore less potential for associated property damage and personal injury as described for Alternative B.

<u>Environmental Justice</u>

Based on the analysis presented in Section 3.10.1, residents of the five-county impact area and the census tracts near the dams are not considered minority populations or low-income communities. Therefore, there would be no disproportionately high adverse direct or indirect impacts on minority or low-income populations because of negative health or environmental effects resulting from Alternative C.

3.11. Cultural and Historic Resources

Cultural resources include, but are not limited to, prehistoric and historic archaeological sites; historic structures; and historic sites that were the location of important events but that lack material remains. Cultural resources are finite, non-renewable, and often fragile. They are frequently threatened by industrial, commercial, and residential development as well as construction of roads, runways, and other infrastructure. They provide data on past environmental and cultural change that span millennia, unlike any kind of historical data. Hence Federal agencies are required to consider how their actions may affect cultural resources and to preserve significant cultural resources.

Regulatory Obligations

TVA is mandated under the NHPA and the Archaeological Resources Protection Act of 1979 (ARPA) to preserve significant cultural resources (archaeological sites and historic structures) located on TVA lands or affected by TVA undertakings. Some cultural resources are identified as "historic properties." A historic property, as defined by NHPA regulations at 36 CFR § 800.16, is any prehistoric or historic district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places (NRHP). The NRHP was established under the NHPA as a means to identify, evaluate and protect the historic properties of the nation. Properties that meet one or more of the following criteria in 36 CFR § 63 may be eligible for listing in the NRHP:

- Associated with events that have made a significant contribution to the broad patterns of our history;
- Associated with the lives of significant persons in our past;
- Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; and
- Have yielded or may be likely to yield, information important in history or prehistory.

Under Section 106 of the NHPA, before any Federal undertaking (i.e., Proposed Action), the lead agency must follow a formal process in which the agency fully considers the potential effects of the undertaking on historic properties and NRHP-eligible cultural resources as described in 36 CFR § 800. By carrying out the Section 106 process, an agency may simultaneously satisfy its obligations under Section 106 to fully consider the undertaking's potential effects on historic properties and its obligation under NEPA to determine whether historic resources will be adversely affected, and if so, whether measures can be implemented that will reduce adverse effects to a level that is found acceptable by all consulting parties.

Cultural resources are generally divided into two broad categories (independently of their eligibility status for the NRHP): archeological resources and historic architecture. By convention, an archaeological resource is defined as an area with a number of associated, non-modern historic (older than 50 years) or prehistoric artifacts that have the potential to provide scientific or humanistic understanding of past human behavior and cultural adaptation. In the state of Tennessee, an archaeological site is identified "based on several factors such as landform, physiographic region, size of site relative to the number and type of artifacts, level of survey and conditions, and previous disturbance" (Tennessee Division of Archaeology 1999). Some examples are: earthworks; fortifications; shipwrecks; whole or broken tools, weapons and projectiles; containers made of ceramics, wood, or basketry; human remains; rock carvings and rock paintings; and remains of subsurface structures such as domestic fire pits. Historic architecture consists of standing structures that are 50 years old or older. Examples of historic architecture with potential for listing on the NRHP include: early farms, houses, and churches; historic cemeteries; and statues and monuments. In addition to meeting one or more of the criteria of Section 106 listed above, archaeological resources and historic architectural resources must retain their integrity in order to be eligible for the NRHP. Integrity can be related to any or all of the following: location, design, setting, materials, workmanship, feeling, and association (36 CFR 60.4).

Area of Potential Effect (APE)

NHPA requires the lead agency in an undertaking to identify an APE for resources that may be affected by the undertaking. The Advisory Council on Historic Preservation defines APE as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if such properties exist." In any given federal undertaking the APE for cultural resources is defined by the lead federal agency in consultation with the appropriate consulting parties. In defining the APE the agency head must consider direct and indirect consequences of the undertaking that could affect historic properties, regardless of whether those historic properties are located within the area in which project activities will take place.

The APE for the proposed undertaking consists of existing HESCO barriers as described in Section 1.3 and the areas that would be affected by their continued maintenance or replacement with permanent barriers. For Alternative B, these modifications consist of the footprints of the floodwalls/embankments and the construction borrow/staging areas as described in Section 2.1.1. For Alternative C, these consist of the footprints of the floodwalls and the construction staging areas as described in Section 2.1.2. Because access to these areas would be on existing paved and gravel roads, the access routes are not part of the APE.

3.11.1. Affected Environment

Cherokee Dam

An archaeological and historic structures survey was conducted adjacent to the APE along the shoreline and a three foot wide strip above the normal summer pool elevation (Gage and Herrmann 2009) at Cherokee Dam. The survey identified no cultural resources adjacent to the Cherokee Dam APE. The records of the Tennessee Division of Archaeology (TDOA) indicate no cultural resources are present in the APE at Cherokee Dam for the action alternatives (including the borrow area and two staging areas). No cultural resources were identified in the APE for the borrow area.

An historic structures survey by TRC concluded that Cherokee Dam is an excellent example of an early TVA dam complex that played a significant role in the development of electrical production in the Tennessee Valley, and in meeting the increased energy needs of the regional defense industry during World War II. In addition, the dam is a representative example of the Modernism style of architecture utilized by TVA in its early phase of dam construction (Karpynec and Holland 2011). Based on this finding TVA determined that Cherokee Dam is eligible for listing in the NRHP under criteria A and C for its historical and architectural significance, and the SHPO agreed by letter dated September 29, 2011 (Appendix C).

Fort Loudoun Dam

TDOA records indicate no cultural resources have been recorded within the APE, including the staging areas at Fort Loudoun Dam. The shoreline and exposed lake bottom adjacent to the southern portion of the APE were included within an archaeological survey (Ahlman et al. 2000). No cultural resources were identified within the Fort Loudoun Dam APE. A second survey at the Lenoir City Marina (Windingstad 2008) included an area adjacent to the eastern portion of the Northern Saddle Dam part of the APE. The surveyors did not excavate shovel tests in that portion of their project area due to steep slope, and no cultural resources were identified within the Fort Loudoun Dam APE. No cultural resources were identified in the APE for the Fort Loudoun-Tellico borrow area.

An historic structures survey by TRC concluded that Fort Loudoun Lock and Dam is an excellent example of an early TVA dam complex that played a significant role in the development of electrical production in the Tennessee Valley, as well as a representative example of the modernism style of architecture utilized by TVA in its early phase of dam construction (Karpynec and Holland 2011). Based on this finding, TVA has determined that Fort Loudoun Lock and Dam is eligible for listing in the NRHP under Criteria A and C for its historical and architectural significance, and the SHPO agreed by letter dated September 29, 2011.

Tellico Dam

Archaeological surveys were conducted in all areas of the Tellico Dam APE during the Tellico Project (summarized in Kimball 1985), and an additional survey was conducted in the APE more recently (Frankenberg and Hermann 2000). No cultural resources were recorded within the Tellico APE. Site 40LD343, a former farm with barns, silos, and outbuildings, was recorded in close proximity to Saddle Dam No. 3, but TDOA records indicate that the site boundary falls outside of the APE and the entire site is inundated by Tellico Reservoir. The construction staging areas for Fort Loudoun Dam will also be used for Alternative B at Tellico Dam. No cultural resources have been recorded in these areas or in the Fort Loudoun-Tellico borrow area.

An historic structures survey by TRC concluded that no historic structures have been recorded within the APE. The Phase I architectural assessment of Tellico Dam found that it is a typical example of a late twentieth-century concrete gravity dam that lacks unique features of architecture or workmanship. Moreover, the dam was completed less than 50 years ago and has yet to gain historical significance. Therefore, TVA determined that Tellico Dam is ineligible for the NRHP, and the SHPO agreed by letter dated September 20, 2011.

Watts Bar Dam

At Watts Bar Dam, due to the extensive disturbance during dam construction, no modern archaeological surveys have been conducted within the corridor extending from the eastern end of the dam along the existing earthen embankment, or within the borrow area and the staging area north of Highway 68. The staging area south of Highway 68 was included within a survey conducted by Garrow & Associates (Fryman 1992). The survey (which included systematic shovel testing) failed to identify archaeological sites, and indicated that dredge or mining spoils were likely disposed of in this area at some time in the past. TDOA records indicate that one archaeological site (40MG1) has been recorded within the APE at Watts Bar Dam. However, the site, which was identified prior to dam construction, is located within the area investigated by Garrow & Associates. The results of that survey suggest the site was destroyed by activities associated with the construction of the lock and dam.

An historic structures survey by TRC concluded that no historic structures other than the dam have been recorded within the APE. The Phase I architectural assessment of Watts Bar Dam found that this structure is an excellent example of an early TVA dam complex that played a significant role in the development of electrical production in the Tennessee Valley and as a representative example of the Stripped Classicism style of architecture utilized by TVA in its initial phase of dam construction (Karpynec and Holland 2011). Based on this finding TVA has determined that Watts Bar Dam is eligible for listing in the NRHP under criteria A and C for its historical and architectural significance, and the SHPO agreed by letter dated September 29, 2011.

A cultural resources survey of the proposed borrow area in Rhea County was conducted by TRC. No archaeological resources were found on the site and no historic structures were present on or in the immediate vicinity of the site.

3.11.2. Environmental Consequences

3.11.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, the HESCO barriers installed at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams would remain in place and be maintained as needed. Longer term use of the HESCO barriers as a solution would require some level of maintenance activities and/or replacement to continue their effectiveness. Access to the HESCO barriers for maintenance would be on existing paved routes and would not disturb native soil. There would be no potential for effects to archaeological resources or historic structures under the No Action Alternative.

3.11.2.2. Alternative B – Combination Floodwalls and Embankments

Cherokee Dam

No archaeological sites are recorded within the APE for Alternative B at Cherokee Dam. The majority of the APE consists of artificial ground. During dam construction, excavation to depths of up to 45 feet took place in the majority of the APE in order to provide a firm surface for the emplacement of rolled fill, including the area of the north and south embankments and Saddle Dam No. 1 (TVA 1946:168-169). Therefore, there is little or no potential for intact archaeological sites within the APE. The borrow area consists of an existing borrow area in which there is significant recent ground disturbance. Both staging areas are paved parking areas with little or no potential for cultural resources. Action Alternative B has no potential to affect archaeological resources in the APE for Action Alternative B at Cherokee Dam.

TVA has determined that Alternative B would have a visual effect on Cherokee Dam, but the effect would not be adverse. Considering the profile of the proposed floodwalls and berm, TVA finds that Alternative B would not compromise the integrity of Cherokee Dam or diminish its architectural and historic significance for which it is recommended eligible for the NRHP. The SHPO agreed by letter dated September 20, 2011 with TVA's determination that the effects of

Alternative B on Cherokee Dam would not be adverse, and that Alternative B has no potential to affect archaeological sites.

Fort Loudoun Dam

No archaeological sites are recorded within the APE for Alternative B at Fort Loudoun Dam. The entire APE consists of road shoulders, which consist of pavement on artificial fill, and lacks undisturbed native soils. Therefore, Alternative B has no potential to affect archaeological resources within the Fort Loudoun Dam APE. The staging areas were likely subjected to significant ground disturbance during excavation of the canal connecting Fort Loudoun and Tellico reservoirs, and are unlikely to contain intact archaeological resources. The proposed Fort Loudoun-Tellico borrow area has been subjected to extensive recent ground disturbance and its use under Alternative B would not affect cultural resources.

TVA has determined that Alternative B would have a visual effect on Fort Loudoun Dam, but the effect would not be adverse. The three segments associated with Fort Loudoun Dam are not located on the main dam and are largely outside the visual-line-of-sight to the resource. Of the three segments, the proposed Segment FTL-2 floodwall is the nearest to the main dam. Situated adjacent to the lock operations building, FTL-2 is at present partially hidden by the presence of the Carmichael Greer Bridge. Considering the profile of the proposed floodwall, TVA finds that the floodwall would not compromise the integrity of Fort Loudoun Dam or diminish its architectural and historic significance for which it is recommended eligible for the NRHP. The SHPO agreed by letter dated September 20, 2011 with TVA's determination that the effects of Alternative B on Fort Loudoun Lock and Dam would not be adverse, and that Alternative B has no potential to affect archaeological sites.

Tellico Dam

No archaeological sites are recorded within the APE for Alternative B at Tellico Dam. The entire APE consists of constructed embankments, with the exception of the approximately 320-foot long corridor along the entrance drive to Tellico Recreation Area, which consists of the road shoulder. Options that include widening the existing embankment would impact strips of ground outside the existing embankment from 2.0 to 3.5 feet wide paralleling the existing Tellico Dam embankment, and up to 5.0 feet wide paralleling Saddle Dam Nos. 2 and 3. Those areas were disturbed (graded and/or covered with artificial fill) during the construction of the dam and access road and have little or no potential to contain intact buried cultural horizons. The staging areas were likely subjected to significant ground disturbance during excavation of the canal connecting Fort Loudoun and Tellico reservoirs, and are unlikely to contain intact archaeological resources. Alternative B has no potential to affect archaeological resources.

The Tellico Dam is a typical example of a late-twentieth century concrete gravity dam that fails to exhibit unique features of its architectural style or workmanship. In accordance with NRHP Criteria Consideration G, a property less than 50 years old is normally not eligible for the NRHP unless it is of exceptional importance. Completed on November 29, 1979, the Tellico Dam has been in operation for only 33 years and its role within local, state, and national events has yet to gain historical perspective. Based on these findings, TVA has determined that Tellico Dam is ineligible for listing in the NRHP and the SHPO agreed by letter dated September 20, 2011.

Watts Bar Dam

No archaeological sites are recorded within the APE for Alternative B at Watts Bar Dam. During dam construction, portions of the APE closest to Highway 68 were subject to very extensive cut and fill operations and the construction of the east dam embankment (TVA 1949:201 and Figures 68, 74, 83, 84). That portion of the APE adjacent to Watts Bar Dam Recreation area was most likely also affected by construction activities, although to a lesser extent; this is supported by photographs taking during construction (TVA 1949). Due to these severe ground disturbing activities the potential for historic properties in the APE is minimal. Therefore TVA considers that Alternative B has no potential to affect archaeological sites within the APE of Watts Bar Dam.

In a letter dated May 21, 2013, TVA contacted the SHPO regarding the potential excavation work required at the previously undisturbed Watts Bar borrow area (Figure 2-19). In April 2013, TVA contracted a Phase I cultural resources survey of the approximately 7.25-acre pasture, including a 0.5-mile radius. Results of the archaeological survey of the proposed borrow area APE indicated that no architectural resources or historic properties were present; therefore, use of the proposed borrow area in Rhea County would have no potential to affect cultural resources.

TVA has determined that Action Alternative B would have a visual effect on Watts Bar Dam, but the effect would not be adverse. The project site is located on the east embankment. Considering the profiles of the proposed embankments, TVA finds that Alternative B would not compromise the integrity of Watts Bar Dam or diminish its architectural and historic significance for which it is recommended eligible for the NRHP. In addition, the embankments and floodwall would not stand out as a visual intrusion to the historic setting of the dam, which has been compromised by the construction of the Watts Bar Nuclear Plant. The SHPO agreed by letter dated September 20, 2011 with TVA's determination that the effects of Alternative B on Watts Bar Lock and Dam would not be adverse, and that Alternative B has no potential to affect archaeological sites.

3.11.2.3. Alternative C – All Floodwalls

Under Alternative C, the HESCO barriers would be removed from the dam structures and replaced with concrete floodwalls. The floodwalls would be in the same locations as the floodwalls and berms proposed under Alternative B, and their construction would not affect archaeological sites. The effects of the floodwalls on Cherokee, Fort Loudoun, and Watts Bar Dams, all of which have been recommended eligible for the NRHP, would be also be similar to those of Alternative B and would not adversely affect these historic properties.

3.12. Noise

3.12.1. Affected Environment

Noise is generally described as unwanted sound, which can be based either on objective effects (hearing loss, damage to structures, etc.) or subjective judgments (such as community annoyance). Sound is usually represented on a logarithmic scale with a unit called the decibel (dB). Sound on the decibel scale is referred to as sound level. The threshold of human hearing is approximately 0 dB, and the threshold of discomfort or pain is around 120 dB.

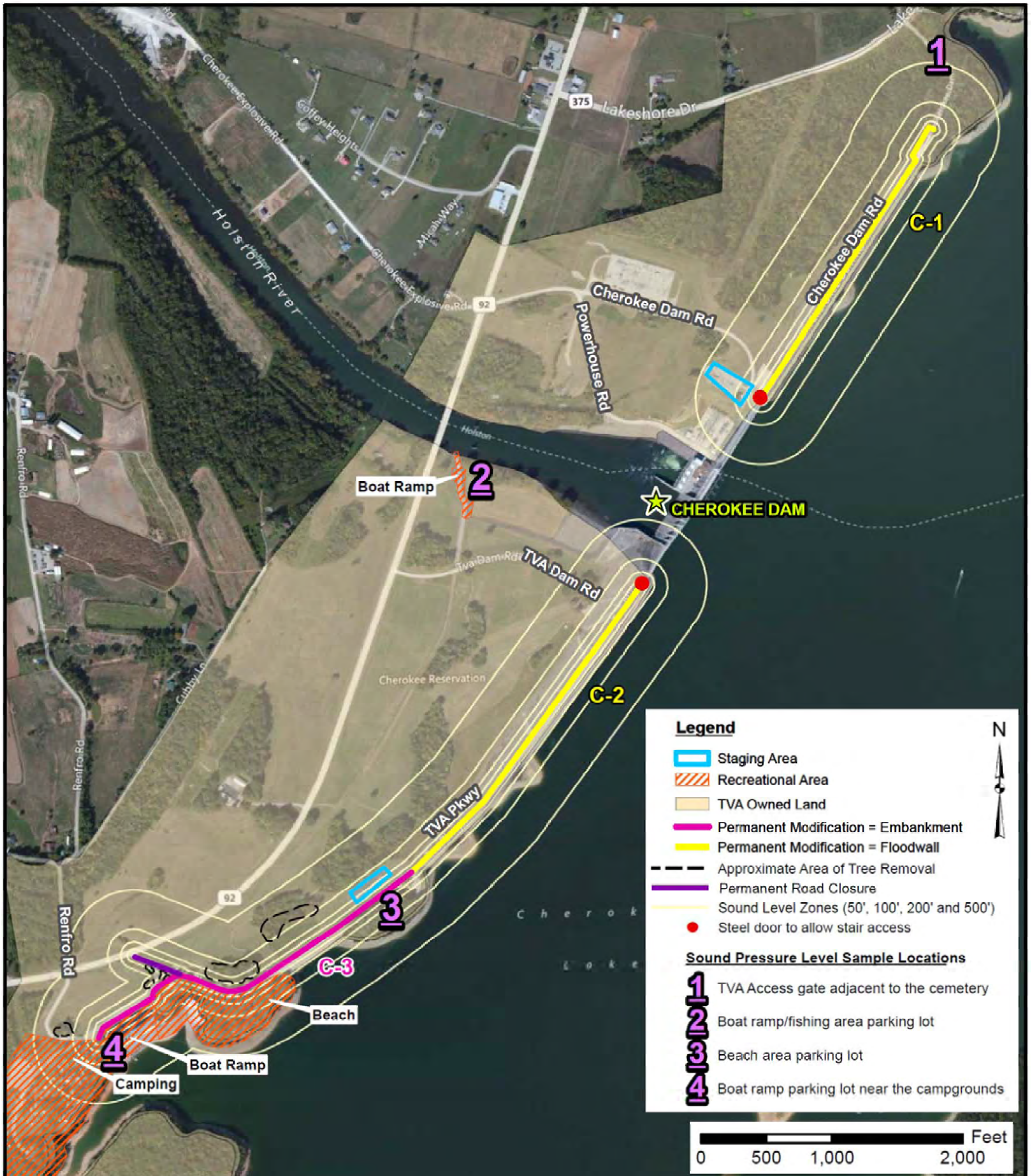
Noise levels are computed over a 24-hour period and adjusted for nighttime annoyances to produce the day-night average sound level (DNL). DNL is the community noise metric recommended by the USEPA and has been adopted by most Federal agencies (USEPA 1974). A DNL of 65 A-weighted decibel (dBA) is the level most commonly used for noise planning purposes and represents a compromise between community impact and the need for activities like construction (The A-weighted sound level, used extensively in this country for the measurement of community and transportation noise, represents the approximate frequency response characteristic of the average young human ear). Areas exposed to a DNL above 65 dBA are generally not considered suitable for residential use. A DNL of 55 dBA was identified by USEPA as a level below which there is no adverse impact. Additionally, to avoid potential long-term effects to hearing, USEPA established a 24-hour exposure level of 70 dBA (USEPA 1974).

Noise occurring at night generally results in a greater annoyance than do the same levels occurring during the day. It is generally agreed that people perceive intrusive noise at night as being 10 dBA louder than the same level of noise during the day. This perception is largely because background environmental sound levels at night in most areas are about 10 dBA lower than those during the day.

TVA contracted with EnSafe, Incorporated to conduct sound pressure level sampling at the Cherokee Dam to establish a baseline comparison for the proposed project activities. Samples were collected in May and June 2011. Sample collection locations were selected based on proximity to the proposed project area including areas used frequently by the general public. Noise levels throughout the project area are variable depending on the time of day and climatic conditions. Land uses in the project vicinity are primarily for TVA dam-related activities, recreation, and transportation. Some industrial noise may be generated in association with the dam activities. Additional transportation noise may be generated along the roadways. Other noise in the project area would be associated with the outdoor recreation activities. The sections below present the results of the baseline conditions survey at the four dam locations.

<u>Cherokee Dam</u>

Sound pressure level samples were collected over a 24-hour period using dosimeters placed at four locations around Cherokee Dam to determine baseline existing noise levels (Figure 3.12-1). The measured results from the existing conditions surveys at these four locations are listed in Table 3.12-1. Existing sound levels were not measured at the Cherokee Dam borrow area (Figure 3.12-2), but they would be expected to be close to or above the 70 dBA criterion due to the proximity to Interstate 81 and ongoing development and borrow activities on and near the site.

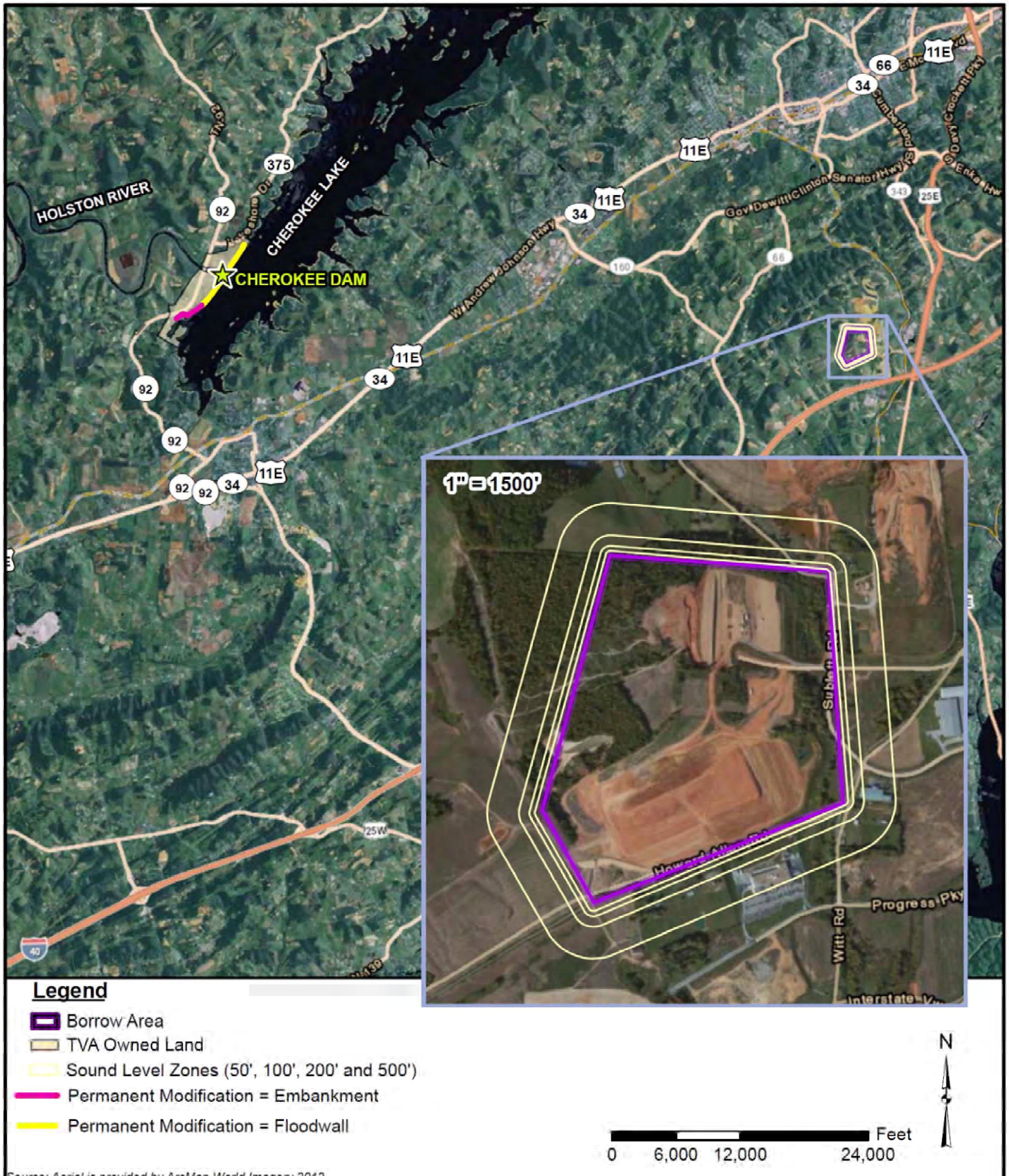


Source: Aerial is provided by ArcMap World Imagery 2012

AECOM

Figure 3.12-1
Sound Level Zones
Cherokee Dam

Tennessee Valley Authority



AECOM

Figure 3.12-2
Cherokee Dam Borrow Area
Sound Pressure Level

Tennessee Valley Authority

Table 3.12-1.
Cherokee Dam Baseline Existing Noise Level Survey

Sample Location	Day Average	Night Average	DNL
1	58.2	56.3	63.3
2	61.7	54.8	63.3
3	63	63.8	70.3
4	68.6	61.9	70.2

Source: EnSafe 2011a

The noise samples from Location 3 (70.3 dBA) and Location 4 (70.2 dBA) currently exceed the 70 dBA criterion value established by USEPA to help prevent hearing-loss in the general population. However, this value is based on continuous, long-term exposure over a period of several years and therefore, not likely to pose problems for the individuals that would typically frequent this area (i.e., TVA workers and recreational users).

Fort Loudoun Dam

Sound pressure level samples were collected over a 24-hour period using dosimeters placed at four locations around Fort Loudoun Dam to determine baseline existing noise levels (Figure 3.12-3). The measured results from the existing conditions survey at these four locations are listed in Table 3.12-2. Existing sound pressure levels were not measured at the Fort Loudoun-Tellico borrow area (Figure 3.12-4). Existing levels would be expected to be close to or above the 70 dBA criterion due to the proximity to Interstate 75, U.S. Highway 321, and the current removal of fill from the area by TDOT.

Table 3.12-2.
Fort Loudoun Dam Baseline Existing Noise Level Survey

Sample Location	Day Average	Night Average	DNL
1	62.6	72.3	68.7
2	59.5	63.3	61.3
3	66.6	70.9	68.7
4	57.0	63.0	60.2

Source: EnSafe 2011b

AECOM

Figure 3.12-3
Sound Level Zones
Fort Loudoun Dam

Tennessee Valley Authority

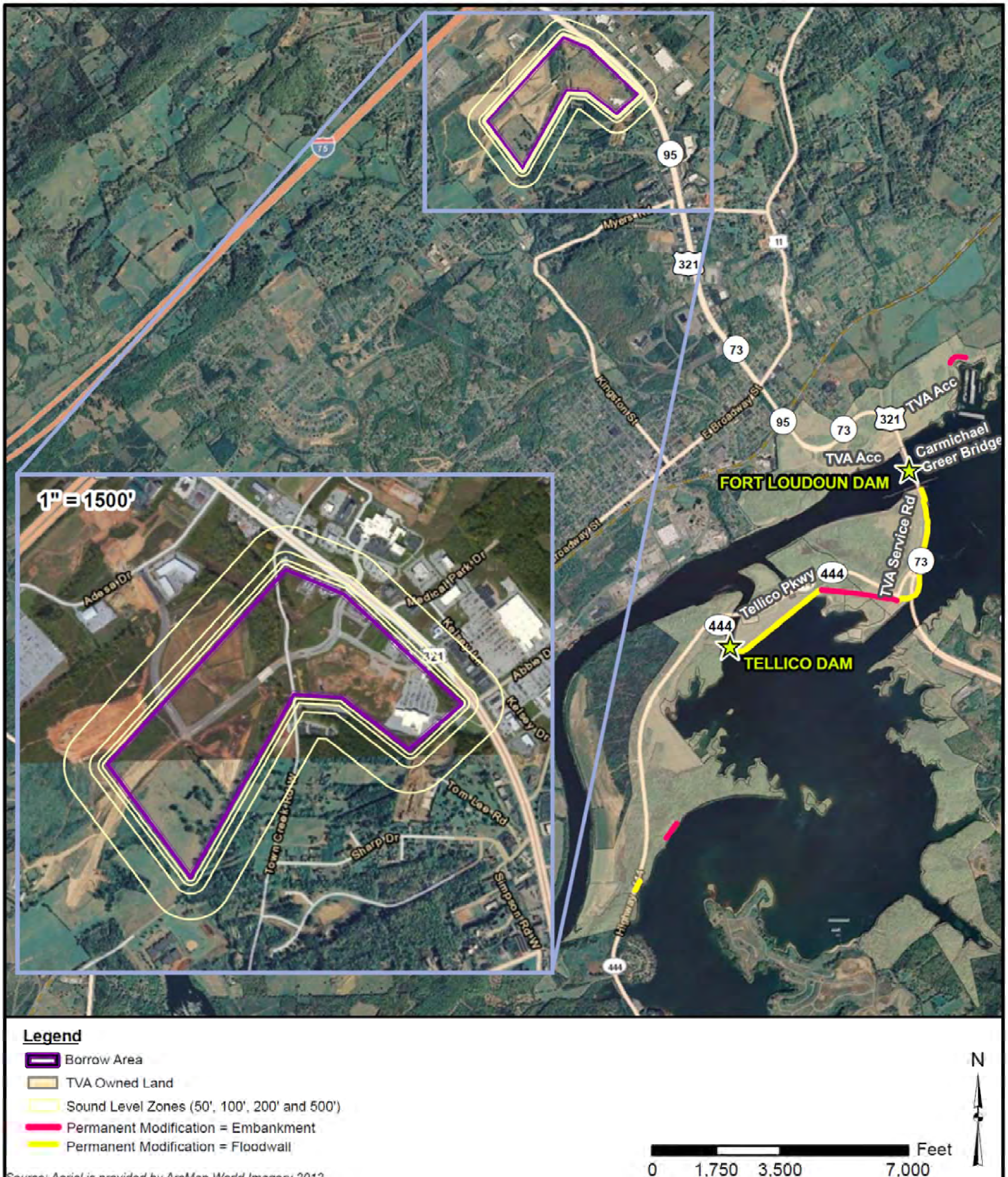


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Figure 3.12-4
Fort Loudoun/Tellico Borrow Area
Sound Pressure Level

Tennessee Valley Authority

Tellico Dam

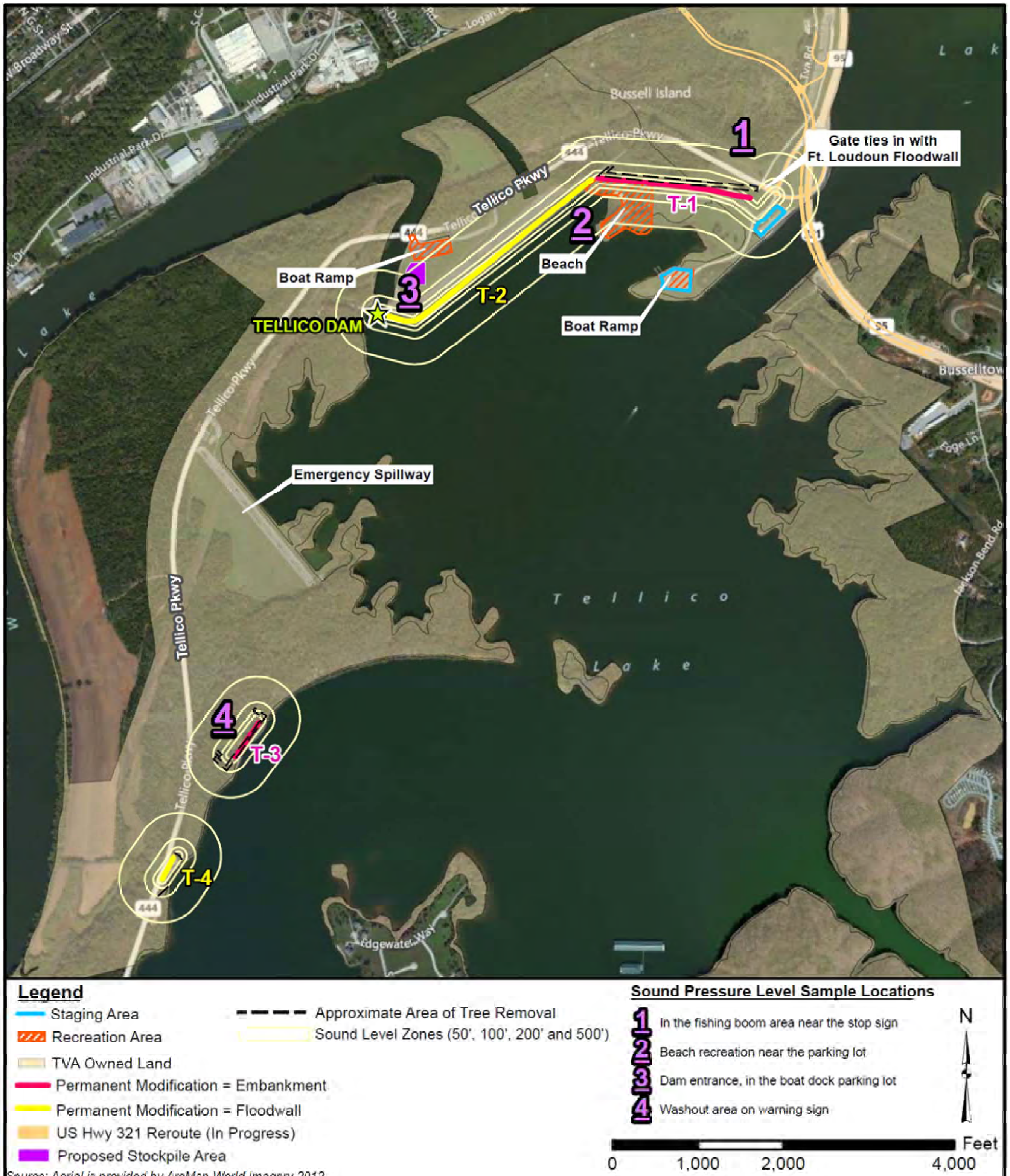
Sound pressure level samples were collected over a 24-hour period using dosimeters placed at four locations around Tellico Dam to determine baseline existing noise levels (Figure 3.12-5). The measured results from the existing conditions survey at these four locations are listed in Table 3.12-3. Fort Loudoun noise survey sample location 4 (Table 3.12-2 and Figure 3.12-5), which had a DNL of 60.2, is also relevant to Tellico Dam.

Existing sound pressure levels were not measured at the Fort Loudoun-Tellico Dam borrow area (Figure 3.12-4). As described above for Fort Loudoun, existing sound levels at the borrow area would be expected to be close to or above the 70 dBA criterion due to the proximity to Interstate 75, U.S. Highway 321, and the current removal of fill from the area by TDOT.

Table 3.12-3.
Tellico Dam Baseline Existing Noise Level Survey

Sample Location	Day Average	Night Average	DNL
1	63.2	46.8	61.7
2	68.4	50.4	66.8
3	63.3	54.7	63.8
4	70.0	59.7	69.9

Source: EnSafe 2011c



AECOM

Figure 3.12-5
Sound Level Zones
Tellico Dam
Tennessee Valley Authority

Watts Bar Dam

Sound pressure level samples were collected over a 24-hour period using dosimeters placed at four locations around Watts Bar Dam to determine baseline existing noise levels (Figure 3.12-6). The measured results from the existing conditions survey at these four locations are listed in Table 3.12-4.

Existing sound pressure levels were not measured at the Watts Bar Dam borrow area (Figure 3.12-7). This area is currently undeveloped and is surrounded by fields and forested areas. The property to the east of the proposed borrow area pasture is occupied by a house, pool, and apparent barn and/or storage structures that belong to the landowner of the proposed borrow area. It is assumed that existing noise levels around this borrow area are equivalent to noise levels in a rural agricultural area. Furthermore, it is assumed that ambient noise in the area would be less than 65 dBA when no agricultural equipment is in operation. In the vicinity of operating agricultural equipment, noise levels would be expected to be similar to those produced by construction equipment.

Table 3.12-4.
Watts Bar Dam Baseline Existing Noise Level Survey

Sample Location	Day Average	Night Average	DNL
1	73.9	74.6	80.9
2	60.0	65.0	71.1
3	74.3	64.7	72.5
4	63.3	65.2	64.2

Source: EnSafe 2011d

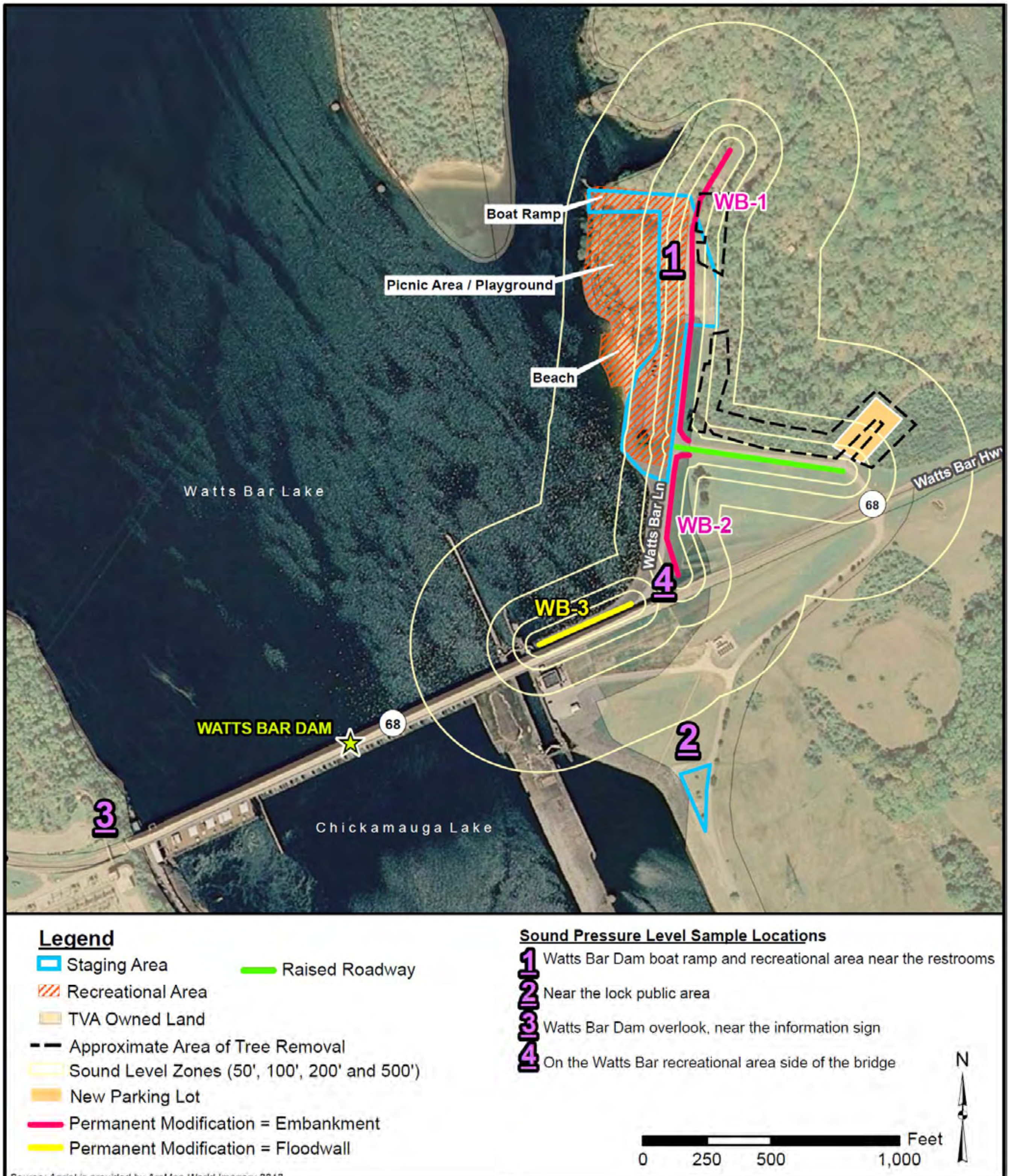


Figure 3.12-6
Sound Level Zones
Watts Bar Dam
Tennessee Valley Authority

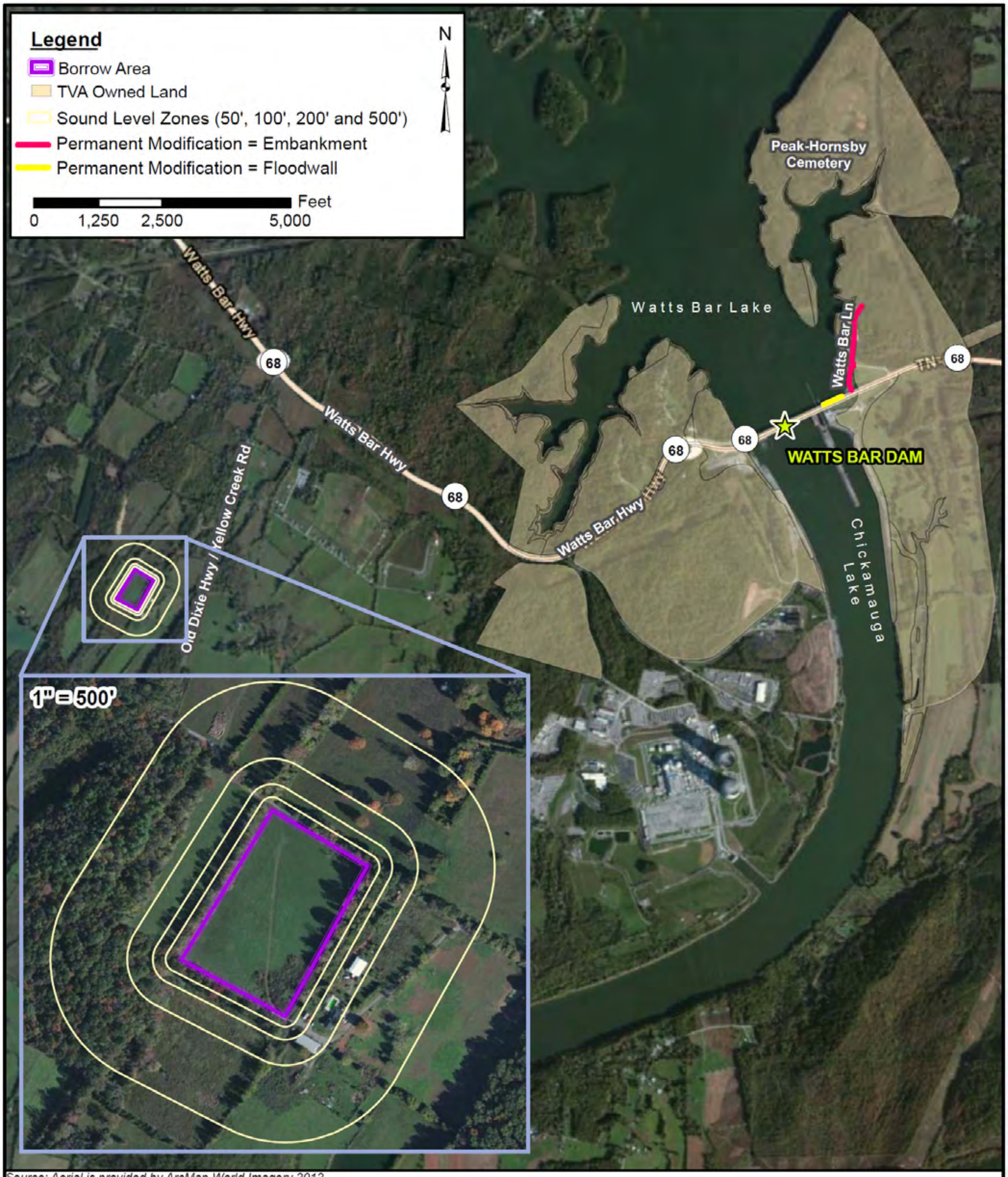


Figure 3.12-7
Watts Bar Borrow Area Sound Pressure Level

Tennessee Valley Authority

3.12.2. Environmental Consequences

The following sections discuss the potential noise impacts associated with the project alternatives.

3.12.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, noise receptors in the vicinity would continue to experience ambient noise from traffic and recreational activities and normal operational noise levels from dam operations at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams. Sound pressure levels as described in the existing conditions above would be expected to continue. Some of these levels are above the 55 and 65 dBA USEPA criterion; however, impacts would not be anticipated unless a person was exposed to these levels on a continuous basis over a period of several years. There are no permanent residents in these areas, only recreational visitors, campers, and TVA workers; therefore, these noise levels would not be anticipated to impact visitors or workers in these areas. Overall, direct and indirect noise related impacts would not be expected to occur at any of the four dam sites in association with implementation of the No Action Alternative.

3.12.2.2. Alternative B – Combination Floodwalls and Embankments

Table 3.12-5 describes noise emission levels for construction equipment expected to be used during the proposed construction activities. As can be seen from this table, the anticipated noise levels at 50 feet range from 76 dBA to 101 dBA based on data from the Federal Highway Administration (FHWA 2006).

Table 3.12-5.
A-weighted (dBA) Sound Levels of Construction Equipment and Modeled Attenuation at Various Distances[1]

Noise Source	50 feet	100 feet	200 feet	500 feet	1000 feet
Backhoe	78	72	68	58	52
Compactor	83	77	71	63	57
Concrete Mixer Truck	79	73	67	59	53
Crane	81	75	69	61	55
Dozer	82	76	70	62	56
Dump Truck	76	70	64	56	50
Excavator	81	75	69	61	55
Front End Loader	79	73	67	59	53
Sweeper	82	76	70	62	56

***Source**:* FHWA 2006. “Highway Construction Noise Handbook.”
The dBA at 50 feet is a measured noise emission. The 100-to 1,000-feet results are modeled estimates.

Assuming the worst case scenario of 83 dBA, as would be the case during the construction of a floodwall or berm along the project corridor, all areas within 200 feet of the project corridor could experience construction noise levels exceeding 65 dBA. Construction noise levels could attenuate to less than 65 dBA at a distance of 500 feet from construction activities.

During the approximately 24-month construction period, construction activities would be expected to create temporary noise impacts above 65 dBA to sensitive receptors within 200 feet of the project corridor, including in the recreation areas closest to the construction areas. Construction activities would take place a minimum of 12 hours per day, and possibly up to 18 hours per day and would occur during daylight hours. Night-time construction could occur as described below for Fort Loudoun. No construction is presently anticipated on weekends or holidays. In addition to noise created by construction equipment, there would also be impacts from noise generated by construction vehicles and personal vehicles for laborers that could use public roads and highways for access to constructions sites. The noise impacts associated with the construction activities would be temporary; following construction, noise levels would return to existing conditions. Throughout construction BMPs would be utilized to minimize noise; these BMPs would include properly maintaining construction equipment, restricting compression release engine breaking by trucks, and supplying employees with hearing protection when appropriate.

For all four dams, the construction noise associated with Alternative B would not be anticipated to impact individuals in water craft on the reservoir/canal side of the dam segments. First, the water craft will likely remain far enough from the construction area on shore that any associated construction noise would be attenuated prior to reaching the passengers. Additionally, for water craft operating with an engine, the immediate noise from the craft itself would likely mask any construction noise from shore. Therefore, the noise environment impact evaluation is concentrated on areas on shore located in close proximity to the construction areas at all four dams.

Cherokee Dam

The noise samples from Location 3 (70.3 dBA) and Location 4 (70.2 dBA) currently exceed the 70 dBA criterion value established by the USEPA to help prevent hearing-loss in the general population (as discussed above). As this value is based on continuous, long-term exposure over a period of several years it does not pose a current risk to individuals working or recreating in the area.

Access by the public to Segment C-1 (Figure 3.12-1) requires walking from Highway 375 and this area of the dam reservation receives little public use. Construction noise at this segment would have the potential to impact TVA employees, the occasional visitor walking to the area, or individuals in recreational water craft in Cherokee Lake. The existing noise levels in this area were measured at 63.3 dBA at Location 1. The construction noise would result in noise increases above the existing conditions (Table 3.12-5). These increases would be noticeable to TVA workers in this area. However, application of BMPs such as properly maintaining construction equipment, restricting compression release engine breaking by trucks, and supplying employees with hearing protection when appropriate would minimize potential impacts. Overall, adverse noise impacts within restricted TVA access areas would be minor and temporary.

The northernmost point of Segment C-2 is located approximately 1,500 feet from the boat ramp on the Holston River off of TVA Dam Road (Figure 3.12-1). Construction of the training walls on the downstream face of the dam, as well as the post-tensioning, would have the potential to impact visitors to this area, to the parking areas on TVA Dam Road, and those fishing in the tailwater immediately below the dam. Sources of construction noise would include the drill rigs used for the post-tensioning, as well as construction truck traffic through the area, both from the construction activities and construction vehicle traffic. This could result in adverse, but short-term, impacts to visitors of the tailwater area, particularly those recreating close to the dam.

Cherokee Dam floodwall Segment C-2 is located immediately adjacent to the lakeside portion of the jogging/walking recreation path on the south main embankment of Cherokee Dam (Figure 3.12-1). The construction activities associated with this segment would be immediately discernible to individuals in this area. During construction, the C-2 walkway would be closed to the public and restricted to construction workers only for safety and access reasons. Therefore, the nearest accessible walking/jogging path would likely be the trail that runs along the south base of the dam. At its closest distance, this trail is located approximately 300 feet from the construction area, at this range, the noise generated by the construction activities may be heard by visitors on the path; however it would not likely be above 65 dBA and thus, not be loud enough to cause potential significant impacts. At most it would annoy visitors using the path; therefore, noise impacts along most of the walking/jogging path would be minor and temporary.

Cherokee Dam embankment Segment C-3 extends from the south end of Segment C-2 to the boat ramp parking lot and campground area (Figure 3.12-1). The parking area located on the north side of the road near the C-2 and C-3 transition point would be used as a staging area during construction, and would be closed to the public as a parking lot permanently. The parking area on the south side of the road near the C-2 and C-3 transition would be closed during the construction period, but would be expected to reopen following completion of the work at Segments C-2 and C-3. Therefore, no direct or indirect noise impacts to visitors in this area would be expected to result from Alternative B.

The construction noise associated with Segment C-3 would also impact recreation activities and general visitor use at other parts of the Cherokee Dam reservation, including the group picnic area, swimming beach, playground, visitor's building and restrooms, boat ramp, and campground. The existing noise levels measured at Station 4 were 70.2 dBA. Within 200 feet of the construction areas, noise levels would exceed 71 dBA, resulting in potential adverse impacts in these areas. Beyond 200 feet from the construction the construction noise would be at levels similar to the existing conditions and therefore, would not have significant adverse impacts. Large portions of the boat ramp and beach are located within 200 feet of the construction zones. The elevated noise levels in these areas would be highly apparent and there would be a potential for significant adverse impacts. Most of the camping area is located beyond 200 feet from the construction area; therefore, while the construction noise may be evident from certain areas of the campground, the potential for significant impacts would be limited to a small area.

Also included under Alternative B is the permanent closure of the existing main access road into the Cherokee Dam reservation. Demolition and removal of this existing roadway would result in increased noise levels in the vicinity of the road removal activities (Figure 3.12-1). These increases would primarily be experienced by persons in automobiles along Highway 92; therefore, potential impacts from increased noise levels associated with the demolition of this roadway would be minor and temporary.

Overall, noise impacts associated with the construction of these dam segments would be minor to significant depending on the timing of the approximately 45-day closure of most of the recreation areas along the TVA Parkway in relation to the various phases of construction and the different equipment used during each phase.

In the vicinity of the Cherokee Dam borrow area, noise associated with the excavation of borrow materials would be audible at levels around the 70 dBA criterion up to 200 feet from the excavation area. This 200 foot zone includes farmland, early successional forest, commercial and industrial facilities, and a few houses to the south across Howard Allen Road. Though existing sound level measurements are not available, noise levels are likely already intermittently elevated above this criterion from ongoing grading and borrow activities on the site. As this borrow area is already being used for similar purposes by other projects, the excavation associated with the collection of borrow materials would not significantly increase noise above the existing levels. Impacts on occupants of nearby commercial, industrial, and residential structures would be minor and temporary.

Overall, noise impacts in the Cherokee Dam area associated with implementation of Alternative B would range from minor to significant and adverse depending on the dam segment location, time of day of construction, proximity to the recreation areas, and the status of the recreation area access (i.e., open or closed). These would be mitigated in part by the timing of construction, which would likely not occur on weekends and holidays when recreational use of the dam reservation is greatest. With implementation of mitigation measures such as limiting access to certain recreation areas during construction, noise impacts would be minimized to a certain extent. Following completion of construction, adverse noise impacts would cease. No indirect noise impacts would be anticipated.

Fort Loudoun Dam

The noise samples collected at all four locations at Fort Loudoun Dam were below the 70 dBA criterion value established by USEPA to help prevent hearing-loss in the general population (as discussed above). This value is based on continuous, long-term exposure over a period of several years. The existing levels below 70 dBA do not pose a current risk to individuals working or recreating in the area.

Segment FTL-1 (Figure 3.12-3) is located immediately adjacent to City Park Drive and is across from the Fort Loudon Marina. Existing noise levels in this area measure 61.3 dBA on average. Nighttime levels are slightly higher at 63.3 dBA. The construction noise associated with implementation of Alternative B would exceed these levels to a distance of at least 200 feet and possibly up to 500 feet depending on the construction equipment in use. Therefore, the construction activities would have impacts on drivers along this section of roadway and would also potentially be noticeable at the northernmost parts of the marina. The construction noise would have a lower potential impact on the marina at night as the existing nighttime noise levels are approximately the same as the estimated highest construction noise emissions at 500 feet. However, night-time construction is not anticipated under this alternative. Along the roadway, the construction noise would still exceed existing levels and would exceed the 70 dBA USEPA recommended levels of hearing protection for human health. Though these USEPA levels were established based on long-term exposure, these elevated levels would be a noticeable annoyance to anyone in the immediate vicinity. The closure of City Park Drive during part of the construction period would mitigate some of the noise impacts. Thus potential noise impacts associated with construction of the floodwall at FTL-1 could range from minor to significant adverse impacts depending on the time of day of construction.

On the south side of Fort Loudoun Dam, Segments FTL-2 and FTL-3 are immediately adjacent to U.S. Highway 321 and the entrance/exit ramps from this highway to the Tellico Parkway and TVA recreation areas. Existing noise levels measured at Stations 3 and 4 are 68.7 and 60.2 dBA respectively. The highway itself is located within 50 feet of the construction areas and therefore, drivers along this roadway would experience the elevated noise levels associated with this construction. However, the U.S. Highway 321 reroute project, which is currently underway, has already resulted in significant increases in noise for motorists, thereby potentially making noise from Alternative B unnoticeable or indistinguishable. Some floodwall construction for these segments would be conducted at night, to reduce the traffic congestion in this area. Traffic flow would be slowed from normal speeds and reduced to one lane to accommodate the construction. Drivers would experience the elevated noise levels while within the construction zone, however once outside of the zone the sound environment would return to normal road noise levels. The time of exposure for drivers would be short-term and though the elevated noise levels could be an annoyance during the time of exposure constituting adverse impacts. Significant impacts to human health would not be anticipated given the short length of exposure and the estimated sounds levels.

The southernmost portion of Segment FTL-3 and the entire FTL-4 embankment segment extend into the Tellico Dam Recreation Area. Due to the elevated access road construction, which would occur as part of the permanent modifications at Fort Loudoun, the Tellico Recreation Area would be completely closed to the public for a period of approximately 30 to 45 days. During this period, all facilities including the boat ramp, picnic area, trailheads, swimming beach, and restrooms would be inaccessible; therefore, adverse impacts to recreationalists in this area would be negligible. The northern entrance to the parking area located immediately south of the proposed raised roadway section (Figure 2-13) would be permanently closed by the permanent modifications at Fort Loudoun. In addition, this parking area is designated to be used as a staging area; therefore, it would be closed to visitors during construction. Noise impacts for visitors on Tellico Parkway entering the recreation area or merging onto U.S. Highway 321 would be similar to the noise levels experienced by drivers on the highway. These impacts would be adverse but short-term.

Overall, noise impacts in the Fort Loudoun Dam area associated with implementation of Alternative B would range from minor to significant and adverse depending on the dam segment location and time of day of construction. With the implementation of mitigation measures such as limiting access to certain recreation areas during construction, noise impacts would be mitigated to a certain extent. Following completion of construction, adverse noise impacts would cease. No indirect noise impacts would be anticipated.

The proposed Fort Loudoun-Tellico borrow area is currently being used as a source for fill by TDOT. Its use by TVA under Alternative B could prolong the noise generated by current borrow activities but would likely not introduce new sources of noise.

Tellico Dam

Noise sample data collected at all four Tellico Dam stations were below the 70 dBA USEPA criterion protective of hearing (as discussed above).

The majority of the Tellico Recreation Area is located within the project construction area (Figure 3.12-4), either along the proposed dam segments or in the potential staging areas. Segments T-1 and T-2 are immediately adjacent to the beach area and the walking/jogging trail. Portions of both the beach and the trail are within 50 feet of the construction area for these two dam segments; therefore, these areas would experience elevated noise levels above the 70 dBA criterion. It is likely that for public safety purposes, visitor access would be restricted in the immediate vicinity of the construction zone. Within 50 feet of the construction zone, visitors would experience elevated noise levels between 76 and 83 dBA. This would constitute an adverse impact and would be a significant disturbance to for individuals recreating in these areas. At a distance of 100 feet noise levels would be reduced to range between 70 and 77 dBA, still constituting an adverse impact and disturbing visitors in the area. At 200 feet distance from the construction zone, noise levels would still be elevated above the existing conditions which range from 68.7 to 61.3 dBA. Noise levels from the construction activities at 200 feet would range from 64 to 71 dBA constituting an adverse impact. The construction noise would be audible and have the potential to impact visitors within 200 feet from the construction zones. This would include portions of the walking/jogging path and the northernmost part of the beach area. At a distance of 500 feet the majority of the construction noise would be below existing sound levels in the area. It is possible that the construction noise may be heard on occasion at this distance, but it would not constitute a significant adverse impact to visitors at this range. In summary, noise related impacts in the vicinity of Segments T-1 and T-2 would be adverse at the beach and along the walking/jogging trail. These impacts would be temporary; once the construction was concluded the sound environment would return to existing levels.

In the vicinity of Segments T-3 and T-4 existing noise levels average 60.2 dBA. Construction noise levels out to a distance of 500 feet could exceed these existing noise levels. Within 200 feet of the construction area, noise levels could exceed the 70 dBA USEPA criterion. These two dam segments are immediately adjacent to the Tellico Parkway and the construction noise would constitute adverse impacts on drivers passing through the area, the noise would be distinctly audible while the vehicles were in range of the construction zones. The exposure times would be short term. Though traffic would likely be slowed through the area as a result of lane closures to complete the construction on Segment T-4, the traffic would still move through in a short time frame resulting only in short-term impacts. The elevated noise levels would cease once the construction was completed.

Noise levels would also be elevated in the vicinity of the Tellico Dam staging areas (Figure 3.12-4), noise in these areas would primarily be restricted to the movement of construction vehicles and supplies. As the Tellico Dam staging areas are located in existing parking lots, the noise increase would likely not be significantly higher than existing vehicle traffic, though construction vehicle engine noises would likely be somewhat louder than passenger vehicle noises. Impacts to the sound environment would be anticipated to be minor and temporary.

Overall, noise impacts in the Tellico Dam area associated with implementation of Alternative B would range from negligible to significant and adverse depending on the dam segment location, time of day of construction, proximity to the recreation areas, and the status of the recreation area access (i.e., open or closed). With the implementation of mitigation measures such as limiting access to certain recreation areas during construction, noise impacts would be mitigated to a certain extent. Following completion of construction, adverse noise impacts would cease. No indirect noise impacts would be anticipated.

Watts Bar Dam

Existing noise levels in the Watts Bar Dam area (Figure 3.12-6) vary across the project area; the highest levels, 80.9 dBA, were recorded at Station 1 in the vicinity of Segments WB-1 and WB-2. The lowest existing sound levels were recorded at Station 4 on the south side of Segment WB-4 at 64.2 dBA. The existing noise levels measured at Stations 1, 2, and 3 all measured above the 70 dBA USEPA criterion. As this value is based on continuous, long-term exposure over a period of several years it does not pose a current risk to individuals working or recreating in the area.

All four dam segments proposed for modification under Alternative B are immediately adjacent to recreation areas including a beach, picnic area and playground, and boat launch. In the vicinity of all four Watts Bar Dam segments, construction noise levels would exceed existing noise levels at a distance of 50 feet from the construction area near Station 1 and at a distance of 200 feet near Station 4. These elevated noise levels would constitute an adverse impact on visitors in the area. Visitor access would be restricted in the immediate construction zone, with the area closed to all access for part of the construction period and partial closures at other times. As the parking areas would be utilized for construction staging, the noise levels would also be elevated in these regions. The elevated noise levels from the construction activities would be distinctly audible and would disturb visitors in the area, most especially utilizing the picnic area, playground, and upper areas of the beach. The adverse noise impacts would, however, be short-term.

Near the Watts Bar staging area located south of Highway 68 (Figure 3.12-6), the existing noise levels were measured at 71.1 dBA, a level that exceeds the USEPA criterion. Construction related noise at this staging area would consist primarily of vehicle traffic as vehicles and equipment were shuttled between the staging area and the construction zone. Therefore, noise levels would not be anticipated to be elevated significantly above the existing levels.

Existing noise levels were not measured in the vicinity of the Watts Bar borrow area. Due to its remote location, located away from any major structures, recreation, or other human activity areas, it is assumed that existing noise levels in this area would be less than the 70 dBA criterion and likely less than 65 dBA. The only nearby residence is that of the landowner. Noise levels associated with the construction activity would range from approximately 64 to 76 dBA at the residence if borrow excavation activities were to occur immediately adjacent to the eastern property line. It is assumed that excavation activities would begin closer to the access road along the north of the borrow area and therefore, noise impacts would be minor and temporary for the nearby residents. Therefore, noise levels associated with Watts Bar borrow excavation would not be anticipated to result in adverse impacts.

Overall, noise impacts in the Watts Bar Dam area associated with implementation of Alternative B would range from negligible to significant and adverse depending on the dam segment/staging area location, time of day of construction, proximity to the recreation areas, and the status of the recreation area access (i.e., open or closed). With the implementation of mitigation measures such as limiting access to certain recreation areas during construction, noise impacts would be mitigated to a certain extent. Following completion of construction, adverse noise impacts would cease. No indirect noise impacts would be anticipated.

3.12.2.3. Alternative C – All Floodwalls

Potential noise-related impacts associated with implementation of Alternative C would be similar to or somewhat less those described above for Alternative B at all four dams. The main differences would be that large volumes of fill would not be trucked to the sites, spread and compacted. There would, however, be multiple trips by trucks delivering concrete. Under Alternative C, the overall construction duration would likely be shorter given that the construction timeframe for concrete floodwalls is slightly shorter than that of earthen embankments or berms. This would result in a shorter potential period of increased noise from construction equipment and activities in the project areas than compared to Alternative B. No indirect noise impacts would be anticipated.

3.13. Transportation

This section describes the transportation network, the traffic counts on this network, and the potential impacts to the transportation network as a result of the project actions.

3.13.1. Affected Environment

The project area at each dam is adjacent to or in the immediate vicinity of a number of public thoroughfares, minor recreation roads, and restricted access maintenance roads. These roadways are discussed in the following sections for each dam respectively.

Cherokee Dam

At Cherokee Dam, approximately 6,685 feet of the existing embankment has a road either on top of it, or immediately adjacent (Figure 2-1).

State Highway 92/Murrell Road

Highway 92/Murrell Road is an undivided two-lane major roadway running approximately northeast-southwest where it crosses the Holston River approximately 2000 feet from the western/downstream side of Cherokee Dam. The most recent Average Annual Daily Traffic (AADT) available from the TDOT is from the 2012 calendar year. Along Highway 92 the AADT is approximately 5,411 vehicles per day at the Cherokee Dam (TDOT 2012a). Near the junction with Highway 11E to the south, the AADT on Highway 92 is 7,194 (TDOT 2012b).

Cherokee Dam Road/Powerhouse Road

Cherokee Dam Road/Powerhouse Road is a restricted access, undivided two-lane minor rural arterial that branches out south from Lake Shore Drive toward a TVA electrical substation and maintenance area. The roadway runs northeast-southwest roughly parallel to Highway 92 along a portion of the western shore of Cherokee Reservoir. Cherokee Dam Road terminates at Cherokee Dam. A restricted access maintenance access road extends across the dam from Cherokee Dam Road and connects with TVA Parkway on the south. No AADT data is available for this restricted access road.

TVA Parkway

TVA Parkway is an undivided two-lane minor rural arterial that branches out east from Highway 92 toward two recreation areas. The roadway runs northeast-southwest roughly parallel to the highway along a portion of the western shore of Cherokee Reservoir. TVA Parkway is located entirely on the Cherokee Dam reservation and terminates at the dam. A restricted access maintenance access road extends across the dam from TVA Parkway and connects with Cherokee Dam Road on the north. TVA Parkway is not heavily traveled as it is used primarily for recreation and maintenance and not through traffic; no AADT data is available.

Renfro Road

Renfro Road is an undivided two-lane minor rural arterial that exits Highway 92 1 mile south of the Holston River and 0.1 mile west of the intersection of Highway 92 and TVA Parkway. It runs south from Highway 92 to the TVA campground and boat launch ramp. Traffic on this section of Renfro Road is primarily for recreation and maintenance; no AADT data is available.

TVA Dam Road

TVA Dam Road is an undivided two-lane minor rural arterial that exits Highway 92 approximately 1,000 feet south of the Holston River. This roadway runs east toward Cherokee Lake and provides access to two recreation areas. This roadway is not heavily traveled as it is used primarily for recreation and not through traffic; no AADT data is available.

U.S. Highway 25E/State Highway 32/Davy Crockett Parkway

The borrow area for the proposed Cherokee Dam berm is located approximately 11 miles away from the project site, approximately 2.5 miles northwest of the town of White Pine, Tennessee near the intersection of I-81 and Highway 25E (Figure 2-2). Interstate 81 is a divided, four-lane highway that runs northeast-southwest. Highway 25E is a divided, four-lane highway that runs northwest-southeast and intersects with Highway 11E in Morristown and with I-81 in White Pine to the south.

This existing borrow area is located a few miles south of Morristown, in Hamblen County, Tennessee. Interstate 81 connects Highway 25E (borrow site location) with Highway 92 (project site location). Construction equipment transporting borrow material would travel these roadways several times a day for a period of up to a few weeks. The 2012 AADT on Sublett Road, immediately adjacent to the borrow areas is 435 vehicles per day, and exceeds 18,000 vehicles per day on Highway 25E (TDOT 2012a). The construction vehicles would most likely travel from Highway 25E to I-81 and then Highway 92, through Jefferson City and eventually to the project site. The 2012 AADT for Interstate 81 ranged from over 45,000 to over 63,000 vehicles per day (TDOT 2012b). The 2012 AADT on Highway 92 south of Jefferson City ranges from approximately 13,000 to over 15,000 vehicles per day (TDOT 2012b). Therefore, the construction traffic associated with implementation of Alternative B would have no significant impact on the traffic volume along these roadways. Therefore, no significant impacts to transportation are anticipated in association with the implementation of Alternative B at Cherokee Dam.

U.S. Highway 11E/Andrew Johnson Highway

To reach the project area at Cherokee Dam from the borrow area on U.S. Highway 25E, the construction traffic could also travel along Highway 11E/Andrew Johnson Highway (Figure 2-2). There could be an increase in construction traffic along Highway 11E through Morristown and Jefferson City and then along Highway 92 to the project site at Cherokee Dam. Along Highway 11E south of the junction with Highway 25E the AADT is over 14,000 vehicles per day (TDOT 2012a). In Jefferson County, near the junction with Highway 92, the AADT on U.S. Highway 11E is over 18,000 vehicles per day (TDOT 2012b).

<u>Fort Loudoun Dam</u>

At Fort Loudoun Dam, approximately 3,800 feet of embankment have a road either on or adjacent to it. Of that 3,800 feet, approximately 3,300 feet of embankment is adjacent to U.S. Highway 321 and approximately 500 feet of embankment is adjacent to Tellico Parkway.

U.S. Highway 321/State Highway 95/State Highway 73

U.S. Highway 321/State Highway 95/Highway 73 is a divided two-lane highway that currently crosses the Fort Loudoun Dam at the elevated J. Carmichael Greer Bridge. The AADT along U.S. Highway 321 at the J. Carmichael Greer Bridge is 20,553 vehicles per day (TDOT 2012c). In late 2012, TDOT began construction on a project to widen U.S. Highway 321 to four lanes and reroute it from the dam to a new bridge downstream of the dam. This project is scheduled to be completed by May 13, 2015. North of the project area, in the vicinity of the borrow areas, the 2012 AADT for Highway 321 is 25,033 vehicles per day (TDOT 2012c).

City Park Drive

City Park Drive is an undivided two-lane major rural roadway that crosses U.S. Highway 321 northwest of the J. Carmichael Greer Bridge. The northern segment of this road travels northeast along Fort Loudoun Lake. A number of recreation facilities including the Fort Loudon Marina approximately 3,000 feet from the U.S. Highway 321 overpass are located along City Park Drive. The roadway continues on toward residential areas to the north. The AADT along City Park Road/Elm Hill Road south of the U.S. Highway 321 overpass is 1,172 vehicles per day (TDOT 2012c). No AADT information is available for the northern section of City Park Drive. Under the U.S. Highway 321 widening and rerouting project described above, the existing City Park Drive overpass will be removed and traffic rerouted to connect directly with the existing U.S. Highway 321 roadway.

Tellico Parkway

The Tellico Parkway (State Highway 444) is an undivided two-lane highway that runs roughly northeast-southwest and intersects U.S. Highway 321 on the east side of the Tellico Canal. This roadway continues to the south. The AADT along the Tellico Parkway is 8,166 vehicles per day at the dam (TDOT 2012c).

TVA Service Road

The TVA Service Road is an undivided two-lane minor rural arterial located west of U.S. Highway 321 runs from the south side of the Fort Loudoun Dam to the Tellico Parkway roughly parallel to the highway’s current route. The TVA Service Road is gated with restricted access. This roadway is not heavily traveled as it is a restricted access road used primarily for dam and lock operations and maintenance by TVA and the Corps of Engineers; no AADT data is available. Under the U.S. Highway 321 widening and rerouting project described above, this TVA service road would also be modified to ensure continued access for operations and maintenance activities.

Unnamed Road

An unnamed, undivided two-lane minor rural arterial travels north toward the Tennessee River from the TVA Service Road approximately 1,200 feet from the intersection with the Tellico Parkway. This road leads to storage tank facilities and a parking area for tailwater fishers. This roadway is not heavily traveled as it is used primarily for recreation and maintenance purposes; no AADT data is available. Under the U.S. Highway 321 widening and rerouting project described above, this road would also be modified to ensure continued access for recreation and maintenance activities.

Town Creek Road West/Sharp Drive/Market Drive

The borrow area for the Fort Loudoun and Tellico Dam embankments is located between Town Creek Road West and Sharp Drive off of U.S. Highway 321. Both roads are undivided two-lane minor rural arterials. The 2012 AADT for Town Creek Road West is 2,844 vehicles per day and for Sharp Drive it is 388 vehicles per day. Because residential properties line Sharp Drive, the construction traffic would most likely travel north to Market Drive and then onto Highway 321. The 2012 AADT for Market Drive is 2,257 vehicles per day (TDOT 2012c).

<u>Tellico Dam</u>

At Tellico Dam, approximately 4,625 feet of embankment have a road either on top of or immediately adjacent.

Tellico Parkway

The Tellico Parkway (State Highway 444) is an undivided two-lane highway that runs roughly northeast-southwest and crosses the canal that connects the Tennessee River and Tellico Lake approximately 1,000 feet north of the Tellico Dam. As reported above, the AADT along the Tellico Parkway is 8,166 vehicles per day at the dam (TDOT 2012c).

Unnamed Road South

Unnamed Road South is an undivided two-lane rural arterial that branches out south from Tellico Parkway and runs west toward the bridge over the canal that connects the Tennessee River and Tellico Lake. This road leads to a parking area and small boat ramp. This roadway is not heavily traveled as it is used primarily for recreation purposes; no AADT data is available.

Unnamed Road West

Unnamed Road West is an undivided two-land rural arterial that branches out south from Tellico Parkway and runs roughly northeast-southwest providing maintenance access to the east side of Tellico Dam. This roadway is not heavily traveled as it is used primarily for recreation and maintenance and not through traffic; no AADT data is available.

Unnamed Road East

Unnamed Road East is an undivided two-lane rural roadway that branches out south from the Tellico Parkway at the exit ramp from U.S. Highway 321. Unnamed Road East provides access to several recreation areas including a large boat ramp. This roadway is not heavily traveled as it is used primarily for recreation and maintenance and not through traffic; no AADT data is available.

Maintenance Access Road – Saddle Dam No. 2

An unpaved gated maintenance access road travels east from Tellico Parkway approximately 3,500 feet south of the emergency spillway. This road is restricted access leading to the dam segment designated T-3 (Saddle Dam No. 2) on Figure 1-4. This maintenance access road is not heavily traveled; no AADT data is available.

Maintenance Access Road – Saddle Dam No. 3

A short gravel maintenance access road exits east from Tellico Parkway 1,600 feet south of the Saddle Dam No. 2 maintenance access road. This access road is not heavily traveled as it is used only for TVA maintenance and not for through traffic; no AADT data is available.

Watts Bar Dam

At Watts Bar Dam, approximately 1,600 feet of embankment have a road on or immediately adjacent.

State Highway 68/Watts Bar Highway

Highway 68/Watts Bar Highway is an undivided two-lane major roadway that runs roughly east-west across Watts Bar Dam on the south side of Watts Bar Lake at the outlet to the Tennessee River. The AADT along Highway 68 is 5,681 vehicles per day at Watts Bar Dam (TDOT 2012d).

Unnamed Road

An unnamed road crosses U.S. Highway 68 approximately 600 feet east of Watts Bar Dam. This unnamed road is an undivided two-lane rural arterial that provides access to a recreation and boat ramp area located approximately 600 and 1200 feet (respectively) north of Watts Bar dam in addition to providing access to the TVA facilities located on the northeast side of the dam. This roadway is not heavily traveled as it is used primarily for recreation and maintenance and not through traffic; no AADT data is available.

Yellow Creek Road

The borrow area for Watts Bar Dam is located along Yellow Creek Road off of Highway 68. Yellow Creek Road is an undivided, two-land rural roadway. The 2012 AADT for Yellow Creek Road is 734 vehicles per day (TDOT 2012e).

3.13.2. Environmental Consequences

This section presents a discussion of the potential environmental impacts to transportation that could occur associated with each of the project alternatives.

3.13.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, the HESCO barriers would remain in place and no additional construction would occur in association with the embankments in the project areas at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams. Short-term lane closures along the roadways within the project areas may be required from time to time during inspection, repairs, or replacement of the existing HESCO barriers, but these would be temporary and result in only minor impacts to transportation. At Fort Loudoun, similar short-term lane closures may be required along U.S. Highway 321 for dam segment repairs in the event of major damage to the segment; however, as discussed below in Chapter 4 – Cumulative Impacts, this highway is being rerouted, therefore the potential for such lane closures will end once the reroute construction is completed. Given the traffic volume along U.S. Highway 321 at present such lane closures would have the potential to create significant impacts to transportation, but it is unlikely that such closures would be required between 2012 and 2015 when the U.S. Highway 321 reroute is completed.

No impacts to the other major roadways in the project areas are anticipated; therefore, potential impacts to transportation at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams under the No Action Alternative would be minor to significant (Fort Loudoun only), though the potential for significant impacts is considered unlikely. All potential impacts to transportation would be short-term (for the duration of the maintenance work).

3.13.2.2. Alternative B – Combination Floodwalls and Embankments

Under Alternative B, the HESCO barriers would be replaced with a combination of concrete floodwalls and raised earthen embankments. Under this alternative, overtopping of each dam during a PMF event would be prevented by construction of a floodwall on the earthen embankments and/or raising the earthen embankments to the same height or higher than the existing HESCO barriers.

TVA has carefully considered the impacts to safety and transportation during the planning of the proposed permanent dam safety modifications. The potential for impacts to safety and transportation is greatest in the vicinity of Fort Loudoun Segment FTL-3. While delaying the construction of the floodwall in this area until TDOT completed the U.S. Highway 321 relocation project would have reduced these impacts, this is not possible due to the overlapping schedules of the two projects. This also would not have eliminated the need to close parts of the ramp between Highway 444 and U.S. Highway 321 during construction of the floodwall. Under either action alternative, TVA would implement traffic control and other methods to reduce safety and transportation impacts during construction. TVA has also designed the floodwall to maximize the roadway width once construction is completed.

Cherokee Dam

Under Alternative B, the segment of the TVA Parkway between Highway 92 and the visitor/restroom building would be permanently closed in order to construct the C-3 embankment. The remainder of the TVA Parkway north and east of the visitor/restroom building would be closed for about 45 days during construction activities beginning in late summer 2013. Access to the campground and picnic area would continue to be available from Renfro Road, although this road would also be used by construction traffic. Impacts to traffic during construction would be short-term and adverse.

As part of the construction activities, the portion of TVA Parkway immediately south of the visitor/restroom building, which presently terminates at a round-about at the western end of a parking area, would be connected to Renfro Road. The travel lanes through the parking area would be widened to reduce congestion. Following the completion of construction, TVA Parkway north of the visitor/restroom building would be reopened to traffic, and Renfro Road would provide access to the visitor facilities along TVA Parkway, as well as to the boat ramp and campground. Rerouting traffic from the TVA Parkway entrance road to Renfro Road would have minor, if any, long-term traffic impacts.

Concrete would be trucked in to the project area using primarily major highways; therefore, significant impacts related to concrete truck traffic would not be anticipated to occur. The borrow area for the proposed Cherokee Dam berm is located approximately 11 miles away from the project site, approximately 2.5 miles northwest of the town of White Pine, Tennessee near the intersection of I-81 and Highway 25E. This existing borrow area is located a few miles south of Morristown, in Hamblen County, Tennessee. Interstate 81 connects U.S. Highway 25E (borrow site location) with U.S. Highway 92 (project site location). Construction equipment transporting borrow material would travel these roadways several times a day for a period of up to a few weeks. Construction traffic could also travel north on Highway 25E and then west on Highway 11E. The increase of construction traffic along Sublett Road could result in minor impacts based on the current average of 435 vehicles per day. However, the current traffic volumes well exceed 10,000 vehicles per day on the other potential routes. Therefore, the construction traffic associated with implementation of Alternative B would have no significant impact on the traffic volume along these roadways. Therefore, no significant impacts to transportation would be expected to result from implementation of Alternative B at Cherokee Dam.

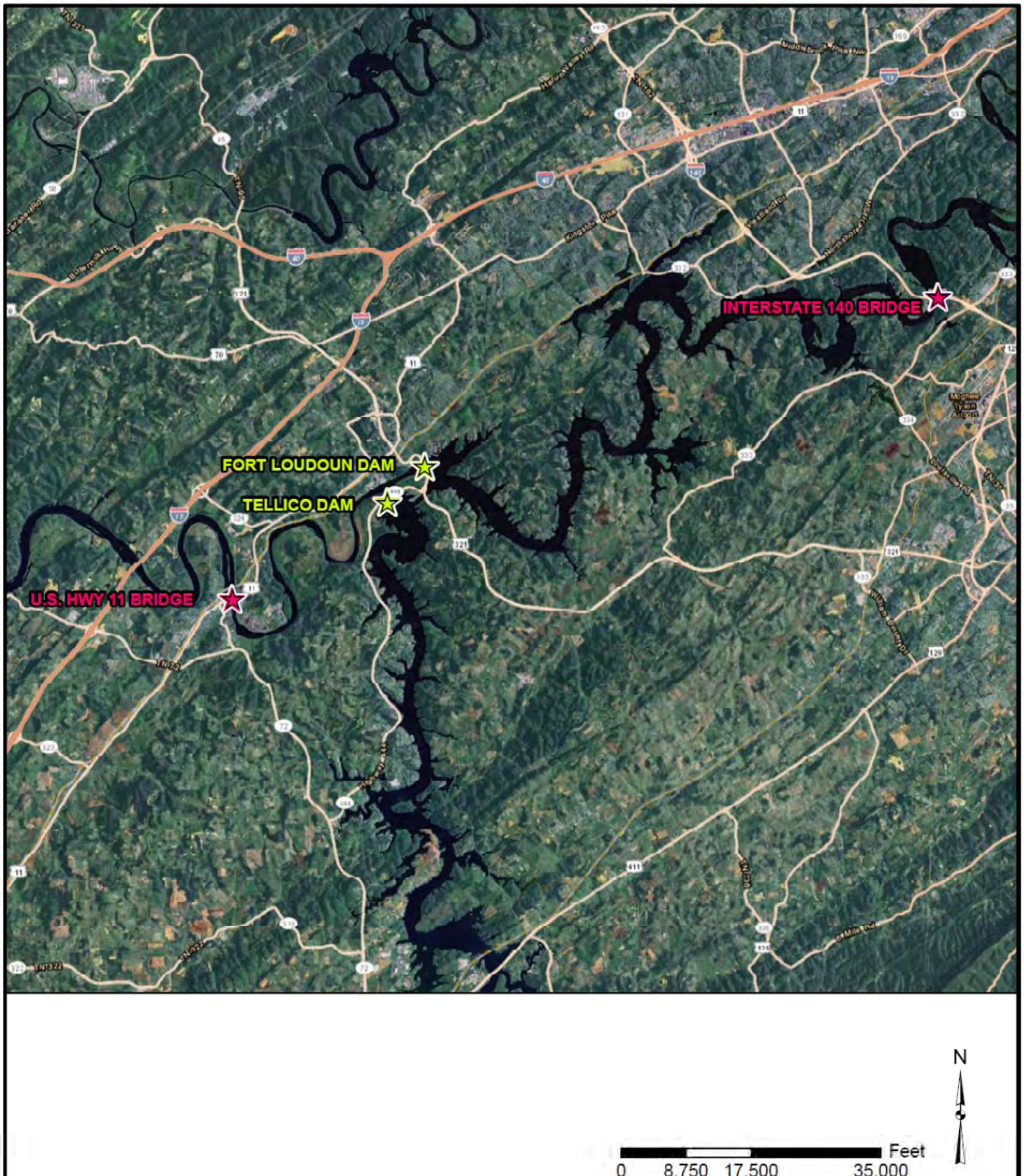
Fort Loudoun Dam

Under Alternative B, potential short-term impacts would likely occur to transportation in association on U.S. Highway 321 and City Park Drive with the implementation of Alternative B at Fort Loudoun Dam. Construction activities along these dam segments would necessitate temporary lane closures increasing traffic congestion along these sections of these two roadways.

U.S. Highway 321

Segments FTL-2 and FTL-3 are immediately adjacent to the heavily traveled U.S. Highway 321. Complete road closure will not be feasible due to the distances drivers would be required to detour should the J. Carmichael Greer Bridge be closed completely. The nearest upstream bridge over the Tennessee River is the Pellissippi Parkway bridge on Interstate 140/Pellissippi Parkway. The Pellissippi Parkway bridge is approximately 50 miles round trip from either side of the J. Carmichael Greer Bridge – this would require drivers to detour an hour out of their way to cross the river. The Mulberry Street bridge on U.S. Highway 11/State Highway 2/Mulberry Street is located downstream of the J. Carmichael Greer Bridge. The Mulberry Street Bridge is approximately 10 miles from the north side and 12 miles from the south side of the J. Carmichael Greer Bridge (Figure 3.13-1). Drivers would require an approximately 40-minute detour to utilize this closest route. Given the large volume of traffic that utilizes the J. Carmichael Greer Bridge on a daily basis, closing this bridge completely and diverting traffic either to the north or the south would constitute a significant impact on transportation.

Single lane closures would be required along U.S. Highway 321 south of the J. Carmichael Greer Bridge and would result in significant increases in traffic congestion along this roadway. Traffic congestion in this area is currently high due to the TDOT U.S. Highway 321 reconstruction project. The lane closures would require traffic controls in which the traffic flow in one direction is completely stopped while the other is allowed to pass for a time after which point the traffic flow would be switched. For traffic volumes exceeding 25,000 vehicles per day, this would result in a significant impact to transportation; there could also potentially be impacts to human health and safety as a result of the increased congestion and the impatience drivers could experience as result of significant delays should the construction and lane closures occur during daylight or weekend hours. To the extent possible, TVA would conduct work on this section at night to reduce traffic impacts. TVA will also coordinate the schedule for the floodwall work at Fort Loudoun with the schedule for the U.S. Highway 321 relocation project to minimize traffic impacts. Delaying the construction of the floodwalls and removal of the HESCO barriers until after traffic has been rerouted to the relocated highway is likely not feasible due to the overlapping schedules of the two projects.



Source: Aerial is provided by ArcMap World Imagery 2012

AECOM

Figure 3.13-1
Alternate River Crossings

Tennessee Valley Authority

City Park Drive

Traffic on City Park Drive would be affected by construction of the earthen embankment on Segment FTL-1. Most of the construction access would be from the north side of FTL-1, opposite City Park Drive. The west-bound lane of City Park Drive would be closed during some of the construction, and would be posted with construction warning and reduced speed limit signs. The section of City Park Drive adjacent to FTL-1 and just east of the entrance to Fort Loudon Marina would be closed to all traffic for up to two weeks to allow construction of components of the embankment and removal of the HESCO barriers. Access to Fort Loudon Marina from U.S. Highway 321 would not be impeded by this road closure. To access areas along City Park Drive east of Segment FTL-1, including Lenoir City Park, traffic from the west and south could be detoured around the area via an approximately five-mile route utilizing Martel, Lakeview, and Easter Ridge Roads. This detour would include a travel time of approximately 15 minutes under normal traffic conditions. This would result in a moderately adverse short-term impact. Fill material for construction of the embankment would be trucked in to the project area using Highway 321 through Lenoir City and then on City Park Drive to the worksite. Significant impacts related to truck traffic delivering fill material would not be expected to occur.

The Fort Loudoun-Tellico borrow area is located approximately 2.75 miles from the Fort Loudoun Dam and 3 miles from Tellico Dam, roughly 2 miles northwest of Lenoir City and just south of the intersection of I-75 and U.S. Highway 321. U.S. Highway 321 would provide a direct route between the borrow area and the project sites. There will be an increase in the amount of traffic moving from the borrow area project construction areas at these dam reservations. Concrete for construction of the floodwalls would be trucked to the project site from local suppliers. The trucks would primarily rely on major highways to reach the dams; therefore, significant impacts to transportation would not result from concrete delivery. Transportation of fill material between the borrow site and the project sites would require multiple truck loads over a duration of several weeks to a few months (depending on the number of berms potentially constructed and the amount of material). The current traffic load on U.S. Highway 321 is approximately 25,000 vehicles per day; therefore, the increase in construction related traffic would be insignificant along this roadway as a result of Alternative B. Therefore, only minor, direct impacts to transportation would be anticipated in this project area as a result of the implementation of the Alternative B at Fort Loudoun and Tellico Dams.

Construction traffic traveling between the borrow area and the Fort Loudoun and Tellico dam construction areas would also result in only minor, direct impacts to transportation along Town Creek Road West and Market Drive based on the current traffic volumes along these roadways. It is assumed that construction traffic would avoid Sharp Drive, in an effort to minimize impacts along this low volume, residential roadway.

In summary, there would be significant impacts to transportation as a result of implementation of Alternative B at Fort Loudoun Dam. These impacts would be minimized to an extent through implementation of BMPs with regard to lane closures. TVA will coordinate the schedule for the floodwall work at Fort Loudoun with the schedule for the U.S. Highway 321 relocation project to minimize traffic impacts. Additionally, these impacts would be temporary lasting only the duration of the proposed construction. Following completion of the construction activities, unrestricted traffic flow would resume.

Tellico Dam

Under Alternative B, the unnamed road that exits the Tellico Parkway and provides access to the large boat ramp and recreational facilities near the west end of the Tellico canal would be closed to all traffic for 30 to 45 days. This closure would likely occur in late summer-early fall. Short-term impacts may also occur along the Tellico Parkway adjacent to Segment T-4. Construction of the floodwall on this segment would likely block the highway shoulder and could result in temporary travel lane closures. A discussion of the Tellico borrow area is included under the Fort Loudoun dam description above. These impacts would be anticipated to be temporary and minor. No impacts to the other roadways in the project area would be anticipated.

Watts Bar Dam

Under Alternative B, the unnamed access road from Highway 68 into the recreation area would be closed to all traffic for about three days at the start and three days at the end of the construction period. This full closure would likely occur on weekdays. During much of the rest of the construction period, the access road would be closed for the placement of embankment fill; TVA would, however, provide an alternative access route to the boat ramp area. Construction of the reinforced concrete floodwalls on the main dam embankment would likely not require the closure of any roads open to the public. Concrete for the floodwall reinforcement would be trucked to the project site from local suppliers. The earthen fill material would be trucked from the borrow area northward on Old Dixie Highway/Yellow Creek Road, then east on Highway 68 across the dam to the construction site. The transport of concrete, fill material, and other construction materials to the project area may result in minor, temporary impacts to traffic on the low volume Yellow Creek Road. Overall, impacts to transportation from the implementation of Alternative B at Watts Bar Dam are expected to be moderately adverse, but short-term.

3.13.2.3. Alternative C – All Floodwalls

Potential impacts to transportation in association with the implementation of Alternative C would be similar to those described above for all dams. Under Alternative C, the overall construction duration would likely be shorter given that the construction timeframe for concrete floodwalls is slightly shorter than that of earthen embankments. This would result in a shorter potential period of increased traffic congestion and lane closures in the project areas than compared to Alternative B. Under Alternative C, there would be no construction traffic associated with the transfer of fill material from the borrow areas because no earthen embankments or berms would be built. However, due to the increased number of floodwalls under this alternative compared to Alternative B, there would be a need for larger amounts of concrete, and thereby an increased amount of concrete construction traffic.

3.14. Visual Resources

Visual resources can have a large influence on aesthetics. Aesthetics is a measure of sentiment or taste that an environment can induce in an observer. This involves the appearance of a view, and its interaction with surrounding views and their individual components. Visual resources include details such as the shape and color of visual elements, relative placement of visual items with respect to roads, green space and structures, light characteristics, and other factors which could affect a person's experience of the area. Individual items, scale, color, texture and lighting are all visual characteristics of the environment.

3.14.1. Affected Environment

Visual Resources in the project area are highly variable. Land uses include dam and reservoir operations, recreation (public and private), wildlife reserves, rural, urban, commercial and industrial categories. These land uses each have their own unique visual aspect, ranging from the emotionally relaxing and refreshing natural areas to the high energy and powerful industrial areas. This section focuses on the visual resources in the immediate vicinity of the four project sites, including borrow areas, as these would be the primary visual environments potentially impacted.

Cherokee Dam

Visual resources at Cherokee Dam are quite variable, with an almost industrial setting near Segment C-1 and the northern portion of C-2, and a more natural setting near Segments C-3 and the southern portion of C-2 (Figure 2-1). Segment C-1, which is accessible to public foot traffic only but receives relatively little public use, visually includes the dam and an associated power plant and switchyard and an expanse of levee with riprap and mowed lawn (Appendix A, Photos 1 through 3). This area combines industrial elements with natural ones, creating a disjointed experience. The soft rolling hills and trees sit in direct opposition to the massive dam and power plant. The transmission lines scattered throughout the natural areas add to this disjointed experience. The large levee with concrete and riprap also breaks up the visual flow in the area which would have created a harmonious and pleasant visual experience, flowing from forested hills to open water. The view from the water is much less impacted by the industrial structures. From the reservoir, the area appears much more natural and peaceful. The levee; however, creates an artificial separation of the calming aspects of water and distant nature, appearing as a disquieting line across the horizon, infringing upon the unrefined aspects of the view.

Visual resources within the southwestern portion of the Cherokee Dam reservation (south of Segment C-2) are dominated by views of natural areas. This area is accessible to the public and is a popular recreation area. Water, forested areas, mowed and landscaped grassy areas, rolling hills and a distinct lack of structures are the main visual elements. Structures and other human constructed items are generally hidden from most viewing spots, heightening the experience of being engulfed in nature (Appendix A, Photos 12 through 15). This area elicits feelings of well-being and enjoyment due to opportunities to experience the natural setting with friends and family and the appearance of a surrounding open and inviting wilderness. The views from the picnic areas and the walkways of the reservoir are especially pleasant as large expanses of calm water with forested hills in the distance are dominant. The parking lots and camping areas are secluded in trees, making these human-made items almost invisible, especially from the water and shoreline.

Segment C-2 represents a middle ground between the two very different visual areas (Appendix A, Photos 4 through 8). This area is visually appealing, but the levee, riprap, HESCO barriers and road interfere with the experience of a natural setting. Views from the walkway towards the water and opposite side of the reservoir are very appealing, making this a popular walking trial, especially for those who are physically limited. Views of this area from the water would be similar to those around Segment C-1, with the levee breaking up the visual appreciation of an undisturbed area. Overall, this area is visually appealing due to the surrounding natural areas.

At Cherokee Dam, the target June 1 pool elevation is 1,071 feet and the target January 1 pool elevation is 1,045 feet, a maximum water level difference of 26 feet. This seasonal change can have large visual impacts. Some of these impacts can be dramatic, as evidenced from visual resources analyses in the 2004 River Operations Study EIS (TVA 2004, Photo 3.14-1). Impacts from water drawdown would be most apparent in the winter season. There are no year round residents in the immediate vicinity of Cherokee Dam; therefore, only temporary recreation enthusiasts would experience low water levels. The visual effect of the drawdown would serve to exacerbate the disturbance of the visual flow from hillsides to water due to the levees in the area.

August reservoir level in 2002 - 1,382 feet

January reservoir level in 2003 - 1,361 feet (21 feet lower than August level)

Photo 3.14-1. Example of the Visual Impacts from Seasonal Water Level Difference, (TVA 2004)

<u>Fort Loudoun Dam</u>

The Fort Loudoun Dam project area has a similar combination of visual resources as at Cherokee Dam, ranging from industrial to natural landscapes. The most industrial views are near the dam, and the most naturally appealing views are near Segment FLT-1 (Figure 2-6).

Segment FLT-1 is adjacent to a commercial marina, immediately next to a boat ramp parking lot (Appendix A, Photos 17 through 19). This area is somewhat recessed from the general viewing spots in the area. The access road to the parking lot separates the forested portion of the view from the structured human-made area adjacent. Except for the taller trees, the natural area is usually blocked from view by the road and the HESCO barriers. The addition of visual interruptions such as electrical poles and the riprap along the levee increase the discordant experience of the scenery. More pleasant views of the marina and its surroundings are available farther from this segment. Although this portion of the project area also has human-made structures, they are more harmonious with the surrounding view. The boat docks are organized and low in stature, allowing the trees across the reservoir to be seen. The boat house and parking lot are also partially hidden in trees or behind grassy swales, reducing the impact of these structures on the surrounding landscape. Overall, this area is attractive, but constitutes more of an intrusion into a scenic and nourishing experience than an area where one would travel to in order to experience an appealing view.

Segments FTL-2 and FTL-3 are more industrial in appearance, compared to Segments FTL-1 and FTL-4. The concrete portion of the dam itself is located near FTL-2 (Appendix A, Photos 20 and 21). This area is highly organized and views are dominated by the dam itself. As at the marina, but at a more extreme level, this access point to the reservoir serves as purely that – an access point. It is unlikely that visitors would linger here for the view after the initial curiosity of the powerful dam structure was satisfied. This portion of the Fort Loudoun reservoir area is not visually appealing due to the large industrial structures, the levee with riprap and the almost complete obstruction of any of the natural areas surrounding it.

Segment FLT-3 is also relatively industrial in character. It runs from the dam along U.S. Highway 321 towards Tellico Dam (Appendix A, Photo 22). FLT-3 also includes views of the elevated portion of U.S. Highway 321 leading to a bridge. This area is not accessible by pedestrians; therefore, it would only be visible from a distance, either from the water or from a distant land based spot. From the water, views would be dominated by the levee, the highway and the bridge. This would be in opposition to the scenic areas across the reservoir, constituting an interruption in the visual experience. This interruption is reduced towards Segment FTL-4 as the bridge is less intrusive and the highway is at ground level. However, the human-made structures still dominate the view. The view of the water from the road is effectively blocked by the HESCO barriers, also creating a disjointed visual experience for drivers. On one side, a pleasant view of forested hills appears; on the other a tall visual barrier prevents any appreciation of the reservoir.

At Fort Loudoun the target June 1 pool elevation range is 813 feet and the target January 1 pool elevation is 807 feet, a maximum elevation difference of 6 feet. Visually, in this area, this difference would not constitute a major change in visual resources over the course of the year.

Tellico Dam

The visual resources at Tellico Dam effectively represent a middle ground between Cherokee and Fort Loudoun dams. Segment T-1 consists of an earthen embankment section that would run under the proposed elevated access road entrance to the Tellico Recreation Area, the eastern end of which would be FTL-4 under Alternative B (Figure 2-13). This embankment would be located in a grassy field and would be in keeping with the current aesthetic of the recreation area and would be generally less intrusive than the existing HESCO barriers (Appendix A, Photo 25). Appreciation of the natural environment is more effortless here than at the Fort Loudoun floodwalls segments. The levee and riprap appear smaller in stature and the highway is farther from the shoreline and is mostly visually obstructed in this area. The walking trail on the reservoir side of the levee would allow generous opportunities for the appreciation of the natural environment as the view of the reservoir and the landscape across the water are completely unhindered by dam reservation structures.

The existing setting at Segment T-2 is very similar to that of T-1 at its beginning, but becomes much more industrial at its southern end (Appendix A, Photos 30 through 36). Tellico Dam is much smaller than the other dams in the project area and is nestled into a forested hillside. It is much less industrial in appearance, mostly because if it's close relationship with the adjacent hill. The walking trail along the levee is located opposite the HESCO barriers from the water. Views from the trail are mostly of the adjacent forested hillsides, as the water is partially blocked from view by the HESCO barriers. The experience, however, would still be pleasant and relaxing as the natural areas are appealing and framed by a foreground of softly undulating mowed lawn areas with small stands of trees. Additionally, unless the observer is very small in stature, some visual appreciation of the reservoir is still possible.

In between Segments T-1 and T-2 is a small recreation area which contains a swimming area, a picnic area and a boat ramp (Appendix A, Photos 26 through 28). There are also some walking trails in this area which lead in both directions – towards Tellico Dam and towards Fort Loudoun Dam. This area has an abundance of visual resources as the levees and the other industrial structures are mostly hidden from view by the trees. From this area views are exceptionally pleasant as it is one of the few areas along the reservoir shorelines where the forested areas are immediately adjacent to the water. There are no obstructions between these two natural settings and the effect is relaxing and enjoyable.

Segments T-3 and T-4 are in more natural settings offering considerable opportunities to appreciate nature (Appendix A, Photos 37 through 39). The surrounding area south of Highway 444 is forested and bisected by the Hall Bend Trail. Walking in this area, a visitor is completely immersed in nature, with only very minor visual interruptions. The view consists generally of forested areas, with intermittent glimpses of the reservoir through the trees. These segments represent one of the most appealing and harmonious visual experiences in the entire project area. The only disturbances are the HESCO barriers, which interrupt the appreciation of the water. The barriers are less obtrusive, however, than the larger levee structures in the other portions of the dam area. Overall, these segments represent a significant visual resource, eliciting agreeable and calming feelings due to the immediate and almost absolute envelopment of the viewer in a natural setting.

Tellico Village is a large residential area located just to the south of Segment T-4 (Appendix A, Photos 40 and 41). This area is located in a picturesque setting with homes nestled in amongst trees and small hills. The water front area is also harmonious with the surroundings as the homes are partially hidden by trees. The view of the reservoir from this residential area would be very pleasant due to the lack of industrial structures within the view. Small sections of levee topped with the HESCO barriers are visible from the village, but these are mostly blocked by trees along the shoreline.

At Tellico Dam, the target reservoir pool elevations are similar to Fort Loudoun, 813 feet on June 1 and 807 on January 1. This results in a maximum water level change of 6 feet. Although Tellico Village is a year-round residential area located at the edge of the water, this change in water level should not result in an extreme visual impact over the course of the year.

Watts Bar Dam

All three segments at Watts Bar Dam are immediately adjacent and in the same general area (Figure 2-18). Watts Bar Dam and the nearby recreation area present a compelling aesthetic juxtaposition due to the visual dominance of the nearby nuclear power plant (Appendix A; Photo 50). The decisively industrial appearance of the plant's cooling towers and the dam and bridge provide a severely disjointed experience at portions of the recreation area. The plant does not visually fit in with the surrounding area although it is often partially screened by trees. It detracts significantly from the recreational experience which visitors seek when coming to the reservoir.

Additional views in the area, even when not including the plant, are disquieting due to other industrial and structural aspects (Appendix A; Photo 52). These areas are much less interrupted by the human-made structures, but they often play a large visual role, detracting from the surrounding serenity and natural setting.

Views from the access road to the recreation area are more pleasant, although the industrial nature of the adjacent plant is still visible and causes minor visual disharmony (Appendix A, Photo 48). In contrast, the view from some portions of the recreation area of the reservoir is breathtaking (Appendix A; Photo 56). These variable views highlight the disjointed visual experience at the Watts Bar Dam recreation area; providing some appealing views, some mostly appealing views and some views which are not appealing at all.

To the north of the recreation area, there is a former campground and hiking trails, which provide a much more attractive visual experience (Appendix A, Photos 45 and 47). This area is highly visually pleasant as the trails wind through forested areas and the former campsites, which shield visitors from views of the more industrial aspects of the Watts Bar Dam reservation. Ironically, the most alluring visual resource in the area is the farthest from the water.

At Watts Bar Dam, the target pool elevations are 741 feet on June 1 and 735 feet on January 1. This results in a maximum 6 foot change in water elevation. Considering the industrial and severely disjointed visual nature of the recreation area, this difference would be insignificant over the course of a year.

3.14.2. Environmental Consequences

This section contains a discussion of the potential impacts to visual resources should any of the alternatives be implemented. A series of graphic renderings using photographs of the existing conditions was prepared in order to illustrate possible impacts to visual resources at the four dam areas.

Under Alternatives B and C, at all four dam areas, short-term, moderate, adverse, direct impacts to visual resources would be anticipated during construction activities. These would include the appearance of large construction equipment in a variety of natural settings, additional traffic on the roads and in parking lots, and other barricades and signage related to safety in the construction areas. Similar temporary, minor indirect adverse impacts to visual resources are also anticipated during construction along access roads and at areas distant from the immediate dam areas such as from the water or locations across the reservoir. These indirect impacts would apply to every project site.

Moderate adverse impacts to visual resources would occur due to potential altered traffic flow at Cherokee, Fort Loudoun, and Watts Bar dam reservations under Alternative B, and less so under Alternative C.

3.14.2.1. Alternative A – No Action Alternative

Under Alternative A, the HESCO barriers would remain in place, maintained as necessary by TVA. Minor, temporary adverse direct impacts during maintenance would occur due to the presence of construction equipment along the dam reservations. Public comments during the scoping revealed that many responders wanted the HESCO barriers removed, due to their existing negative visual impact. The barriers appear temporary and industrial, and block the view of the water in many places, influencing the aesthetics of the dam environments. Although the No Action Alternative was intended to be the baseline from which the other alternatives were evaluated, in this case the HESCO barriers constitute an ongoing negative impact to visual resources.

3.14.2.2. Alternative B – Combination Floodwalls and Embankments

Cherokee Dam

Under Alternative B, the HESCO barriers would be replaced with combination of floodwalls and berms at Cherokee Dam. Segments C-1 and C-2 would be raised with floodwalls and Segment C-3 would be raised with an earthen embankment (Figure 2-1).

Reinforced concrete floodwalls (6.6 ft in height) would be constructed on the downstream side of Segments C-1 and C-2. Photo 3.14-2a shows a portion of the main embankment at Cherokee Dam (Segment C-2 facing northeast), and photo 3.14-2b shows a rendering of the area if the proposed 6.6-foot-tall textured floodwall wall were built along the downstream side Segment C-2. This photo also simulates the proposed 3-foot-tall raised walkway, essentially making the final floodwall height for pedestrians and visitors of the C-2 walkway, just 3.6 feet tall. The shorter wall, located farther from the industrial aspects of the Cherokee Dam complex would provide much more pleasant recreational views more in keeping with the existing setting of the official recreation area.

The proposed height of the floodwall at Segment C-1 is 6.6 feet, similar to the rendering of C-2; however the walkway at Segment C-1 would not be raised (Photo 3.14-2c). This nearly 7-foot tall floodwall would block the view of both a pedestrian and a boater on the water of the rolling hills and forested areas on the downstream side of the C-1 embankment. This visual obstruction could significantly alter the appearance of the area and the experience of walking or boating due to the loss of view of the downstream hillsides. Additionally, even while looking from the walkway out over the water the presence of the high wall nearby would have a disquieting effect, contrasting the tranquility generated by the presence of the water and the distant hills. Very few people visit this portion of the Cherokee Dam complex as it is only accessible by the public on foot. Therefore, any impacts to the visual resources at this segment would generally only be felt by boaters or workers at the facility. Therefore, this direct adverse impact is considered minor.

Photo 3.14-2a. Cherokee South Main Embankment

Photo 3.14-2b. Visual Rendering of a 6.6-foot-tall floodwall on the downstream side of Segment C-2 with a 3-foot-tall raised walkway at Cherokee Dam

Photo 3.14-2c. Visual Rendering of a 6.6-foot-tall floodwall on the downstream side of Segment C-2 at Cherokee Dam. The Proposed Segment C-1 Floodwall would appear very similar to this rendering.

Photo 3.14-3a represents Segment C-2 as seen from the parking lot at the bottom of the stairs at the end of TVA Dam Road. Photo 3.14-3b shows a rendering of a 6.6-foot floodwall atop this segment. This area is already highly visually impacted by the large concrete dam, associated embankment, and the parking lot. Under Alternative B, a 6.6-foot tall concrete floodwall would be built at Segment C-2, with the addition of a 3-ft-tall raised walkway. The addition of this floodwall from this area would merely appear as a larger levee to visitors viewing this segment from the TVA Dam Road parking lot and/or the reservoir itself. From the perspective of C-2 walkway recreationalists, a 3.6-foot-tall permanent floodwall would not block most pedestrians' views of the rolling hills and forested areas on the downstream side of this embankment; therefore, this floodwall would not greatly alter the appearance of the area since most visitors would continue to be able to experience existing views. Because pedestrians utilizing the top of the Segment C-2 embankment for recreation purposes likely do so primarily for the view of the reservoir and not the view of the downstream hillsides, minimal impacts to visual resources would be anticipated under Alternative B.

Cherokee Segment C-3, a 6.6-foot-tall earthen embankment would be in keeping with the existing natural setting following construction. The grassy embankment would be able to be used for pedestrian activities, providing a new, slightly elevated walking trail option for visitors of the Cherokee reservation.

Photo 3.14-3a. View of Cherokee South Main Embankment (Segment C-2) from the TVA Dam Road Parking Area

Photo 3.14-3b. Rendering of a 6.6-foot-tall Floodwall atop Segment C-2

The installation of the post-tensioning and the training wall on the north side of the concrete portion of the dam would result in negligible long-term changes to the appearance of the dam. The construction of the larger training wall on the south side of the concrete portion of the dam would slightly alter the appearance of the dam from the vicinity of TVA Dam Road and a short stretch of Highway 92. The training wall would blend with other concrete elements of the dam and not adversely affect its appearance.

Fort Loudoun Dam

At Fort Loudoun Dam, permanent modifications to Segments FTL-1 and FTL-4 would be in the form of earthen embankments, and Segments FTL-2 and FTL-3 would be accomplished using concrete floodwalls, due to site and access limitations. At Segment FTL-1, adjacent to the parking area by the marina, the proposed 6-ft-tall embankment would result in a minor visual impact during construction. This area is not centrally located, nor is it an attraction. The existing HESCO barriers currently block the view to the north for motorists on City Park Drive. This view would remain blocked by the new embankment under Alternative B; however, an earthen embankment would be much more in keeping with the natural surroundings, much more visually appealing than the existing HESCO barriers. During and immediately following construction, before this embankment has been re-seeded, it would stand out from its surroundings as a large mound of earthen fill material. Once the vegetation has had time to regrow, this embankment would no longer adversely impact visual resources.

Floodwall segments FTL-2 and FTL-3 are dominated visually by the road and bridge and are located in a highly industrial setting that is not readily accessible by foot. Photo 3.14-4a shows the Fort Loudoun Bridge and U.S. Highway 321. Photo 3.14-4b presents a rendering of a 5.8-foot floodwall near the Fort Loudoun Dam, Segment FTL-2. The HESCO barriers under the bridge (portion of FTL-2) are currently stacked two-high, resulting in a 7- to 8-foot-tall wall (Figure 3.14-3a). The height of the proposed permanent floodwall for Segment FTL-2 would be 5.8 feet, shorter than the wall simulated in the visual rendering (Photo 3.14-4b). From the water, the addition of the floodwalls would not impose additional industrial characteristics to the view. Segment FTL-3 would be modified using a 4.8-ft-tall floodwall, which would partially block views of the reservoir for motorists heading east on Tellico Parkway. Moving the floodwall on Fort Loudoun Segment FTL-3 to the land side is not feasible due to traffic and safety concerns. Following the completion of the U.S. Highway 321/SR 95 bridge relocation project (slated for May 2015), this floodwall would have little effect on the views of motorists on U.S. Highway 321. It would affect the views of motorists on an approximately 1,200-foot portion of the entrance and exit ramps from Tellico Parkway to north-bound U.S. Highway 321. Aside from the restricted view from the Highway 444–U.S. Highway 321 ramps, the proposed permanent modifications have relatively little effect on views of the Tellico Reservoir from Highway 444. Therefore, the proposed floodwalls at FTL-2 and FTL-3 would not be anticipated to result in any significant impacts to visual resources.

Photo 3.14-4a. Photo of Existing Temporary Measures at Segment FTL-2 (Under Bridge)

Photo 3.14-4b. Rendering of a 5.8-foot Floodwall at Fort Loudoun Dam Segment FTL-2

Embankment Segment FTL-4, located at the entrance to the Tellico Recreation Area, would be a short section of raised earthen berm built to a height of 4.8 ft to tie into Segment T-1. Photo 3.14-5a shows the existing visual attributes of the entrance to the Tellico Recreation Area and Photo 3.14-5b shows a rendering of the proposed 4.8-ft embankment and raised access roadway that crosses over it. The rendering shows that there would be minimal visual disturbance to this area as the new road would be built over the proposed embankment, thereby eliminating the need for a gap closure barrier. Minor visual differences would be expected for motorists traveling on Tellico Parkway near the entrance, and for visitors entering the recreation area as they approach the parking area. From these vantage points, motorists and visitors can catch a brief glimpse of a small portion of the reservoir. The parking lot itself would also be slightly less visible from the road. Following construction of Alternative B, the trees in the background would still be visible from the road; however, the reservoir itself would only be visible from the crest of the raised entrance road crossing the berm. This would be considered an insignificant direct impact to visual resources because the current view of the reservoir from these areas is very limited.

The removal of the HESCO baskets would be an improvement to the visual experience of this area. As described for FTL-1, there would be minor, temporary adverse impacts to aesthetics during and immediately after construction, before vegetation has regrown. Once this embankment has been re-seeded, it will blend in with the existing surroundings and no longer adversely impact visual resources. Therefore, at FTL-4, the proposed embankment would constitute minor, short-term direct impact to visual resources.

Photo 3.14-5a. Entrance to Tellico Recreation Area

Photo 3.14-5b. Rendering of FTL-4 and Elevated Entrance Road

Tellico Dam

At Tellico Dam, two of the segments would be modified using floodwalls (T-2 and T-4), and two segments would be modified using earthen embankments (T-1 and T-3). The transition between Segment FTL-4 and T-1 would occur in the grassy field south of Tellico Parkway (Highway 444), in front of the Tellico Recreation Area (Figure 3.14-6a). Figure 3.14-6b shows a simulation of what this area would look like from Tellico Parkway (heading east) with the continuous embankment in place. Photo 3.14-7a shows a slightly different perspective of Segment T-1 from Tellico Parkway, with Photo 3.14-7b providing a rendering of a 4.8-foot tall embankment built along the current T-1 alignment. Although some of the trees at this location are partially obscured, there is only a minor visual difference between the photo of the existing viewshed and Alternative B simulations. Due to the natural topography of this area, the view from the Tellico Parkway observation point does not significantly change with the addition of permanent modifications at FTL-4 and T-1; therefore, impacts to visual resources from this perspective would be negligible.

Photo 3.14-6a. Existing View of HESCO Barriers at the Transition Point of FTL-4 and T-1

Photo 3.14-6b. Rendering of a 4.8-foot-tall Embankment at the FTL-4 and T-1 Transition Point

Photo 3.14-7a. View of Existing Segment T-1 From Tellico Parkway (facing SW)

Photo 3.14-7b. Rendering of Segment T-1 Embankment from Tellico Parkway

Photo 3.14-8a, which was captured (facing north) from the boat ramp peninsula located within the Tellico Recreation Area, shows Segment T-1 with the pedestrian walkway on top. Photo 3.14-8b presents a rendering of a 4.8-ft-tall embankment on the downstream side of Segment T-1. From the water, the raised height of the embankment would result in a slight visual disruption between the forested hillsides in the distance and the shoreline, but there is an abundance of similar views in the vicinity. The selection of the proposed embankment at this segment would be more harmonious with the surrounding greenery and natural resources than compared to a concrete floodwall.

In addition, the construction of an embankment at Segment T-1 could result in beneficial direct impacts to visual resources in the area as it would allow a walkway to be constructed atop the berm. Therefore, pedestrians on the walkway would have an unobstructed view of both the forested areas on the downstream side and the reservoir on the upstream side. Additionally, the industrial-looking HESCO barriers would be removed, allowing a more natural environment for the appreciation of the viewer. Therefore, at this segment, the replacement of the HESCO barriers with a berm would constitute a minor, positive direct impact to visual resources.

Photo 3.14-8a. Photo of the Existing T-1 Embankment with Pedestrian Walkway

Photo 3.14-8b. Rendering of a 4.8-foot-tall Embankment at Segment T-1

Photo 3.14-9a shows Segment T-2, the main embankment of Tellico Dam. Photos 3.14-9b simulates Alternative B at Segment T-2. Under Alternative B, the Tellico T-2 Main Embankment would be raised by a combination of a 4.8-foot floodwall on the lake side and a 2-foot raised walkway. This would reduce the effective height of the floodwall, as perceived by pedestrians on the embankment, to 2.8 feet. Of all the proposed construction areas, permanent modifications to this segment would have been most significant, if not for the raised walkway feature, which was incorporated into Alternative B in response to public comments. Segment T-2 is one of the more highly used segments for recreational purposes. Under Alternative B, a 4.8-foot-tall berm with a raised walkway would not be expected to completely obscure the public's view of Tellico Reservoir from the south embankment because the majority of adults would be able to see over the floodwall. As can be seen in the rendering, the addition of the new embankment would not result in a significantly different view from the existing one.

The view from land towards the dam would even less dramatically affected (Photos 3.14-10a and 3.14-10b). Observers walking in the downstream areas of the reservation would not experience an extremely jolting visual change. From this perspective, the reservoir is already not visible, and the wall blends with the existing embankment. Overall, at Segment T-2, the replacement of the HESCO baskets with a berm in combination with a raised walkway should not cause significant impacts to visual resources.

Photo 3.14-9a. Tellico Dam Main Embankment (Segment T-2)

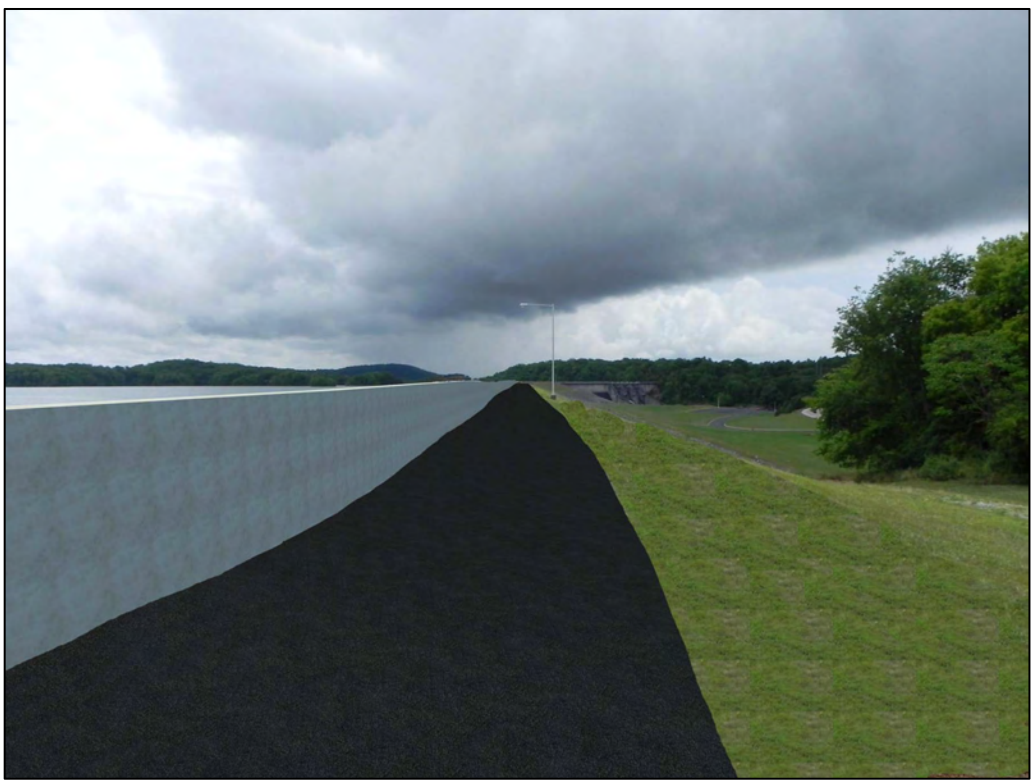


Photo 3.14-9b. Rendering of a 4.8-foot-tall Floodwall and 2-ft Raised Walkway at T-2

Photo 3.14-10a. View of Tellico Dam (Concrete Portion of Dam)

Photo 3.14-10b. Rendering of a 4.8-foot-tall Floodwall atop Segment T-2

Segments T-3 and T-4 represent Tellico Saddle Dams Nos. 2 and 3, respectively. The permanent modifications proposed for these segments consist of a 5-ft-tall upstream embankment at T-3 and a 4.8-ft-tall concrete floodwall at T-4. Segment T-3 is set back from the Tellico Parkway, and therefore only visible from the reservoir. Because of this, renderings were not generated for this dam segment. The view from the Hall Bend Trail along Segment T-3 could be slightly more impacted than this perspective (Appendix A, Photos 37–39). The existing HESCO barriers currently present a disjointed experience of the wilderness and reservoir. However, the construction of a 5 foot tall berm to replace them may constitute a direct positive visual impact for observers from this area since an embankment would blend into the surrounding natural landscape better that the existing HESCO barriers.

Segment T-4 is located adjacent to Highway 444. Photo 3.14-11a shows Segment T-4 (Saddle Dam No. 3) as seen from the closest part of Tellico Village. Photo 3.14-11b presents a rendering of the view of a 4.8-foot-tall floodwall at Segment T-4 from Tellico Village. In the rendering, the new wall is not any more visually imposing than the existing HESCO barriers. The existing concrete structures and rip rap in this view already represent a visual disturbance in comparison to the surrounding nature-scape. From this perspective, direct negative impacts to visual resources are anticipated to be minor.

From the perspective of a motorist traveling on Tellico Parkway, the visual aspects of the view of Segment T-4 would also not be significantly impacted (Photos 3.14-12a and 3.14-12b). Tellico Segment T-4 is in view for 4 to 5 seconds by a person in a vehicle travelling the speed limit on southbound Highway 444 and for a somewhat longer time by a northbound traveler. Prior to the installation of the HESCO barriers, Tellico Reservoir would have been visible from the roadway for most of these time intervals. It is presently only visible to a southbound traveler for a small portion of this time and at the southern end of Segment T-4. It is visible to a northbound traveler for a longer time period. Additional views of the reservoir are available about 0.2 miles south of Segment T-4, near the Tellico Village entrance sign, and 0.5 miles south of Segment T-4, near the Poplar Springs Boat Ramp. TVA has considered potential mitigation measures for the construction of the T-4 floodwall in response to public comments. Creating a viewing area at the unmaintained roadside pull-off about 250 feet south of Tellico Saddle Dam 3 could mitigate some of the visual impacts of the proposed permanent dam modifications. The volume of traffic on the adjacent two-lane Tellico Parkway is high and vehicles frequently travel at a high rate of speed. Due to the configuration of the roadway, the sight distance of northbound traffic is limited due to the rise in the roadway just south of Saddle Dam 3. These factors could make ingress and egress to the proposed viewing area difficult. Currently, TVA has no plans to construct a roadside viewing area.

Overall, direct impacts to visual resources at Tellico Dam range from slightly negative to slightly positive, depending on the segment and the situation of the observer. At Segment T-2, impacts would be moderate for observers walking along the embankment trail, but would be minimized by the addition of the raised walkway. These impacts would also be less noticeable for those walking farther from the embankment. Observers from Tellico Village could experience a very minor negative impact, although the similarity between the existing condition and the proposed floodwall could result in no impacts. Those walking on the backwoods trails may experience a minor positive impact due to the removal of the industrial looking HESCO barriers and the construction of a more natural appearing berm. Walkers on Segment T-1 would be able to recreationally use the top of the embankment, resulting in a direct positive impact along the length of the berm.

Photo 3.14-11a. Segment T-4 (Saddle Dam No. 3) at Tellico Dam, as seen from Tellico Village

Photo 3.14-11b. Rendering of a 4.8-foot Floodwall at Segment T-4 from Tellico Village

Photo 3.14-12a. View of Segment T-4 (Saddle Dam No. 3) from Highway 444

Photo 3.14-12b. Rendering of a 4.8-foot Floodwall at Segment T-4, viewed from Highway 444

Watts Bar Dam

Under Alternative B, Segments WB-1 and WB-2 at Watts Bar Dam would be raised by constructing a 3.5-foot-tall embankment. Photo 3.14-13a shows a view of the existing embankment at Watts Bar Dam. Photo 3.14-13b presents a rendering of the embankment raised by 3.5 feet. As can be seen in the rendering, there is very little difference visually between the two photos. The HESCO barriers in this area are relatively set back from the reservoir and the recreation areas, constituting a very minor visual disturbance. The area is also already highly industrial in appearance due to the nearby power plant contrasting with the natural scenery. The construction of berms to replace the HESCO barriers is not anticipated to have a significant direct impact to visual resources in this area. In contrast, depending on where the new embankment is viewed from, it could represent a minor positive direct impact to the visual resources of the Watts Bar Dam recreation area.

The area by the former campground and trails is likely to be the most visually impacted by the construction. This area is surrounded by trees and natural areas and the construction of the WB-1 and WB-2 embankments, associated new parking lot, and elevated entrance road would necessitate the removal of some of the immediately adjacent vegetation. Overall, Alternative B would have a minor negative direct impact to visual resources at Watts Bar Dam.

Under Alternative B, the existing floodwall at Segment WB-3 would be strengthened. No change in elevation in this segment is proposed. Therefore, other than the temporary visual disturbance from equipment during construction, no direct impacts to visual resources are anticipated at Segment WB-3.

Overall, construction of earthen embankments as the permanent modification type at WB-1 and WB-2 would blend in with the surroundings and be virtually unnoticeable from the key observation points (KOPs) within the project area.

Photo 3.14-13a. View of Existing Watts Bar Dam Embankment from Recreation Area

Photo 3.14-13b. Rendering of the WB-1 and WB-2 Embankments at Watts Bar Dam

3.14.2.1. Alternative C – All Floodwalls

Under Alternative C, all segments at each of the four dams would be raised using floodwalls as the permanent modification type. Impacts to visual resources under Alternative C would be similar to, but much more severe, compared to those under Alternative B. Berms are generally more visually appealing as they are gentle rises and fallings of landscape and are usually covered with grass. This is in stark contrast to a floodwall which appears much more industrial in nature due to its construction of concrete and the placement at right angles to the surrounding natural areas. The possibility of constructing new walkways on top of berms, providing pleasant views, would be eliminated when using floodwalls exclusively under this alternative. Tall floodwalls would also impair the vision of recreational visitors wishing to observe the reservoirs from the existing trails and pathways. The addition of raised walkways adjacent to the proposed floodwalls at some dams would alleviate this visual blockage for pedestrians. However, raised walkways adjacent to floodwalls are not included in this alternative, and would not be possible at all locations.

The existing HESCO barriers and floodwalls are similar in aesthetics, if not completely visually similar. This alternative would merely replace an existing industrial-appearing visual blockage with another, in some cases an even larger man-made structure. Therefore, overall, Alternative C could have severe negative direct impacts to visual resources in comparison to Alternative B.

Under either action alternative, TVA would implement traffic control and other methods to reduce safety and transportation impacts during construction. TVA has also designed the floodwalls to maximize the roadway width once construction is completed.

Staging and Borrow Areas

As part of both Alternatives B and C, staging and borrow areas would be necessary during construction. Figures 2-1, 2-6, 2-13, and 2-18 show the staging areas and Figures 2-2, 2-7, and 2-19 show the borrow areas at Cherokee, Fort Loudoun, Tellico, and Watts Bar, respectively. Post construction, the staging areas would either be re-vegetated or returned to their original use.

The staging areas are all located either immediately adjacent to or very near the construction at all four dams. These areas will be visually interlaced with the other surrounding construction and would, therefore, create a minor temporary direct visual impact directly related to construction. As soon as construction is complete, the staging areas would be either re-seeded, or returned to their former use, resulting in no permanent direct impacts to visual resources.

The borrow areas are located farther from the construction sites for all four dams. The Cherokee Dam borrow area has previously been used as a borrow area (Figure 2-2); negative visual impacts at this site have already occurred. Their use by TVA for the construction at Cherokee Dam could create a minor direct negative impact to visual resources in the immediate area. This would be due to construction equipment on site and traffic on local roads. However, as this site is already disturbed and has been used as a borrow area prior to this project; these impacts are considered minor and temporary.

The borrow area for Fort Loudoun-Tellico is also distant from the construction at the dam sites (Figure 2-7). This site is currently in use by the TDOT U.S. Highway 321 Bridge Project. Although the addition of the dam project to the existing use of the area could make the direct visual impacts greater in the local area, it would remain a temporary and minor direct impact. This is due to the fact that more equipment would be added to the site, more traffic would be travelling the local roads and the use of the site may last a longer duration with both projects involved. Therefore, although there would be a temporary negative direct impact to visual resources at the Fort Loudoun-Tellico Dam borrow area, it is considered minor overall.

The Watts Bar borrow area (Figure 2-19) is located in a remote location; the only adjacent property is that of the landowner. However, during construction of the embankments at Watts Bar, when fill material is actively being excavated from the borrow area, the nearby landowner would experience temporary, adverse aesthetic impacts. This area would experience greater negative direct visual impacts because it is not currently nor has it formerly been used as a borrow area. This borrow area would be re-vegetated after use because it has not been previously disturbed. During construction, a direct moderate negative impact to visual resources would be experienced by nearby residents and, to a lesser extent, those travelling on local roads. The appearance of construction equipment on site and large vehicles on small roads would disturb the usual bucolic nature of the area. Although this direct impact would be considered negative, it would be minor as it would be temporary and the site would be returned to an area with the characteristics of a natural environment post construction.

3.15. Recreation

3.15.1. Affected Environment

TVA has developed recreation facilities on all four dam reservations. These facilities include parking areas, visitor overlooks, restrooms, picnic areas, a campground, and boat launching ramps above and below the dams. Except for the campground, these facilities are normally open and used by the public year-round. The heaviest use occurs during the peak summer recreation period between late May and early September. Following is a more detailed description of the recreation facilities and visitor use at each of the four dams.

Cherokee Dam

Recreation facilities on Cherokee Dam Reservation are concentrated on the south side of the dam. A paved sidewalk extends from the south end of the south main dam embankment for approximately 2,275 feet. Because of the construction of the HESCO barriers on a portion of this trail, a 700-foot section does not presently meet ADA guidelines. This trail is accessible from the south overlook and day use area parking lots. A second trail crosses meadows and woodlands between the embankment and U.S. Highway 92. This trail is accessible from the day use area parking lot and a tailwater parking lot.

The day use area contains a visitor center with restrooms, picnic area (Photo 3.15-1), swimming area with sand beach, a picnic pavilion, playground, and an all-season two-lane boat launching ramp (Photo 3.15-2) and parking lot with space for 86 vehicles with trailers. To the southwest of the boat ramp is a campground open from mid-March through mid-November. The campground contains 42 sites with water and electric hookups, dump station, and restrooms with heated showers.

Recreation facilities on the south bank below the dam include a tailwater boat launching ramp that provides access to the Holston River, parking lots at the base of the dam, open space areas with a trail as described above, and a concrete stairway that provides pedestrian access to the top of Cherokee dam. The tailwater boat launching ramp is popular with float fishermen and other boaters.

Based on surveys conducted between 2006 and 2009, TVA estimates that the Cherokee Dam Reservation recreation facilities, excluding the campground, receive 20,000 to 25,000 annual visits. Recreation uses include fishing, boating, picnicking, sightseeing, walking, wildlife observation, swimming, and sunbathing.

The National Park Service has listed the Holston River from Cherokee Dam to its confluence with the Tennessee River on the Nationwide Rivers Inventory. This listing is in recognition of the high scenic, recreational, and other values of this river segment and its potential for qualifying as a national wild, scenic, or recreational river.

Several other recreation areas occur in the surrounding area. The closest of these is Black Oak Park, located about 0.9 miles southeast of the dam and across the reservoir in Jefferson County.

Photo 3.15-1. Cherokee Dam Recreation Area between Segments C-4 and C-5

Photo 3.15-2. Cherokee Dam Boat Ramp Parking Lot and Camping Area near Segment C-6

Fort Loudoun Dam

Recreation facilities on Fort Loudoun Dam Reservation include a parking area and tailwater fishing berm on the south bank below the dam. Parking areas, restrooms, tailwater fishing berms, and a boat ramp are located on the north bank below the dam. TVA also maintains a parking area, visitor overlook, and picnic area on the north bank upstream of the dam. Based on 2006-2009 surveys, TVA estimates that these facilities receive between 30,000 and 35,000 annual visits. Recreation uses include fishing, sightseeing, picnicking, walking, sunbathing, boating, and wildlife observation.

City Park Road, which intersects with U.S. Highway 321/State Route 95 on the dam reservation, is the main access road to Fort Loudon Marina and Lenoir City Park. Fort Loudon Marina, one of the largest marina operations on the Tennessee River system, is located in a cove immediately east of the dam reservation. Facilities include boat ramps, covered and uncovered boat slips, dry boat storage, fuel pumps, boat rentals, and restaurants. Lenoir City Park is located immediately east of the marina, about 0.4 miles north east of Segment FTL-1. This park is managed by the Lenoir City Parks and Recreation Department. Facilities include tennis courts, picnic shelters, restrooms, a fishing pier, a boat ramp and courtesy dock, playground area and walking trail.

Tellico Dam

TVA maintains several recreation facilities on the Tellico Dam Reservation. Immediately south of the junction of Tellico Parkway and U.S. Highway 321/State Route 95 are a parking area, restroom building, and ADA-accessible fishing area along the canal connecting Fort Loudoun and Tellico reservoirs. To the west of this there is a large boat ramp and parking area featuring two double-lane launch ramps with courtesy docks and space for 98 vehicles with trailers, and a separate day use area with swim beaches, restrooms, picnic area, and a paved, ADA-accessible walking trail (Photo 3.15-3). A separate boat launch ramp and parking area located on the east bank below the dam provide access to the Tellico and Fort Loudoun tailwaters. A parking area adjacent to Tellico Parkway near Saddle Dam No. 1 provides access to the five-mile Hall Bend Trail system that runs through the Hall Bend Habitat Protection Area and adjacent parts of the dam reservation.

Based on 2006-2009 survey results, TVA estimates that the Tellico Dam Reservation recreation facilities receive between 30,000 and 35,000 annual visits. Recreation uses include fishing, sightseeing, picnicking, walking, hiking, sunbathing, boating, and wildlife observation.

Photo 3.15-3. ADA-Accessible Walking Trail at Tellico Dam Segment T-1

Watts Bar Dam

The TVA day use area on the east bank of the reservoir above the dam is one of the most heavily used recreation areas on the reservoir. Facilities include parking areas, a swimming beach with ADA access, playground, picnic area with group pavilion, restrooms with showers, and a boat ramp. An existing road network through an adjacent former campground is regularly used by joggers, walkers and bicyclists (Photo 3.15-4). These roads are ADA-accessible. An overlook and parking area are located on the west bank immediately upstream of the dam. TVA maintains parking lots, fishing berms, and a boat launching ramp on the east bank downstream of the dam.

Based on 2006 to 2009 survey results, TVA estimated that the Watts Bar Dam Reservation recreation facilities receive between 10,000 and 15,000 annual visits. Recreation uses include fishing, sightseeing, picnicking, walking, bicycling, sunbathing, boating, and wildlife observation.

Photo 3.15-4. Example of the Walking Trail with Adjacent HESCO Barriers near the Watts Bar Recreation Area Boat Ramp

Borrow and Staging Areas

Several parking areas in the vicinity of recreational facilities have been designated as potential staging areas. At Cherokee Dam, two existing parking lots would be used for construction staging areas (Figure 2-2). One of these is just west of the southern end of Segment C-1. The second is located on the northwest side of TVA Parkway, just west of the southern end of Segment C-2. At Fort Loudoun and Tellico dams, two existing parking lots could be used for construction staging areas (Figures 2-6 and 2-13). They are adjacent to the canal near the entrance to the area and at the boat ramps at the west end of the canal (Segments FTL-4 and T-1). A third staging area was identified just north of the proposed Fort Loudoun Saddle Dam embankment construction near the Fort Loudon Marina (Figure 2-6). At Watts Bar Dam, potential construction staging areas include the two large parking lots in the recreation area adjacent to the proposed embankments and a grassed area south of the Lock (Figure 2-18). None of the proposed borrow areas are on the dam reservations, and no recreational facilities or established recreational uses occur on the areas.

3.15.2. Environmental Consequences

This section contains an analysis of potential direct and indirect impacts on recreation that could occur if any of the alternatives were implemented.

3.15.2.1. Alternative A – No Action Alternative

Under the No Action Alternative, the HESCO barriers would remain in place and no additional construction would occur in association with the embankments in the project areas at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams. The HESCO barriers would be maintained by the TVA as necessary. A minor temporary adverse direct impact would occur to recreational resources while the HESCO barrier liners are replaced approximately every five years. These impacts would be due to short-term potential lane closures at the reservations, the possible need for small staging/stockpiling areas for the crushed stone, and minor noise and visual disturbances during active maintenance. No indirect impacts to recreation at any of the four dams (or any impacts associated with borrow areas) would be anticipated under the No Action Alternative.

3.15.2.2. Alternative B – Combination Floodwalls and Embankments

Under Alternative B, the HESCO barriers would be replaced with a combination of concrete floodwalls and raised earthen embankments. Under this alternative, failure due to overtopping of each dam during a PMF event would be prevented by construction of a floodwall on the earthen embankments and/or raising the earthen embankments to the same height or higher than the existing HESCO barriers.

Cherokee Dam

HESCO barriers would be replaced with floodwalls at Segments C-1 and C-2, and a single embankment extending from the southern end of the south main embankment to the boat launch area and campground at Cherokee Dam (Segment C-3). The north embankment has no recreational facilities and relatively little public use; therefore, limited direct or indirect impacts to recreation in the area of Segment C-1 would be anticipated.

At Segments C-2 and C-3, several recreational facilities and activities would be temporarily adversely impacted by Alternative B. As described in Section 3-13.2.2, road access to these areas from TVA Parkway would be closed for about 45 days in late summer/early fall. These areas include the visitors/restroom building, swimming beach, picnic area, and overlook areas. Some of these areas, such as the beach and picnic area, would likely be accessible by foot during some of the closure period by visitors entering the reservation on Renfro Road and parking at the boat ramp or the large gravel area on the northwest side of the campground. The boat ramp and campground would remain open and accessible, although construction traffic would travel on Renfro Road during part of the construction period. Additionally, due to the use of the parking lots as staging areas during this time, parking for both boat ramp visitors and other recreational users could be limited.

The parking area on the downstream side near the northern end of Segment C-3 would be permanently closed. This parking area contains spaces for 60 vehicles. It is, however, lightly used, even on summer weekends, and its closure is not anticipated to adversely affect general recreation use of the area. Due to the loss of other parking during the construction period, the closure of this lot could constitute a moderate temporary direct impact to recreation at Cherokee Dam. However, as this lot is generally lightly used, when construction is complete there should be no permanent impacts to parking due to the closure of this lot.

The walking trail along the main south embankment would likely be closed for several months for the construction of Segment C-2. Other trails on the reservation are likely to remain accessible, but as described in Section 3.12 and 3.14, there would be noise and visual impacts during construction. One of the parking areas used to access these trails could also be inaccessible during construction due to its use as a staging area. Therefore, although potentially accessible by foot, lack of parking may temporarily directly impact all of the trails near Segment C-2.

The embankment adjacent to the boat ramp parking lot would also be under construction; this is not likely to directly negatively impact the boat ramp or the parking area, but would contribute to noise and visual disturbance during construction activities. During construction, additional indirect impacts would occur due to heavy equipment and truck traffic on the access roads in the area. The campground to the southwest of the boat ramp would experience similar indirect negative impacts.

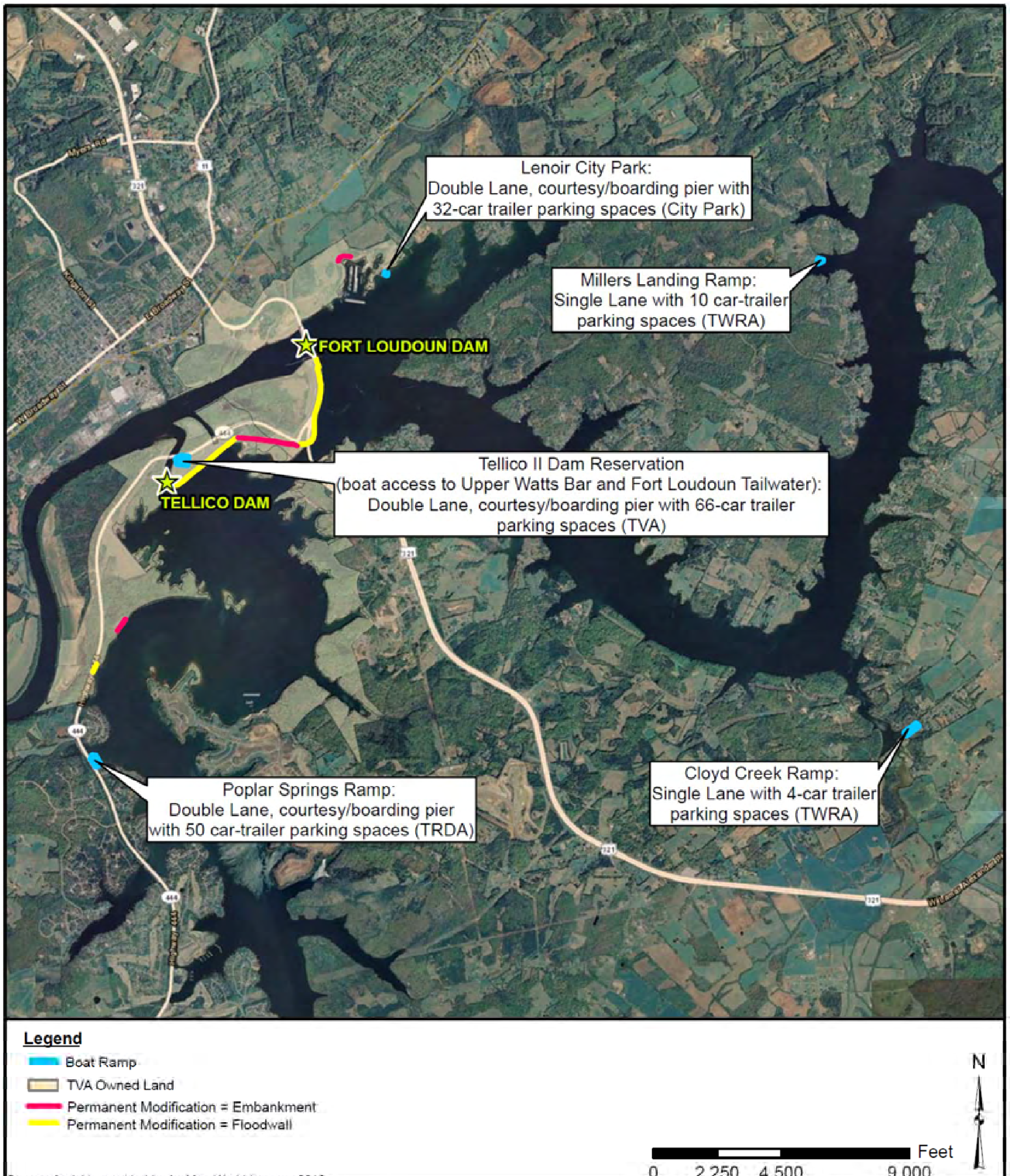
Overall, moderate to significant short-term adverse impacts to recreation would occur at Cherokee Dam due to inaccessibility of some recreational areas and parking lots during construction. Minor indirect negative impacts to recreation would include noise and visual disturbance and the presence of heavy equipment on roads during construction. A positive direct impact would be the return of the entire Cherokee Dam recreational area to ADA-accessible status after the completion of the floodwalls. Additionally, the raised walkway along Segment C-2 would improve the recreational experience in comparison to its current state with the HESCO barriers.

Fort Loudoun Dam

Construction of the Segment FTL-1 earthen embankment would result in the total closure of City Park Drive for approximately 12 days and the closure of the west-bound lane for a longer time period. This closure would not affect traffic to Fort Loudon Marina. It would inconvenience traffic travelling on City Park Drive from the west to Lenoir City Park; however, Martel Road runs parallel to City Park Drive, approximately 0.5 miles to the northwest, and would remain open and available to accommodate detour traffic. Recreation users of Fort Loudon Marina and, to a lesser degree, Lenoir City Park could be indirectly impacted by noise and visual disturbances from construction. These impacts are expected to be minor and short-term.

Construction of the FTL-2 and FTL-3 floodwalls would have little impact on recreation users aside from the increased traffic congestion described in Section 3-13.2.2. The construction of the FTL-4 embankment section across the entrance to the recreation areas near the Tellico canal, including the canal fishing access, restrooms, large boat ramp, walking trail, swimming beach, and day use area, would be closed to all public access for a 30-45 day period. This closure would likely occur during the heavily used late summer-early fall period. The resulting impacts would be significant and adverse for the duration of the area closure. Once the area is reopened, recreation users would continue to be inconvenienced by construction traffic, noise, and visual disturbance for the remainder of the construction period. Additionally, although the boat ramp would be reopened, the boat ramp parking area is a proposed staging area, so parking may be limited with respect to boat ramp use. The permanent closure of the northeast entrance road to the Tellico canal restroom building and fishing access parking area would have little long-term impact on recreation users as the southwest entrance road to the parking would be reopened as soon as construction is completed.

Other public recreation facilities in the vicinity that offer free boat launching are illustrated in Figure 3-15.1. The distance by road from the Tellico canal ramp to these other facilities ranges from about 1 mile for the boat ramp downstream of Tellico Dam to 8.4 miles for the Millers Landing Ramp. Note that the boat ramp downstream of Tellico Dam provides access to the upper end of Watts Bar Reservoir and the Fort Loudoun tailwater; to access Fort Loudoun and/or Tellico reservoirs after launching from this ramp, a boater would have to pass through the Fort Loudoun lock. These boat ramps could provide alternative launch sites for boaters displaced by the closure of the Tellico recreation area. The closure of the boat ramp and the necessity of using another in the area would represent a minor temporary direct negative impact to recreation at the Tellico Dam reservoir.



AECOM

Figure 3.15-1
Fort Loudoun and Tellico Dams
Public Boat Ramp Locations
Tennessee Valley Authority

Tellico Dam

Impacts to recreational facilities and activities in the recreation area just west of the Tellico canal near the intersection of U.S. Highway 321 and Tellico Parkway are described above in the Fort Loudoun Dam section. The construction of the embankment on Segment T-1 and the floodwall and raised roadbed on Segment T-2 would result in the closure of the recreation trails spanning the length of these segments. This would result in a moderately adverse, but short-term direct impact to recreation users. Following the completion of construction, long-term impacts to recreation users would be beneficial compared to the No Action Alternative. The replacement of the HESCO barriers with a raised embankment on Segment T-1 would remove the restrictions on the view of walkers. Similarly, walkers on the completed Segment T-2 would see a 2.8-foot tall floodwall on the lake side of the trail instead of the taller HESCO barriers presently on the embankment. Construction of the earthen embankment on Segment T-3 would result in the short-term closure of a segment of the Hall Bend Trail system. Other portions of the Hall Bend Trail would remain open and the impacts of the closure would likely be small. Overall, direct impacts to recreational facilities and activities at Tellico Dam would be moderately adverse to significant during construction and moderately beneficial once construction is completed. Indirect adverse impacts would be similar to those at the other dams due to noise and construction equipment.

Watts Bar Dam

At Watts Bar Dam, the permanent modifications under Alternative B include two earthen embankments (Segments WB-1 and WB-2), the raised access roadway, the closure of a parking area, and the construction of a new parking area near the junction of the access road and Highway 68 (Figure 2-18). The construction of these modifications would result in the total closure of public access to the recreation facilities for about a week and restricted access during the remainder of the construction period. During the periods when the recreation is open with restricted access, recreation users, particularly those using the picnic area, playground, and swim beach, would hear the nearby dump trucks and other heavy equipment being used to construct the berms. The parking area to be permanently closed rarely receives heavy use and the proposed new parking area would provide parking for a few more cars than does the area to be closed. The construction of the WB-3 reinforced floodwall would have little impact on recreation users as it is over 200 yards from the recreation facilities and truck traffic servicing it would not pass through the main recreation areas. Overall, direct impacts to recreational facilities and activities at Watts Bar would likely be moderately adverse and short-term. Long term impacts, beneficial or adverse, would be minimal. Although the boat ramp would remain open throughout most of the construction period, the adjacent parking area is proposed for use as a staging area; therefore, parking for the ramp may be limited and could constitute a temporary direct impact to recreation.

Borrow and Staging Areas

Removal of fill from the borrow areas would not directly affect recreation. The staging areas proposed for the construction are mostly parking lots which are used by people recreating at the dams. There would be a major direct negative impact to recreation if parking at other lots nearby is not sufficient. Additional inconvenience could occur if the parking at the boat ramps were insufficient even when the ramps are open as some of these parking areas are proposed for construction material staging. This impact would be temporary, but likely parking would only be considerably disrupted during construction at Watts Bar Dam. The impact at Watts Bar Dam would be most severe as all access to the reservoir on the east embankment would be lost due to the construction and staging areas. Indirect negative impacts to recreation due to the use of the parking lots as staging areas would include noise and visual disturbance during construction. Additionally, heavy equipment traffic in the area could cause minor temporary direct and indirect negative impacts to recreation because of noise and visual disturbance.

The borrow areas are located at a distance from the recreation areas; therefore, only minor indirect adverse impacts would result due to noise and visual disturbance of dump trucks hauling borrow material to the construction sites.

3.15.2.3. Alternative C – All Floodwalls

Cherokee Dam

Under Alternative C, all the segments would be floodwalls. Direct and indirect impacts would be similar to those under Alternative B. A slightly smaller temporary negative impact to recreation may occur due to the floodwall construction, which would require fewer trucks and take less time than the berm construction. The addition of gap closures should not adversely impact construction activities or timing. However, if all floodwalls are selected, permanent adverse direct impacts to recreation would be greater than under Alternative B. This would be due primarily to the fact that trails would not be constructed atop embankments and the walkway would not be raised at Segment C-2. This would constitute a moderate negative impact to recreation as views could be blocked in several areas along trails at Cherokee Dam.

Fort Loudoun Dam

Direct and indirect impacts to recreation under Alternative C at Fort Loudoun Dam would be less than those under Alternative B. Constructing the floodwall at Segment FTL-1 would likely not require closure of City Park Drive for more than brief time periods. Any closure of the entrance road to the recreation areas near the Tellico canal would likely be for much shorter time than under Alternative B.

Tellico Dam

At Tellico Dam, the berms proposed under Alternative B would be replaced with floodwalls under Alternative C. Fewer impacts to recreation during construction would be expected under this alternative compared to Alternative B; however floodwalls would be expected to have slightly greater long-term impact than earthen embankments (Alternative B). The walking trails which run atop the existing embankment would likely be inaccessible for a shorter time during construction. However, adverse impacts to recreation would be greater since trails would be located adjacent to the floodwalls, not on top of the berms, potentially blocking views of the surrounding area. Access to walking trails would also have to be at a few points along the walls instead of patrons being able to climb the embankments at any location. The fishing areas and boat ramps would be inaccessible for a shorter period of time as well. Additionally, less equipment would be needed to import material for floodwalls than for berms, resulting in a smaller indirect negative impact due to traffic and parking access. Overall, temporary adverse direct impacts would be smaller during construction, but permanent adverse direct impacts would be larger as the proposed floodwalls would interfere more with the views from the recreation areas.

Watts Bar Dam

As at Tellico Dam, potential impacts to recreation at Watts Bar Dam during construction would likely be smaller than those under Alternative B. Floodwalls have a smaller footprint and are constructed more quickly than berms. Therefore, the recreational areas that would be inaccessible during construction would be so for a shorter time. If this alternative were selected, there would not be a need for a borrow area to the north of the campground. This would eliminate any impacts associated with the borrow area and the equipment needed for transporting fill material. Additionally, indirect noise and visual impacts would also be smaller due to the decreased size of the construction.

Borrow and Staging Areas

Under Alternative C, impacts to recreation due to the use of the staging areas would be similar to those under Alternative B. They would be lesser; however, as it would take fewer materials to construct the floodwalls, and no space and equipment would be necessary to accommodate the fill material. Additionally, there would be fewer indirect adverse impacts to noise and visual resources under Alternative C during construction.

3.16. Solid and Hazardous Waste

Wastes are generally classified into two categories, solid waste, and hazardous waste. Both types would likely be generated under any of the alternatives.

3.16.1. Affected Environment

Solid Waste

Solid waste is more commonly referred to as trash or garbage and is generated by normal, day-to-day operations. It is generally managed in a variety of ways including reduction, recycling and disposal in landfills. Reduction considers the design, production, and use of materials to reduce the amount of waste; recyclables are those items diverted from the solid waste stream such as paper, glass, plastic, and metals; and disposal refers to the placement of solid waste in engineered areas designed to protect the environment from contaminants. Solid waste is generally considered low risk and may be disposed of in dumpsters pending removal from site by the contracted municipal waste hauler for disposal in a licensed landfill. Most construction debris, such as cleared trees, packing materials, and scrap lumber and metals would also fall into this category.

Currently, there is little solid waste generated at the four dam locations. Most of this waste would consist of general trash that is left by visitors and employees.

Hazardous Waste

Hazardous materials are solids, liquids, or gases that have properties that pose the potential to harm people, other living organisms, property, or the environment. Hazardous materials have the potential to become or to create hazardous waste. Hazardous materials include materials that are radioactive, flammable, explosive, corrosive, oxidizing, asphyxiating, biohazardous, toxic, pathogenic, or allergenic as defined by U.S. Department of Transportation (DOT) regulations. These materials pose a risk to health, safety, and property when transported in commerce (49 CFR 172.101, Hazardous Materials Table). The National Fire Protection Association (NFPA), in Section 704 of the National Fire Code, uses a different system for identifying the hazards associated with materials developed primarily with the needs of fire protection agencies in mind.

Hazardous waste refers to a class of wastes specifically defined in the Resource Conservation and Recovery Act (RCRA). These wastes contain certain toxic chemicals or have certain characteristics that cause them to be a significant risk to the environment and/or human health with respect to storage, transportation, or disposal. Hazardous waste may be classified as hazardous because of toxicity, reactivity, ignitability, or corrosivity. Certain types of wastes are "listed" or identified as hazardous by the USEPA in 40 CFR 263.

Currently there are little or no hazardous wastes at the four dam locations. Any possible hazardous materials and wastes would be associated with routine maintenance of the existing facilities and landscaping. Fort Loudon Marina has facilities for refueling boats, and most boats would contain gas and oil. Petroleum products are considered a hazardous material. The gas station and individual vessels are not anticipated to be impacted by any of the alternatives.

3.16.2. Environmental Consequences

This section contains a discussion on the potential impacts to existing levels of solid and hazardous waste should any of the alternatives be implemented.

3.16.2.1. Alternative A – No Action Alternative

Under Alternative A, TVA would continue to use the HESCO barriers as a solution to prevent flood overtopping and potential impacts to the dam embankments and possibly dam failure.

Small amounts of solid waste may be generated by the HESCO barriers inspection and maintenance process. This could include general trash brought in by the inspection team and general office waste. Every five years, the liners would have to be replaced, which would result in a minor increase in solid waste. The crushed stone would be removed from the HESCO barriers, the liners replaced and then the stone would be returned to the barriers. The old liners would be disposed of at a municipal waste landfill. This would constitute a very minor increase in solid waste.

During the liner replacement process, a minor increase of hazardous waste and materials could occur due to the need for construction equipment, fuel, and maintenance materials. This would constitute a very minor temporary increase in hazardous waste.

3.16.2.2. Alternative B – Combination Floodwalls and Embankments

Under Alternative B, the HESCO barriers would be replaced with a combination of floodwalls and earthen embankments.

The crushed stone in the HESCO barriers would be considered solid waste. The stone will either be reused at another TVA project site, stockpiled on TVA land for use on future TVA projects, returned or resold to the supplier, or disposed of at a municipal landfill. Depending on what TVA elects to do with the stone, this could amount to a moderate increase in solid waste. If the stone is reused or resold, it would not represent an increase in waste. TVA would attempt to recycle the HESCO barrier metal frameworks and liners by reusing them for other TVA purposes or selling them for use by others. If this effort is not successful, TVA would, to the extent feasible, recycle their components. Otherwise, the HESCO barriers would also contribute to solid waste, representing a minor increase in solid waste. During construction of both berms and floodwalls, general construction debris would be generated. Waste would consist of packaging materials, general trash, cleared brush and trees, fill, extra lumber and other materials. This would represent a temporary moderate increase in solid waste.

During construction, a minor temporary increase in hazardous waste would occur due to the use of heavy equipment and other machinery. Potential hazardous waste items could include petroleum fuels, hydraulic fluids, testing supplies, car batteries and paints. Upon completion of the construction project, the amount of hazardous materials at the four dams would return to the current condition. BMPs such as secondary containment and silt fencing would be used to assure that hazardous substances would not be released to the environment.

3.16.2.3. Alternative C – All Floodwalls

Under Alternative C, the temporary HESCO barriers currently in place at each dam would be removed and replaced with permanent concrete floodwalls. Increases in solid and hazardous wastes during construction would be temporary and similar to those described under Alternative B.

3.17. Public Safety

There are several Federal safety regulations and requirements which apply to all TVA projects. These include:

- Comprehensive Environmental Response Compensation and Liability Act (CERCLA) 42 USC, 9601 et seq.);
- Superfund Amendments and Reauthorization Act (SARA) Public Law 99-499 (100 Stats. 1613);
- RCRA (42 USC, 6901 et seq.);
- CWA (33 USC, 1251 et seq.);
- Hazardous Material Transportation Act (HMTA);
- Toxic Substances Control Act (TSCA) (15 USC, 2601 et seq.);
- Federal Regulations on Hazardous Waste Management (40 CFR, 260-279);
- Chemical Accident Prevention Provisions;
- Emergency Planning and Community Right-to-Know Act (EPCRA);
- Occupational Safety and Health Standards;
- Spill Prevention Control and Countermeasures Plans (SPCC); and an
- Emergency Evacuation Plan.

TVA ensures that all regulations are followed and requirements are met during the course of its construction activities.

3.17.1. Affected Environment

<u>Flood risk</u>

During an NRC audit following efforts by TVA to license the proposed Bellafonte Nuclear Plant in Alabama, it was discovered that the PMF calculations were not accurate using current data. This prompted TVA to re-evaluate the PMF calculations at all of its dams.

As described in Section 1.1, the updated PMF elevations at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams were higher than the previously calculated PMF elevations as well as those at TVA's Watts Bar, Sequoyah, and Browns Ferry Nuclear Plants. These differences are due to changes in river operating assumptions, higher initial reservoir levels under the current reservoir operating policy (see the River Operations Study ([TVA 2004]), and revised data from a reanalysis of spillway water flow rates. The previous and revised PMF elevations are shown in Table 1-1.

As the Federal agency responsible for the operation of numerous dams, and consistent with the Federal Guidelines for Dam Safety (FEMA 2004), TVA prepares for the worst case flooding event in order to protect against dam failure, loss of life, major property damage and impacts to critical facilities. This worst case flooding event is known as the PMF. NRC nuclear plant operating regulations also require that nuclear plants be protected from the PMF.

The differences in PMF elevations are sufficient to indicate that a PMF event could cause water to flow over the top of the four dams, even with the floodgates wide open, possibly resulting in dam failure. Failure of one or more of these dams would result in extensive damage to buildings, infrastructure, property, and natural resources, and potential personal injury and loss of life. Many communities, agricultural and industrial areas lie downstream from the dams, and the failure of any safety systems at the nuclear plant would be catastrophic (Figure 3.17-1).

To minimize the potential effects of the PMF, TVA implemented temporary measures to avoid floodwaters overtopping the four dams. These measures consisted of placing interconnected, fabric-lined, stone-filled metal containers ("HESCO barriers") on top of the earthen embankments of each dam. These HESCO barriers raise the elevation of each dam by 3 to 8 feet and provide additional floodwater storage capacity. TVA also installed permanent ArmorFlex concrete mats on an approximately two-acre area on the downstream earthen embankment of Watts Bar Dam just east of the Lock Operations Building. TVA must now develop and implement permanent dam safety modifications to replace the temporary measures at the four dams.

Traffic/Transportation

Almost all of the segments proposed for modification are either adjacent to a road, or have a road on top of them (see Section 3.13, Transportation). The current condition of the HESCO barriers could be affecting road safety at some of the sites. At Fort Loudoun Dam, the HESCO barriers are located on the upstream side of U.S. Highway 321 due to identified traffic hazards associated with locating the barriers on the downstream side of U.S. Highway 321, adjacent to the existing floodwall.

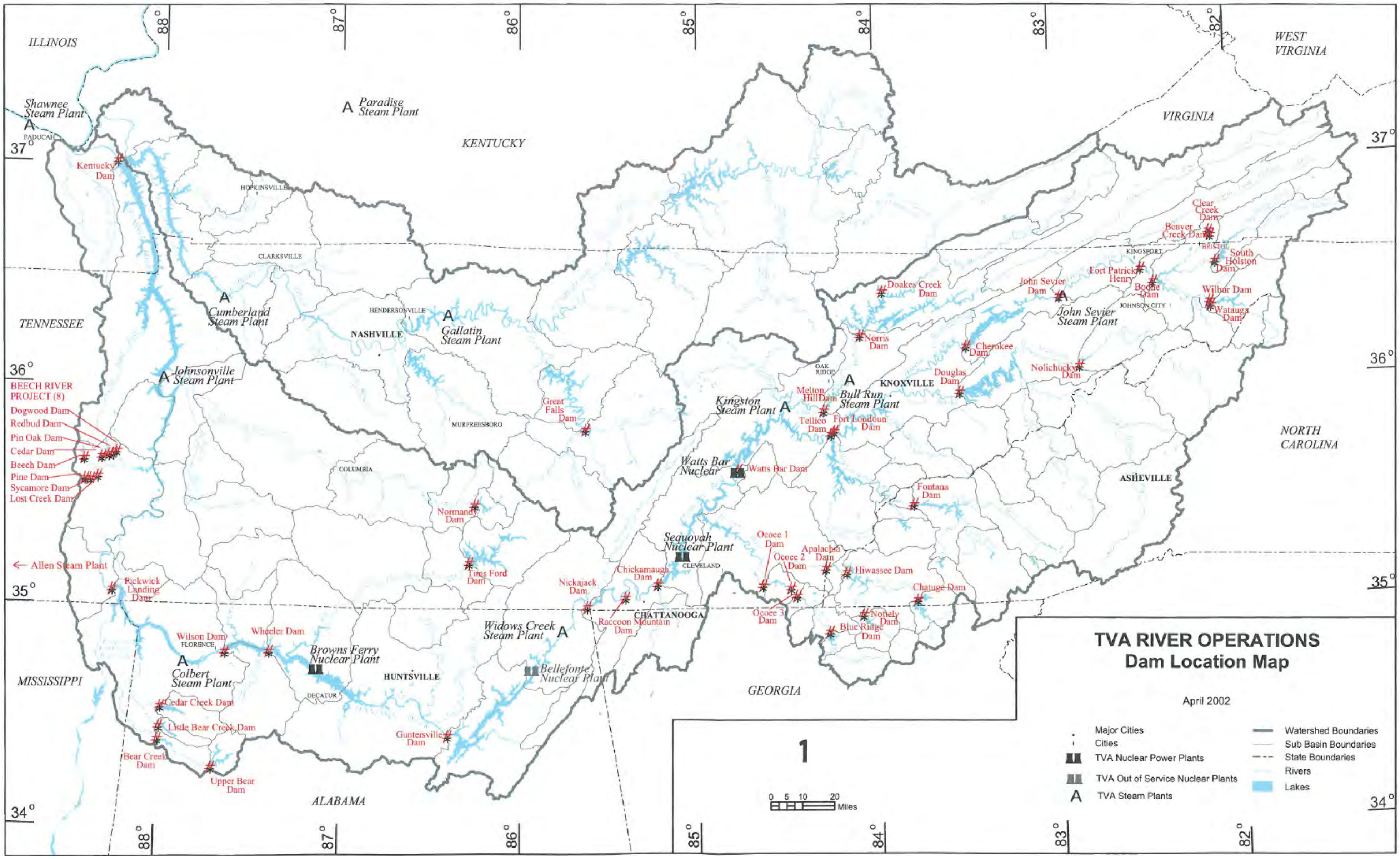


Figure 3.17-1. Locations of the Four Dams and Three Nuclear Plants in the Tennessee Valley

3.17.2. Environmental Consequences

This section contains and analysis of potential impacts to public safety should any of the proposed alternatives be implemented.

3.17.2.1. Alternative A – No Action Alternative

Flood risk

Under the No Action alternative, the HESCO barriers would continue to minimize the potential for failure of the four dams and prevent an increase in flooding at the downstream nuclear plants during the PMF. However, in a letter to TVA dated January 25, 2012, the NRC stated: " the NRC staff finds that the sand baskets are not capable of resisting debris impact... if a design flood were to occur, there is a high likelihood that significant debris would accompany flood waters which could impact the baskets. There is the potential for this debris to damage the baskets or push the individual baskets apart causing a breach... Therefore, sand baskets that are not designed and constructed to withstand impacts from large debris are not acceptable as a long-term solution." Therefore, implementation of the No Action Alternative would increase the risk of flooding and potentially impact public safety due to possible dam failure and nuclear plant flooding.

Traffic/Transportation

Under the No Action Alternative, the HESCO barriers would remain in place, to be maintained by TVA as necessary. Any public safety issues along roads would continue to exist, such as those along U.S. Highway 321 at Fort Loudoun. Additionally, TVA would have to replace the liners in the barriers every five years, which could necessitate lane closures during this process. This could result in an increase in public safety concerns due to road congestion, single lane areas where traffic may need to be halted in one direction periodically, and reduced maneuverability. TVA would follow all traffic laws and safety regulations in order to minimize this potential direct impact. Indirect impacts are also possible as people delayed in the project area could drive at unsafe speeds once out of the area in order to make up lost time. Overall, minor and temporary direct and indirect impacts to public safety due to traffic and transportation could occur under the No Action Alternative.

Construction

No major construction would occur under the No Action Alternative; therefore, no direct or indirect impacts related to construction safety are anticipated.

3.17.2.2. Alternative B – Combination Floodwalls and Embankments

Flood risk

Under Alternative B, the HESCO barriers would be replaced with either floodwalls or berms. These structures are far more stable than the existing barriers. Debris that would likely accompany a PMF, should not dislodge or break a floodwall or earthen berm. The likelihood of the dams being over topped or the nuclear plants being flooded is greatly reduced under this option. Therefore, positive direct impacts to public safety under this alternative are anticipated.

Traffic/Transportation

Under Alternative B, greater construction and impacts to traffic and transportation would be expected to occur (see Section 3.13). This could contribute to impacts to public safety on roads in or near the project area. More construction equipment would be necessary and lane closures and other disruptions are likely to be in place for much longer than under the No Action Alternative. Although TVA would follow all traffic regulations and have safety procedures in place, this alternative could result in a moderate temporary impact to public safety on roads in the project area. Indirect impacts would be similar, but larger than under the No Action Alternative, as lane closures would be in place for a longer time and could impact longer stretches of road.

Construction

Construction activities would expose on-site workers to hazards associated with most large construction projects. According to the Occupational Safety and Health Administration (OSHA), the top four causes of construction fatalities are falls, heavy equipment accidents, trenching accidents, and electrocutions. These potential hazards would be expected at all of the dam sites. In general, the sites requiring the greatest amount of construction would statistically present the greatest occupational risk. Environmental hazards of construction projects would include working in extreme temperatures (primarily heat stress) and potential exposures to biological hazards such as mosquitoes, ticks, poisonous spiders and venomous snakes. Additional work place hazards would include exposure to hazardous materials such as petroleum, hydraulic fluid or paint, slips, trips and falls, vehicular accidents and drowning. Hazardous materials are discussed in more detail in Section 3.16. TVA would require the construction contractors to emphasize safety and follow all OSHA and other Federal and state regulations with respect to worker safety, minimizing the risk to workers. However, due to the construction and the likelihood of accidents, potential temporary minor negative impacts to public safety are anticipated. Indirect impacts due to the construction could include increased traffic accidents due to workers leaving the project area, accidents involving equipment travelling to and from the site, such as loads of materials, spills of hazardous materials on travelled roads, and other possible off-site accidents. These indirect impacts would be considered to be temporary and minor.

3.17.2.3. Alternative C – All Floodwalls

Direct and indirect impacts to public safety related to a reduction in flood risk, traffic and transportation, and/or construction would be similar to those described under Alternative B.

3.18. Relationship of Short-Term Uses and Long-Term Productivity

The NEPA requires consideration of the “relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity” (40 CFR §1502.16). For implementation of Alternative B, short-term uses generally are those that are expected to occur within the construction period, while long-term uses refer to the post-construction period lasting for several decades.

Implementation of the action alternatives would have various short- and long-term consequences. Short-term (construction related) impacts caused by the project would be similar for either Alternative B or Alternative C. These impacts would occur during and immediately after construction and would generally result in adverse effects. However, the long-term impacts that would occur over the life of the project would result in overall beneficial effects with regard to human health and the environment.

Temporarily adversely affected resources include: socioeconomics and environmental justice, noise, transportation, visual resources, recreation, solid and hazardous waste, and public safety. However, most of these impacts would be temporary, lasting only the duration of the construction activities.

Implementation of either Alternative B or Alternative C would result in beneficial long-term impacts. Either project alternative would address the need for TVA to prepare for the PMF, the worst case flooding event, in order to protect against dam failure, loss of life, major property damage, and impacts to critical facilities (including the downstream nuclear plants). Failure of any of these dams in a PMF could result in water flowing over the top of the four dams, even when the floodgates are fully open, possibly resulting in dam failure. Failure of one or more of these dams would result in extensive damage to buildings, infrastructure, property, and natural resources, as well as potential personal injury and loss of life. Not taking action would continue to place human safety and the environment at risk from a PMF.

3.19. Irreversible and Irretrievable Commitments of Resources

A commitment of resources is irreversible when options are lost to future generations. An irreversible commitment of resources suggests that a permanent or long-term – over 50 years – commitment of environmental resources would result from implementing the action alternatives. Irreversible commitments of resources also generally occur from the use of nonrenewable resources, such as minerals, cultural resources, and fossil fuels, which have few or no alternative uses following completion of construction. Other factors are also considered such as resources like soils where productivity is renewable only over long time spans. Conversely, an irretrievable commitment of resources suggests that a short-term – less than 50-year – commitment of resources would result in the lost production of elimination of renewable resources such as timber, agricultural land, or wildlife habitat. Opportunities for use of these resources are foregone for the period of the action alternatives, but these decisions are reversible. The use of opportunities foregone is irretrievable.

Implementation of the action alternatives and construction of the floodwalls and/or berms would result in direct impacts to the environment. Construction activities would result in an irretrievable and irreversible commitment of natural, physical, and cultural resources.

Under the No Action Alternative, there would be no foreseeable changes of land use within the project area. Thus, adoption of Alternative A would preclude any irreversible or irretrievable commitments of resources. Implementation of Alternative B would involve irreversible commitment of fuel energy, and building materials including irreversible excavation of borrow materials. Irreversible and irretrievable commitment of the borrow materials would be less under Alternative C as berms would not be constructed under this alternative; however, additional building materials (including concrete for floodwalls) would be utilized instead.

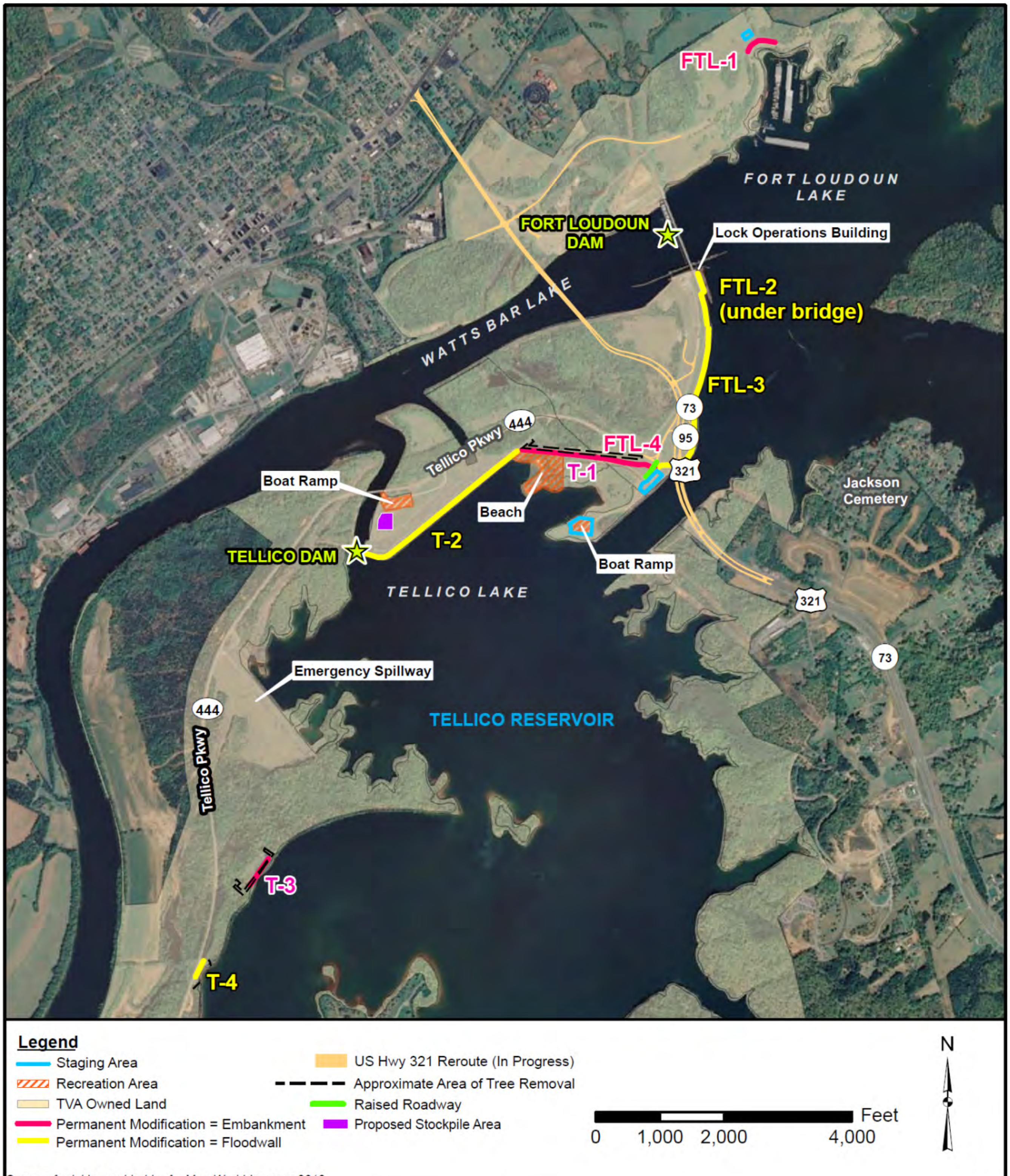
CHAPTER 4 – CUMULATIVE IMPACTS

4.1. Introduction

Cumulative impacts are defined as the effects of the proposed permanent dam safety modifications when considered together with other past, present, and reasonably foreseeable future actions. Chapter 3, Affected Environment and Environmental Consequences, presents information about past and present environmental conditions, as well as future trends where appropriate. This chapter addresses the cumulative impacts of the proposed permanent dam safety modifications and other reasonably foreseeable actions in the vicinity.

One ongoing project has been identified in the project area that would have the potential of causing cumulative impacts in conjunction with the construction of Alternative B (Proposed Action; combination floodwalls and embankments) or Alternative C (all concrete floodwalls) – this project is the U.S. Highway 321 rerouting and widening project.

Approximately 1.2 miles of U.S. Highway 321 between Lenoir City (beginning approximately 0.2 miles west of the U.S. Highway 11 intersection) and the Tellico Canal is scheduled to be widened and diverted beginning in July 2012. The highway will be widened from two lanes to four lanes to relieve traffic congestion and improve safety. As part of the highway project, the J. Carmichael Greer Bridge over Fort Loudoun Dam is scheduled to be replaced by a new, 1,400-foot-long, four-lane bridge over the Tennessee River located about 2,000 feet downstream (west) of Fort Loudoun Dam (Figure 4-1). The current bridge over the dam will be removed once the replacement bridge is completed. In association with the U.S. Highway 321 construction, the roadway between the J. Carmichael Greer Bridge and the bridge over the Tellico Canal to the southeast will be reconfigured. Water, sewer, gas, electric, phone, and cable lines will also be relocated within the construction area. A new two-lane bridge is scheduled to be constructed over the Tellico Canal adjacent to the current bridge. The existing two-lane bridge over the Tellico Canal will service traffic flow in one direction along U.S. Highway 321 while the new bridge over the canal will service traffic flow in the opposite direction. Significant long-term lane closures are not anticipated with this project as most construction will occur in areas where no roadways are currently present and would ultimately connect with existing roadways. Short-term disruptions, including short-term lane closures, may occur when the new and existing roadways are joined. As a result of the rerouting process, increased traffic congestion is possible at the time of connection. The widening and diversions of U.S. Highway 321 are scheduled to be completed in May 2015 (TVA 2001; Jacobs 2012).



Source: Aerial is provided by ArcMap World Imagery 2012

AECOM

Figure 4-1
U.S. Highway 321 Reroute

Tennessee Valley Authority

There would be no or only very minor or indirect cumulative impacts as a result of the construction of the U.S. Highway 321 rerouting and widening project and the proposed permanent dam safety modifications (either Alternative B or Alternative C) for the following resource areas at Fort Loudoun and Tellico Dams: geology and soils, water resources, flooding and floodplains, wetlands, aquatic ecology, terrestrial ecology, threatened and endangered species, land use, environmental justice, cultural resources, and air quality and GHG emissions. Because of the absence or insignificance of potential cumulative impacts, those resource areas are not addressed further under the cumulative impacts analysis discussion. However, cumulative impacts are possible for the following resource areas, which are discussed below: socioeconomics, noise, transportation, visual resources, recreation, solid and hazardous waste, and public safety.

Because of the location of the U.S. Highway 321 project (Figure 1-1), there would be no potential cumulative impacts in association with that project and the construction of the proposed permanent dam safety modifications at either Cherokee or Watts Bar Dams, and there are no other actions in the vicinity of these two dams that potentially would result in cumulative impacts.

4.2. Socioeconomics

Cumulative impacts on socioeconomics from construction of the proposed permanent dam safety modifications in conjunction with the U.S. Highway 321 project would be beneficial rather than adverse. Short-term, beneficial, direct, economic impacts from construction activities associated with the proposed permanent dam safety modifications and the U.S. Highway 321 project include the purchase of materials, equipment, and services and a temporary increase in employment and income. In addition, there would be beneficial indirect employment and income effects. Thus, the cumulative direct and indirect impacts to socioeconomic resources in the five-county impact area would be beneficial.

4.3. Noise

Short-term, cumulative impacts to the sound environment could occur in the vicinity of the combined U.S. Highway 321 project and the proposed permanent dam safety modifications at Fort Loudoun and Tellico Dams. These impacts would occur along the existing U.S. Highway 321 corridor and along the Tellico Parkway. Noise levels in the vicinity of these roadways would be elevated for the duration of these two projects as a result of the construction activities and the increased amounts of construction traffic in the area during the course of the projects. The elevated noise levels would be greatest during the period when the new U.S. Highway 321 construction is merged with the existing roadway; these impacts could be adverse but would be short-term in nature. These impacts could potentially be mitigated if the construction on the two projects is staggered. Because of the need for lane closures during the TVA dam segment repairs, it is possible TVA would delay work on at least the FTL-3 segment until completion of the U.S. Highway 321 project. Staggering the construction projects would extend the time duration of potential noise related impacts in the immediate vicinity of the project area. Following the completion of construction, noise levels along the current U.S. Highway 321 corridor from Fort Loudoun Dam to the junction with Tellico Parkway would be reduced from existing levels due to the relocation of U.S. Highway 321. Noise levels in the vicinity of the Tellico Canal and the nearby recreation areas would return to existing levels and likely increase in the future due to the anticipated increase in traffic on U.S. Highway 321.

4.4. Transportation

Short-term, adverse cumulative impacts to transportation along U.S. Highway 321, Tellico Parkway, the TVA Service Road, and the unnamed recreation area roads would occur as a result of the simultaneous nature of the U.S. Highway 321 rerouting and widening project (currently ongoing) and the construction of the proposed permanent dam safety modifications at Fort Loudoun and Tellico Dams. The majority of the U.S. Highway 321 project construction is taking place in areas where there are no existing roads. As the construction nears completion (slated for May 2015), a new road will connect the existing highway and minor roads. At the time of connection, increased traffic congestion is possible as a result of the rerouting process, including possible lane closures. Segments FTL-4 and T-1, and the elevated access road that crosses over FTL-4 would fall within the construction area for the U.S. Highway 321 rerouting project (Figure 4-1). This could result in potential cumulative impacts; however, the Bridge Replacement Project began last year and as a result, reduced speed limits have already been posted within construction work zones along the potentially affected roadways. In addition, construction signs have been posted to caution drivers of the construction activities and potential impacts to traffic; therefore, the cumulative effects of the permanent dam safety work at Fort Loudoun and Tellico dams could include short-term lane closures and increases in traffic congestion, but these impacts would be minimal since motorists in the project area have already been subjected to the similar impacts from the Bridge Replacement project. These impacts would be temporary, but potentially significant, given the current high traffic volume along U.S. Highway 321.

To avoid the potential for significant cumulative impacts to transportation, TVA could coordinate with TDOT during this rerouting process and schedule work to minimize or avoid cumulative impacts. It is possible that potential dam segment repairs could proceed with fewer impediments following the conclusion of the U.S. Highway 321 rerouting project. Segments FTL-2 and the northern portions of FTL-3 are located north of the reroute and therefore, no lane closures would be required along the highway if the construction of the proposed permanent dam safety modifications were implemented after completion of the U.S. Highway 321 rerouting process. However, delays in the dam segment construction may not be possible given the need for implementation of the floodwall/berm construction. Even without delays in the dam segment construction, cumulative impacts to transportation in association with the U.S. Highway 321 project, would be short-term, localized, and unlikely to reach significant levels. Over the longer term following the completion of construction, the U.S. Highway 321 project should improve traffic conditions in the project area, resulting in beneficial long-term impacts.

4.5. Visual Resources

Under Alternative B (Proposed Action), the construction of floodwalls and/or embankments at Fort Loudoun and Tellico Dams potentially would create cumulative visual impacts in association with the rerouting and widening of U.S. Highway 321. Similar visual impacts would be associated with the construction of floodwalls only associated with the implementation of Alternative C at these dams. Visual impacts would include short-term disruptions as a result of the construction activities and the construction equipment and long-term changes in the visual environment at each dam segment. Construction activities and equipment would result in only short-term disruptions to the viewshed. The physical relocation of U.S. Highway 321 and the removal of the J. Carmichael Greer Bridge will result in permanent changes to the viewshed. During construction of the proposed permanent dam safety modifications and U.S. Highway 321 project, the short-term construction-related visual impacts would be noticeable around both Fort

Loudoun and Tellico Dams. These adverse impacts would include the highly visible construction equipment, construction barriers, staging areas, and increased traffic congestion disrupting views in recreation areas where visitors are accustomed to peaceful and natural settings. The construction-related visual impacts would be adverse, though temporary and minor.

Following the completion of the construction projects, the viewshed would be altered from the current conditions, though the new configuration would contain similar features in altered positions and sizes. These visual impacts would be permanent and could be considered adverse to some visitors in the area who are accustomed to the current appearance. The reduction in the profile of the dam due to the removal of the current bridge could contribute to beneficial impacts to visual resources at Fort Loudoun Dam. Overall, the cumulative impacts to visual resources from the proposed permanent dam safety modifications in conjunction with the U.S. Highway 321 project would be minimal.

4.6. Recreation

Construction of the proposed permanent dam safety modifications and the construction of the U.S. Highway 321 project could result in potential adverse cumulative impacts to recreation. As part of the construction activities for the rerouting and widening of U.S. Highway 321, there will be changes in the configuration of some of the TVA and recreation area access roads. During construction in these areas, there could be adverse impacts to recreation as a result of reduced access from increased traffic congestion associated with lane closures. Additionally, there could be adverse impacts to recreation associated with the increased noise levels in the construction areas, as well as disruptions in the visual environment associated with the appearance of the project areas during construction activities. These combined effects on transportation, noise, and visual resources could reduce the enjoyment level for visitors to the recreation areas. If construction of the U.S. Highway 321 project occurs at night, it is possible the impacts to recreation would be minimized, at least in terms of the associated traffic congestion (i.e., access) and noise impacts, though the visual impacts would still be expected to occur due to the presence of the construction equipment and construction zones. The potential cumulative impacts to recreation would be minimally adverse, but limited to the construction period (i.e., short-term).

4.7. Solid and Hazardous Waste

Moderate, temporary increases in solid waste are anticipated due to the cumulative effects of construction of the proposed permanent dam safety modifications and the U.S. Highway 321 project. Materials that are not recyclable would need to be disposed of at a municipal landfill; resulting in reduced landfill capacity as a result of the disposal of materials such as construction debris, bridge and road demolition debris, and general trash produced by construction activities and workers. After construction of the projects is completed, solid waste generation in the area should return to current levels.

A minor, temporary increase in hazardous waste generation also may occur as a result of the cumulative effects of these projects. Both projects would require significant heavy equipment and machinery and associated fuels and maintenance materials. BMPs would be used in both projects to ensure that any hazardous substances would not be released to the environment, and regulations would be followed to clean up any spills immediately if they occur. After construction is completed, hazardous waste generation in the area should return to current levels. Overall, cumulative impacts from the generation of solid and hazardous wastes from the proposed permanent dam safety modifications, in conjunction with the U.S. Highway 321 project, would be minor and would not significantly impact human health or the environment.

4.8. Public Safety

Potential adverse impacts to public safety are possible as a result of construction of the proposed permanent dam safety modifications and the U.S. Highway 321 project. These impacts would be associated primarily with the increased risk of traffic accidents as a result of greater congestion and altered road conditions in the construction zones. Lane closures, detours, and traffic hazards associated with proximity to construction equipment could contribute to driver distractions, increased stress, and corresponding increases in traffic accidents. Safety risks, including potentially significant impacts such as serious injury or loss of life, could also occur if access to construction areas and equipment is not properly restricted. However, BMPs would be utilized by construction crews to minimize potential risks to public safety, and construction-related risks to public safety would be temporary. Overall, the potential for cumulative impacts to public safety from the proposed permanent dam safety modifications, in conjunction with the U.S. Highway 321 project, would be limited by established safety procedures and planning, and impacts on public safety during the construction period are not expected to be significant.

Following completion of both the proposed permanent dam safety modifications and the U.S. Highway 321 project, there would be a cumulative beneficial impact to public safety. Completion of the permanent dam modifications would result in increased safety for individuals living in the vicinity and downstream of the dams as a result of the reduction in flood risk and corresponding reduction in risk to the nuclear facilities, and in conjunction with this beneficial impact on the safety of the public in the vicinity, the completion of the U.S. Highway 321 project would result in increased traffic safety as a result of the widened road. These beneficial impacts would be both significant and long-term.

CHAPTER 5 – LIST OF PREPARERS

5.1. TVA NEPA Project Management

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Kenneth P. Parr (retired)

Education:	M.S., Environmental Engineering; B.S., Biology
Experience:	30 years in water resources engineering, regulatory compliance, and environmental reviews
Involvement:	NEPA Compliance

5.2. AECOM NEPA Project Management

Roberta A. Hurley

Education:	M.A., Chemistry; B.S., Chemistry; B.S., Biology
Experience:	30 years in regulatory and NEPA compliance, including project management and public outreach
Involvement:	Project Management and Public Meeting Support

5.3. TVA Contributors

John T. Baxter

Education:	M.S. and B.S., Zoology
Experience:	22 years in protected aquatic species monitoring, habitat assessment, and recovery; 14 years in environmental review
Involvement:	Aquatic Ecology/Threatened and Endangered Species

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Michael F. Broder, P.E.
Education: M.S. and B.S., Agricultural Engineering
Experience: 33 years in agricultural and environmental engineering
Involvement: Air Quality

Stephen C. Cole
Education: Ph.D., Anthropology; M.A., Anthropology; B.A., Anthropology
Experience: 12 years in cultural resource management, 4 years teaching anthropology at university
Involvement: Cultural Compliance

Patricia B. Cox
Education: Ph.D., Botany (Plant Taxonomy and Anatomy); M.S. and B.S., Biology
Experience: 31 years in plant taxonomy; 9 years in rare species monitoring, environmental assessment, and NEPA compliance
Involvement: Threatened and Endangered Species, Invasive Plants, and Terrestrial Ecology

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James H. Eblen
Education: Ph.D., Economics; B.S., Business Administration
Experience: 46 years in economic analysis and research
Involvement: Socioeconomics and Environmental Justice

Michael A. Eiffe, P.E.
Education: M.E., Civil and Environmental Engineering; B.S., Civil and Environmental Engineering
Experience: 32 years in water resource systems analysis
Involvement: Hydrologic Analysis

David A. Hankins
Education: B.S., Fish and Wildlife Management
Experience: 32 years in geographic information system
Involvement: Geographic Information System (GIS) Mapping Support

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Patricia Bernard Ezzell
Education: M.A., History with an emphasis in Historic Preservation; B.A., Honors History
Experience: 24 years in history, historic preservation, and cultural resource management; 9 years in tribal relations
Involvement: Tribal Consultation

Heather M. Hart

Education:	M.S., Environmental Science and Soils; B.S., Plant and Soil Science
Experience:	9 years in environmental assessments, specializing in surface water quality, soil and groundwater investigations, and natural areas
Involvement:	Natural Areas

Husein A. Hasan

Education:	B. S., Civil Engineering
Experience:	26 years in structural analysis, seismic and earthquake engineering, structural and soil dynamics
Involvement:	Engineering Support

Charles S. Howard

Education:	M.S., Zoology; B.S., Biology
Experience:	20 years in aquatic ecology research, impact assessment, and endangered species conservation.
Involvement:	Aquatic Ecology/Threatened and Endangered Species

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James David Lane, Jr.

Education:	M.S., Civil Engineering; B.S., Civil Engineering
Experience:	7 years in civil and environmental engineering, environmental compliance
Involvement:	Project Management

Holly G. LeGrand

Education:	M.S., Wildlife; B.S., Biology
Experience:	8 years in biological surveys, natural resource management, and environmental reviews
Involvement:	Terrestrial Ecology/Threatened and Endangered Species

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Mark C. Lowe, P.E.

Education:	B.S. Civil Engineering
Experience:	17 years in environmental and civil engineering projects
Involvement:	Engineering Support

Robert A. Marker

Education:	B.S., Outdoor Recreation Resources Management
Experience:	41 years in recreation resources planning and management
Involvement:	Recreation Resources

Roger A. Milstead, P.E.

Education:	B.S., Civil Engineering
Experience:	36 years in floodplain and environmental evaluations
Involvement:	Flooding and Floodplains

Karen Officer-Bell

Education:	B.S. Electrical Engineering; M.B.A.; and Project Management Professional Certification
Experience:	25 years in electric utility, telecommunications, and industrial equipment industries
Involvement:	Project Management Support and Coordination

Craig L. Phillips

Education:	M.S. and B.S., Wildlife and Fisheries Science
Experience:	6 years aquatic sampling and hydrologic determinations; 5 years in environmental reviews
Involvement:	Aquatic Ecology/Threatened and Endangered Species

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Kim Pilarski

Education:	M.S., Geography, Minor in Ecology
Experience:	17 years in wetlands assessment and delineation
Involvement:	Wetlands

J. Hunter Terrell

Education:	B.A., Environmental Studies
Experience:	4 years in heritage database maintenance, 5 years in environmental review
Involvement:	Aquatic Ecology/Threatened and Endangered Species

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A. Chevales Williams

Education:	B.S., Environmental Engineering
Experience:	9 years in water quality monitoring and compliance; 7 years in environmental services
Involvement:	Water Quality (Water Resources)

W. Richard Yarnell

Education:	B.S., Environmental Health
Experience:	40 years, cultural resource management
Involvement:	Cultural Resources

5.4. AECOM Contributors

Erika A. Grace

Education:	M.S., Environmental Toxicology; B.S., Biological Sciences
Experience:	5 years in NEPA coordination and document preparation; 7 years in environmental services and technical evaluations
Involvement:	Project Coordination; Purpose/Need, Project Alternatives, Flooding and Floodplains, Water Resources, Wetlands

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Carol Butler Freeman

Education:	M.S., Space Studies; M.S., Geological Sciences; B.S., Geology
Experience:	17 years in scientific and technical research, including NEPA and NHPA compliance and geologic field work.
Involvement:	Geology and Soils, Air Quality and GHG Emissions, Cultural Resources, Noise, Transportation, Cumulative Impacts

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Zoe Knesl

Education:	M.S., Marine Science; B.A., Integrative Biology and Studio Art
Experience:	4 years in NEPA evaluation; 10 years in biological and environmental studies and analysis; 3 years in visual and aesthetic impacts analysis
Involvement:	Aquatic Ecology, Terrestrial Ecology, Threatened and Endangered Species, Land Use, Visual Resources, Solid and Hazardous Waste, Public Safety, Water Resources, Wetlands, Flooding and Floodplains, Recreation

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Susan Provenzano, AICP

Education:	M.S., Marine Environmental Sciences; B.A., Earth Science
Experience:	31 years in environmental impact assessment, including NEPA and State-level; 35 years in environmental services and planning
Involvement:	Socioeconomics and Environmental Justice

Michael Przybyla

Education:	B.S., Environmental Planning
Experience:	20 years GIS impact analysis, 7 years transportation impact analysis
Involvement:	Visual Resources (renderings)

Steve Dillard

Education:	M.S., Environmental Systems Engineering; B.S., Zoology
Experience:	20 years in NEPA assessment, endangered species assessment, and risk assessment
Involvement:	Threatened and Endangered Species

Nikki Thomas

Education:	M.Ed., English Language Instruction; B.A., Speech Communication
Experience:	5 years as a technical editor at AECOM editing a variety of NEPA reports and documents; 20 years in English and foreign language instruction
Involvement:	Quality Control/Quality Assurance Technical Review

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CHAPTER 6 – DRAFT ENVIRONMENTAL IMPACT STATEMENT RECIPIENTS

6.1. Federal Agencies

Army Corps of Engineers, Nashville District

Army Corps of Engineers, Nashville Regulatory Branch

Department of Agriculture, Natural Resource Conservation Service

Nuclear Regulatory Commission

Department of the Interior

Environmental Protection Agency, Region 4

Fish and Wildlife Service, Cookeville, Tennessee

Forest Service, Cherokee National Forest

6.2. Federally Recognized Tribes

Cherokee Nation

Eastern Band of Cherokee Indians

United Keetoowah Band of Cherokee Indians in Oklahoma

The Chickasaw Nation

Muscogee (Creek) Nation of Oklahoma

Alabama-Coushatta Tribe of Texas

Alabama-Quassarte Tribal Town

Kialegee Tribal Town

Thlopthlocco Tribal Town

Seminole Tribe of Florida

Absentee Shawnee Tribe of Oklahoma

Eastern Shawnee Tribe of Oklahoma

Shawnee Tribe

6.3. State Agencies

Tennessee Department of Environment and Conservation
- Division of Water Pollution Control
- Division of Air Pollution Control
- Division of Natural Heritage
- Division of Ground Water Protection
- Division of Water Supply
- Division of Solid Water Management

Department of Economic and Community Development

Department of Transportation

Tennessee Historical Commission

Tennessee Wildlife Resources Agency

Tennessee Emergency Management Agency

East Tennessee Development District

Southeast Tennessee Development District

6.4. Individuals and Organizations

Ammon, Sandi, Loudon, TN
Bacarro, J. Paul, Loudon, TN
Bagg Jr., James F., Loudon, TN
Baker, Phil and Sarina
Bell, Ed, Lenoir City, TN
Benn, Brock, Loudon, TN
Benson, Larry, President, Watershed Association of the Tellico Reservoir, Greenback, TN
Bickers, Tom, Mayor of Louisville, TN, Louisville, TN
Bills, Phillip, Loudon, TN
Birge, Gordon, Loudon, TN
Bishop, Dave, Loudon, TN
Blaker, Barbara, Loudon, TN
Bloome, Janis, Loudon, TN
Blough, Rick, President, Homeowners Association of Tellico Village, Loudon, TN
Bollinger, Lawrence, Loudon, TN
Bonck, Perry, Loudon, TN
Borleglou, Tom, Loudon, TN
Bowerfind, James
Brandt, Art, Loudon, TN
Braun, Charles and Carol, Loudon, TN
Brooks, Lesley and Patrick
Brooks, Marjorie and Richard
Brosh, Susan, Loudon, TN
Bucholz, Ted
Buckner, Bobby J., Lenoir City, TN
Burdick, Diana, Loudon, TN
Burger, Bruce, Lenoir City, TN
Bush, Karen and Jim, Loudon, TN
Carey, Hamill B., Loudon, TN
Caru, Mary, Loudon, TN
Clabough, Judith, Knoxville, TN
Collins, Tom and Brenda, Loudon, TN
Comiso, Richard, Loudon, TN
Cowley, Neil, Loudon, TN
Crowder, Bill, Tellico Village, TN
Davis, Carl David, Loudon, TN
Davis, Doug, CENTURY 21 The Real Estate Place, Lenoir City, TN
DeBoer, Cathy
DeGraaf, Robert, Loudon, TN
DeLawter, Wayne, Tellico Village Townhouse Association, Loudon, TN
Denney, Gerald, Loudon, TN
Diggs, Dan, Loudon, TN
Dixon, John T, Loudon, TN
Doty, Raymond, Loudon, TN
Driver, Jeffery, Loudon, TN
Dunphy, Ron, TN
Edson, Carl, Vonore, TN
Eilertsen, Nellie, Loudon, TN
Ek, Harold, Loudon, TN

Ericson, Robert, Loudon, TN
Evans, Bill, Loudon, TN
Evans, Ray, LashBrooke Community Association, Louisville, TN
Faster, Ronald, Homeowners Association of Tellico Village, Loudon, TN
Fausch, John, Loudon, TN
Flannelly, Dr. Susanne, Loudon, TN
Flannelly, Francis, Homeowners Association of Tellico Village, Loudon, TN
Francis, Dean, Lenoir City, TN
Frank, Michael, Loudon, TN
Franke, Carolyn, Greenback, TN
Franke, Robert, Loudon County Commissioner - Third District, Greenback, TN
Frierson, Mary, Loudon, TN
Gallagher, Caryl, Loudon, TN
Galloway, Ray and Peggy, Homeowners Association of Tellico Village, Loudon, TN
Gardner, Allen Loudon, TN
Garner, Mary, Loudon, TN
Geoffrey, Mary Ann, Tellico Village, TN
Geoffrey, Steve, Loudon, TN
Giambrone, Charles, Loudon, TN
Gilbert, Gary, Tellico Village, Loudon, TN
Golden, David, Loudon, TN
Goldsmith, Roger, Loudon, TN
Gondoly, Thomas, Resident, Loudon, TN
Graff, Mary, Loudon, TN
Greene, Mike, Loudon, TN
Groat, David, Homeowners Association of Tellico Village, Loudon, TN
Hambrecht, Eileen and Rob, Loudon, TN
Hammontree, Wilie, Spring City, TN
Hartman, Marianne, Loudon, TN
Harton, Steve, Loudon, TN
Harvey, James, Loudon, TN
Harvey, Jean, Loudon, TN
Harvey, Kenneth, Loudon, TN
Hathcock, Alfred, Lenoir City, TN
Haupt, Jean
Helka, Richard, Loudon, TN
Hemelright, David, Lenoir City, TN
Hendricks, Brian, Lenoir City, TN
Hines, Cheryl, Loudon, TN
Hinze, Richard, Loudon, TN
Holsapple, Ron and Patti, Loudon, TN
Horan, Martin, Loudon, TN
Hult, Terri, Homeowners Association of Tellico Village, Loudon, TN
Humphries, Weldon and Nancy, Loudon, TN
Jaffe, Jerry, Loudon, TN
Jensen, Toby
Johannesen, Nils, Loudon, TN
Johnson, Linda, Loudon, TN
Johnson, Tom
Johnson, Wade, Jefferson City, TN
Johnston, Alison, Loudon, TN
Johnston, Bob, Loudon, TN
Jones, Dr. John, Loudon, TN
Jutze, Gary, Loudon, TN
Kahlo, Robert, Loudon, TN
Kania, Randy, Greenback, TN
Karg, Carole, Loudon, TN
Kinzler, Kennard, Loudon, TN
Klint, Joe and Kay
Knott, Kim, Lenoir City, TN
Kofink, Kennth, Loudon, TN
Kray, Eugene, Loudon, TN
Krolikowski, Linda, Loudon, TN
Larkins, Don, Loudon, TN
Larsen, Roger, Loudon, TN
Leech, John and Marianne, Loudon, TN
Leeds, Judy, TN
Lindbert-Kelly, Mary, Loudon, TN
Livingston, Edwad, Homeowners Association of Tellico Village, Loudon, TN
Livingston, Jane B., Loudon, TN
Long, Thomas, Lenoir City, TN
Luersen, Greg, Tellico Village, Loudon, TN
Macklem, Joy
Malone, Jim, Loudon, TN
Malone, Ross, Hixson, TN
Manzo, Claire, Loudon, TN
Marra, Shirley, Loudon, TN
Martin, George, Loudon, TN
Marutz, Nancy, Loudon, TN
McDermott, Peter and Carolyn, Loudon, TN
McDonald, Ted, Loudon, TN
McFadden, Stuart, Loudon, TN
McGill, David, Talbott, TN
McLaughlen, Richard and Carole, Loudon, TN
Meyerhofer, Donald, Loudon, TN
Miller, Don, Loudon County Commission - District 7, Loudon, TN
Miller, Lou, Loudon, TN
Mitchell, Kathleen and Michael, Loudon, TN
Morton, Bernie, Loudon, TN
Mugge, Bob, Loudon, TN

Mullen, Kenneth, Loudon, TN
Mummert, Philip J., Louisville, TN
Muth, Sally and Ken
Nagelson, Elaine, Loudon, TN
Neale, Doug and Sandy, Homeowners Association of Tellico Village, Loudon, TN
Neident, Al and Nancy
Noble, Gardiner, Loudon, TN
Nolan, S, Tellico, TN
Nowlin, Sarabel, Loudon, TN
O'Banion, Raymond, Tellico Village, Loudon, TN
O'Brien, James, Homeowners Association of Tellico Village, Loudon, TN
Ondrus, Martin, Loudon, TN
Opiteck, Margaret
Pacello, Vincent, Loudon, TN
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Pecze, Bill, Loudon, TN
Perrine, Donald, Louisville, TN
Pettit, Susan
Popovich, Steve, Loudon, TN
Prince, Janet, Louisville, TN
Proaps, Byron, Lenoir City, TN
Proud, James, Loudon, TN
Provart, Patricaa, Loudon, TN
Purvis, Clarence, Loudon, TN
Rafferty, Mary Ann, Homeowners Association of Tellico Village, TN
Raft, Peter, Loudon, TN
Ranaudo, Richard, Loudon, TN
Reller, William, Loudon, TN
Richards, Rosalie, Loudon, TN
Riggleman, Martha, Loudon, TN
Roberts, Al, President, Tellico Village Townhouse Association, Loudon, TN
Roberts, Jack, Loudon, TN
Roberts, Linda, Loudon, TN
Roberts, Sue, Loudon, TN
Rueth, David, Loudon, TN
Russell, Dennis, Loudon, TN
Russell, Warren and Carole, Loudon, TN
Sawinski, Richard, Homeowners Association of Tellico Village, Loudon, TN
Schiller, Ceree, Loudon, TN
Schins, Guillaume, Loudon, TN
Schmidt, H., Loudon, TN
Schmidt, Janet, Loudon, TN
Sciarretta, Debra, Loudon, TN
Sciarretta, Richard, Loudon, TN
Sech, Stan, Loudon, TN
Shanahan, Edith, Lenoir City, TN
Sheffer, Julie, Loudon, TN
Sheldon, Kay, Loudon, TN
Silvis, Ann, Loudon, TN
Sinner, Ronald, Loudon, TN
Smith, Brad, Jackson Bend Homeowners Association, Louisville, TN
Smith, DJ, Loudon, TN
Smith, ME, Loudon, TN
Spaeth, Jeanne and Don, Loudon, TN
Sponholz, Liz, Loudon, TN
Sprich, Dan, Loudon, TN
Staas, George, Loudon, TN
Stanczuk, Dennis, Homeowners Association of Tellico Village, Loudon, TN
Strasser, Betsy, Loudon, TN
Stridiron, Karen, Loudon, TN
Struttmann, Larry, Loudon, TN
Swicegood, Tom, Town of Louisville, Town Engineer, Louisville, TN
Tarr, Mr. and Mrs. Henry, Loudon, TN
Tinder, Sue
Tingle, Rob, Louisville, TN
Tomasko, Ronald, Loudon, TN
Treece, Ken, Loudon, TN
Tuck, John, Tellico Realty and Auction Company, Lenoir City, TN
Twesme, David, Loudon, TN
Valenzo, Tom, Loudon, TN
Vasicek, Ronald, Loudon, TN
Vietor, Gene, Loudon, TN
Visconti, Gerald, Loudon, TN
Visconti, Penny, Loudon, TN
Vreeland, James, Loudon, TN
Vreeland, Pandora, Loudon, TN
Wager, James, Loudon, TN
Wainwright, John, Loudon, TN
Waldrop, W. R., Loudon, TN
Waldrop, William, Loudon, TN
Walker, Charles, Loudon, TN
Weaver, John, Loudon, TN
Webb, Linda, Louisville
Weber, Gene, Loudon, TN
Wendoloski, Ronald, Loudon TN
Werner, Mark, Homeowners Association of Tellico Village, Loudon, TN

Wielgos, Dennis, Tellico Village Property
Owners Association, Loudon, TN
Wiggins, Robert, Loudon, TN
Willer, Elizabeth, Loudon, TN
Williams, Alden, Loudon, TN
Willis, Helen, Loudon, TN
Wilson, Jean, Loudon, TN
Wood, Ken, Loudon, TN
Wright, Will, Tellico Village, T

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---. 2011c. Environmental Sound Pressure Level Sampling – Tennessee Valley Authority Tellico Dam, Lenoir City, Tennessee. EnSafe Project Number 0888810178 PH05. TVA PPO Number 266468. Prepared for Tennessee Valley Authority, 400 West Summit Hill Drive, W 11B, Knoxville, Tennessee 37902. June 10.

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APPENDIX A

PHOTO LOG

Photo 1. Cherokee Dam (Segment C-1) Embankment Access Road (Facing North)

Photo 2. Cherokee Dam (Segment C-1) Embankment Access Road (Facing Southwest)

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Photo 12. Cherokee Dam Segment C-5 and Gate Location (Facing Northeast)

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APPENDIX B

PUBLIC COMMENTS AND TVA RESPONSES

PMF PERMANENT DAM SAFETY MODIFICATIONS DRAFT EIS COMMENT RESPONSE REPORT

May 2013

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1.0 INTRODUCTION

TVA carefully reviewed all of the substantive comments that it received on the draft EIS. Several of the individual comments were similar in substance. To avoid repetition, TVA grouped similar comments and produced one synthesized comment for each comment grouping. The commenters contributing to each synthesized comment are listed with the comment. Because TVA tried to be careful and not lose comment nuances that were different, a number of synthesized comments still are similar and there is some overlap. The result of this analysis and synthesis process is the list of 70 individual comments to which TVA has provided responses in this appendix.

2.0 INDEX OF COMMENTERS

Following is a list of the commenters, their affiliations, and the numbered comment statements incorporating their comments. One comment was received which lacked the name of the commenter.

Commenter	Affiliation	Comment No.
Ammon, Sandi	Loudon, TN	5, 63
Anonymous	*Not Available*	10, 66
Colaw, Larry & Barbara	Loudon, TN	4
Hall, Jack	Loudon, TN	22, 37, 38, 61
Holcomb, E	*Not Available*	1
Johannesen, Nils P.	Loudon, TN	3, 13, 23-27, 29-33, 37, 43-44, 52, 54
Kastner, Howard	Loudon, TN	52, 64
LaRue-Baker, Lisa	United Keetoowah Band of Cherokee Indians in Oklahoma (UKBCIO) Tahlequah, OK	15
Miller, Mitch & Denise	*Not Available*	13
Mueller, Heinz	U.S. Environmental Protection Agency (EPA), Atlanta, GA	7-8, 23, 46-47, 49
Sawinski, Richard	Loudon, TN	6, 9, 11, 34, 36-37, 41, 53, 56-60, 63, 65, 67-69
Schell, Wayne	*Not Available*	14, 22
Stanczuk, Dennis T.	Homeowners Association of Tellico Village (HOATV), Loudon, TN	2, 10, 12, 23, 26, 27, 28, 32, 34, 35, 36, 37, 39, 40, 41, 42, 43, 45, 48, 52, 55, 58, 62, 67
Stanley, Joyce	U.S. Department of the Interior Atlanta, GA	16-21, 23, 46-47, 49
Van Fleet, Robert S.	Knoxville, TN	58
Walker, Michelle B	Tennessee Department of Environment and Conservation (TDEC)	50-51, 70
Weiss, Al	Loudon, TN	34
Wendoloski, Ronald	Loudon, TN	13, 66
Werner, Mark F.	*Not Available*	37, 63

3.0 COMMENTS AND RESPONSES BY TOPIC

3.1 Alternatives

Alternative A - No Action

1. Alternative A, No Action, is preferred. There is no need to spend more money to replace the HESCO barriers now since future flood level estimates will likely be revised at which point the barriers can be more easily removed and the beautiful views restored. Other safety measures such as spillways already exist. (*Commenter: E. Holcomb*)

   Response: Comment noted. As explained in Final EIS Section 2.1.1, however, the No Action Alternative does not meet the project's purpose and need. It is unlikely that PMF elevations will be revised downward to the point that the HESCO barriers or their proposed permanent replacements would no longer be needed.

2. Because TVA has described the HESCO barriers as temporary, Alternative A, the No Action Alternative, must be described as the removal of the HESCO barriers and restoration of the original dam configurations which is a permanent condition. (*Commenter: Dennis T. Stanczuk- HOATV*)

   Response: TVA installed the HESCO barriers as a temporary measure to quickly provide additional protection to the dams from the effects of the probable maximum flood. At that time, TVA realized that they would have to be replaced by permanent dam modifications. Until the permanent dam modifications are completed, TVA must maintain the HESCO barriers. Therefore, the removal of the barriers and restoration of the original dam configurations does not represent the current baseline conditions that comprise the No Action Alternative. The removal of the HESCO barriers would be an action alternative, rather than the No Action Alternative.

3. The NEPA process was bypassed for installation of the HESCO barriers and environmental and safety impacts were not analyzed or addressed. Therefore, analyzing the No Action Alternative beginning with the HESCO barriers in place results in an incomplete analysis in the DEIS. Alternative A should be redefined to start from baseline conditions prior to installation of the HESCO barriers. (*Commenter: Nils P. Johannesen*)

   Response: As described in the response to the preceding comment and in other comment responses in this appendix, the current baseline conditions include the HESCO barriers, which therefore comprise the No Action Alternative. Removal of the HESCO barriers without their replacement is not feasible and would not comply with dam safety requirements and guidelines. An analysis based on conditions that existed before the HESCO barriers were installed would not add information useful to the current decision to be made by TVA.

Alternative B - Permanent Modifications with Combination of Concrete Floodwalls and Earthen Embankments

4. Alternative B is the preferred option. (*Commenter: Larry & Barbara Colaw*)

   Response: Comment noted.

5. Earthen berms are preferred over concrete floodwalls as they would be less expensive. (*Commenter: Sandi Ammon*)

   Response: Comment noted. Alternative B, TVA's preferred alternative, consists of a combination of earthen embankments and concrete floodwalls. After completing additional design studies and in response to comments on the Draft EIS such as this, TVA has modified Alternative B to incorporate more segments of raised earthen embankments, and fewer segments of concrete floodwalls, at Cherokee, Fort Loudoun, and Tellico Dams. These design changes would result in reduced costs, elimination of many gap closure barriers, reduced impacts to recreational uses, and reduced visual impacts.

6. Neither Figure 2-15 or 2-16 show the future Highway 444 roadbed and the horizontal or vertical proximity of the road to the embankment. It appears the road is present at the top of the embankment in both figures. In Figure 2-16 this would place the road between the two berms on top which would replicate the current situation with the HESCO barriers which blocks the views that formerly existed at this location. Therefore, the configuration shown in Figure 2-16 is undesirable and would be a poor choice. (*Commenter: Richard Sawinski*)

   Response: DEIS Figures 2-15 and 2-16 were intended to show concepts for raised earthen embankments and raised earthen berms at Tellico segments T-3 (Saddle Dam 2) and T-4 (Saddle Dam 3). The Highway 444 roadbed would not have been located on the top of either of these saddle dams. Highway 444 in the vicinity of these two segments would not be reconstructed or otherwise altered by either TVA's proposed action or the Tennessee Department of Transportation's US 321 bridge and highway relocation project. Segment T-3 is located some distance from Highway 444 and would have little effect on the view from the highway. Segment T-4 is located adjacent to Highway 444. Under the preferred Alternative B as described in the Final EIS, a concrete floodwall 4.8 feet high would be constructed on Segment T-4. As described in Section 3.14.2.2 and in the responses to other comments, this floodwall would affect the view from Highway 444.

7. Review of the previous comments indicates support for TVA's preferred alternative in removing the HESCO barriers and implementing a permanent solution. (*Commenter: Heinz Mueller - EPA*)

   Response: Comment noted.

8. The 'engineering constraints' which resulted in floodwalls being selected as the permanent modification configuration appropriate for five of the six Cherokee Dam segments should be further explained in the FEIS. (*Commenter: Heinz Mueller - EPA*)

   Response: After further engineering analyses and in response to public comments, the preferred Alternative B has been modified to replace Cherokee floodwall Segments C-3, C-4, and C-5 with a continuous embankment that would connect to an embankment at Segment C-6. Much of the embankment would be built on the downstream side of the existing embankment, an engineering option that was not considered in detail in the Draft EIS. The changes to the design of these segments would eliminate some of the restrictions imposed by the HESCO barriers and by floodwalls on recreational use and access. Constructing raised embankments instead of floodwalls on the Cherokee main embankment Segments C-1 and C-2 would have required very large volumes of fill to raise the upstream and downstream embankment slopes. TVA proposes to reduce the impacts of the floodwall on Segment C-2, which receives much heavier visitor use than Segment C-1, by raising the roadbed with fill so that visitors will be able to see over the floodwall.

9. The view near Tellico dam Segment T-4 near the primary entry point to Tellico Lake is one of the best views from Highway 444. Restoring this view for automobile passengers would resolve the visual and socioeconomic impacts resulting from loss of the view caused by the HESCO barriers. The configuration shown in Figure 2-15 is the preferred option over the configuration shown in Figure 2-16. (*Commenter: Richard Sawinski*)

   Response: Tellico Segment T-4 is in view for 4-5 seconds by a person in a vehicle travelling the speed limit on southbound Highway 444 and for a somewhat longer time by a northbound traveler. Prior to the installation of the HESCO barriers, Tellico Reservoir would have been visible from the roadway for most of these time intervals. It is presently only visible to a southbound traveler for a small portion of this time and at the southern end of Segment T-4. It is visible to a northbound traveler for a longer time period. Additional views of the reservoir are available about 0.2 miles south of Segment T-4, near the Tellico Village entrance sign, and 0.5 miles south of Segment T-4, near the Poplar Springs Boat Ramp. While the construction of the permanent dam safety modification at Segment T-4 would continue to restrict the view of the reservoir at this location, TVA is unable to quantify any associated socioeconomic impact.

10. TVA should consider placing the permanent barriers on the land side of hiking trails to maintain views of the lake for everyone on the trails, particularly children and persons in wheelchairs. The permanent barriers should also be placed on the land side of roadways to preserve views for passengers in automobiles. The DEIS analysis should be revised to consider these configurations. (*Commenters: Unknown, Dennis T. Stanczuk - HOATV*)

    Response: One of the objectives of the modifications to Alternative B that TVA has made since the DEIS was issued is to reduce the impacts of permanent barriers, especially floodwalls, on people visiting and recreating at the four dams. The number of segments of floodwalls has been reduced by replacing some of them with earthen embankments which would maintain lake-side and land-side views. At the Cherokee Dam C-2 South Embankment, the 6.6-foot floodwall would be built on the downstream side of the embankment and the embankment would be raised 3 feet. This would reduce the effective height of the floodwall, as perceived by pedestrians on the embankment, to 3.6 feet. Similarly, the Tellico T-2 Main Embankment would be raised by a combination of a 4.8-foot floodwall on the lake side and a 2-foot raised embankment. This would reduce the effective height of the floodwall, as perceived by pedestrians on the embankment, to 2.8 feet. Moving the floodwall on Fort Loudoun Segment FTL-3 to the land side is not feasible due to traffic and safety concerns. Following the completion of the US 321/SR 95 bridge relocation project, this floodwall would have little effect on the views of motorists on US 321. It would affect the views of motorists on an approximately 1,200-foot segment of the entrance and exit ramps from Tellico Parkway to north-bound US 321.

11. Use the configuration shown on the left side of Figure 2-10 for the east/upstream side (no curb) for FTL-3 which appears to show sufficient space for an emergency pull-off/shoulder. (*Commenter: Richard Sawinski*)

Response: Under both action alternatives, TVA intends to locate the Fort Loudoun Segment FTL-3 floodwall as far from the highway traffic lanes as possible. Once the Tennessee Department of Transportation project to relocate US 321 is completed, less than half of the 2,500-foot FTL-3 floodwall would be alongside highway traffic lanes, on the ramp from east-bound Tellico Parkway to north-bound US 321. TVA discussed raising the elevation of this stretch of roadway with TDOT to avoid having to construct the floodwall. Raising the roadway was not feasible because of clearance requirements under the US 321 bridge across the Tellico canal.

12. Why are 7 foot floodwalls necessary at Fort Loudoun and Tellico dams to mitigate the PMF? The height of the HESCO barriers at FLT-2 and 3 is incorrectly listed as two feet high in the DEIS. Why are 7 foot floodwalls required here? (*Commenter: Dennis T. Stanczuk - HOATV*)

    Response: TVA does not propose to construct 7-foot floodwalls or embankments at Fort Loudoun or Tellico Dams under either of the action alternatives. At Fort Loudoun, TVA proposes to construct permanent flood barriers with a top elevation of 836.0 feet. Given the existing top of embankment elevation at 830.0, the height of the newly constructed permanent flood barrier would be 6 feet. At Tellico, TVA proposes to construct permanent flood barriers with a top elevation of 834.9 feet. Given the existing top of embankment elevation at 830.0, the height of the newly constructed permanent flood barrier would be almost 5 feet.

Other Alternative

13. Removal of the HESCO barriers with no further permanent modifications is the most cost effective option. This will resolve economic impacts to property owners associated with installation of the HESCO barriers and permanent dam segment modifications including visual impacts, higher electric utility rates, flood insurance costs, loss of property value, and potential loss of property during a PMF. Other safety measures such as spillways already exist, therefore the HESCO barriers and permanent modifications are unnecessary. (*Commenters: Nils P. Johannesen, Mitch and Denise Miller, Ronald Wendoloski*)

    Response: The DEIS did not address the economic impact to residents who live along the lake because the comparison of impacts between the base case (with HESCO barriers) to a permanent modification is non-existent and imposes no additional economic burden specifically on those lake residents. Even if the base case had been defined as “prior to HESCO barriers,” the economic impact would have been minimal. This same Probable Maximum Flood (PMF) event, if it were to occur, for example, at Tellico Dam without any temporary or permanent modifications in place, would exceed the height of the earthen embankment at the dam. Water would continue to rise and cascade over the earthen embankment to a depth of two to three feet (elevation 833), and the embankment would erode to the extent that it completely fails. Thus the water level in Tellico Reservoir would achieve practically the same height (within an estimated few tenths of a foot) with or without modifications. The difference is that the modifications would prevent the sudden failure of Tellico and Fort Loudoun Dams, thereby 1) preventing the loss of the respective reservoirs and 2) reducing the property damage and potential loss of life downstream.

For those areas below the 500-year flood level, the flood probability has not changed and the delineation of the 100-year and 500-year floodplains remains unchanged. For those individuals that live above the 500-year flood elevation, their flood probability likewise has not materially changed. The only difference now is that they have updated information on the PMF. Floods larger than a 500-year flood, up to and including the PMF, have always been a possibility, and the modifications to the dams will not change this. Along TVA's reservoirs, TVA requires all habitable structures to be located above the 500-year flood level to minimize flood risk. Persons may incur whatever risk they choose, either knowingly or unknowingly above this level. Exposure to the PMF flood event is no different on the four subject reservoirs than on any other reservoir in the TVA system. In fact, the majority of the downtown area of Chattanooga lies well within the PMF delineation, with no appreciable decrease in property value that we are aware of. The purchase of flood insurance is a personal choice. Most communities adjoining TVA reservoirs participate in the National Flood Insurance Program (NFIP) and as a result homeowners, renters, and business owners can purchase flood insurance. See http://www.floodsmart.gov/floodsmart/pages/choose_your_policy/agent_locator.jsp to learn more about the NFIP and contact an agent.

14. The HESCO barriers are visually unappealing and bad for the environment. They should be removed and nothing should be put in their place. Permanent modifications would also be visually unappealing and bad for the environment. Installation of permanent barriers will not stop a flood. A large flood would go over the dam and cause significant damage whether the barriers are there or not. Removal of the HESCO barriers and no permanent modifications is an alternative that should be evaluated. (*Commenter: Wayne Schell*)

    Response: The visual impacts of the HESCO barriers and of the permanent modifications proposed to replace the HESCO barriers are discussed in EIS Section 3-14. As discussed in EIS Section 2.1.4, the removal of the HESCO barriers without replacement by permanent barriers is not feasible. TVA agrees that installation of permanent barriers will not stop a flood. In the event of a flood of the magnitude of anything approaching a PMF, there would be widespread flooding damages over large areas. However, the temporary barriers, as well as the proposed permanent barriers, were designed so they would not be overtopped in a large flood event. The barriers, by their very nature, prevent the original embankments from being overtopped and subject to potential failure, with the associated loss of the upstream reservoir.

3.2 Cultural Resources

NHPA Compliance and Tribal Consultation

15. The United Keetowah Band of Cherokee Indians in Oklahoma has no objection or comment regarding the DEIS other than to ask that all work be stopped and the Band be contacted immediately in the event human remains or funerary items are inadvertently discovered during construction. (*Commenter: Lisa LaRue-Baker – UKBCIO*)

    Response: Comment noted. TVA will cease work and notify appropriate tribes and others in the event human remains or funerary items are inadvertently discovered during construction.

3.3 Endangered & Threatened Species

Impact Analysis and Section 7 Consultation

16. In Section 3.8.1.2 Terrestrial Fauna, Page 3.38, first paragraph, third sentence, the bald eagle is incorrectly noted as a 'listed' species. The fourth and fifth sentences in the same paragraph give the correct status as delisted and protected under the Bald and Golden Eagle Protection Act (BGEPA) and Migratory Bird Treaty Act (MBTA). The third sentence should be corrected. (*Commenter: Joyce Stanley - USDOI*)

    Response: The incorrect statement of the bald eagle's status in the third sentence of Section 3.8.1.2 Terrestrial Fauna has been corrected.

17. The discussion regarding the cave in Grainger County should be more accurately described as 'the use of the Grainger County cave by grey bats has not been documented in recent years' rather than indicating that the population of grey bats is likely extirpated. (*Commenter: Joyce Stanley - USDOI*)

    Response: The discussion in the last paragraph of Section 3.8.1.2 Terrestrial Fauna regarding the Grainger County bat population has been revised.

18. The discussion regarding the existence of listed terrestrial species in the vicinity of the dams is inconsistent between Section 3.8.1.2 Terrestrial Fauna (Page 3.38, first paragraph) and 3.8.2.2 Alternative B - Combination Floodwalls and Embankments/Berms, Terrestrial Fauna (Page 3-41, second sentence). The inconsistency needs to be rectified and the status of federally listed terrestrial species accurately described. (*Commenter: Joyce Stanley - USDOI*)

    Response: Sections 3.8.1.2 Terrestrial Fauna and 3.8.2.2 Alternative B - Combination Floodwalls and Embankments/Berms have been revised and the inconsistencies noted have been rectified.

19. The sheepnose and spectaclecase aquatic species have recently been listed as federal endangered species. The DEIS effect determination should be updated accordingly. (*Commenter: Joyce Stanley - USDOI*)

    Response: Table 3.8-1 and the text of Section 3.8.1.1 have been revised to reflect the current status of these species. These two recently listed mussels would not be affected by the proposed actions.

20. The status of federally designated critical habitat for terrestrial animals and plants in the proposed project vicinities should be included in sections 3.8.1.2 Terrestrial Fauna and 3.8.1.3 Aquatic and Terrestrial Flora consistent with the previous discussion in section 3.8.1.1 Aquatic Fauna. (*Commenter: Joyce Stanley - USDOI*)

    Response: Sections 3.8.1.2 and 3.8.1.3 have been revised to provide a discussion of critical habitat that is consistent with Section 3.8.1.1.

21. TVA is asked to coordinate with the U.S. Department of the Interior, Office of Environmental Policy and Compliance regarding the proposed action to ensure compliance with Section 7 of the Endangered Species Act, the Bald and Golden Eagle Protection Act, and the Migratory Bird Treaty Act. (*Commenter: Joyce Stanley - USDOI*)

Response: Comment noted. None of the alternatives described in the Draft EIS would have affected threatened or endangered species. Effects on eagles would have been, at most, minimal. Due to the habitat conditions at the project sites, effects on migratory birds would have been minimal. Since the publication of the Draft EIS, TVA has changed the design of several of the permanent modifications included in the preferred Alternative B, which now has the potential to affect habitat suitable for the endangered Indiana bat. TVA is consulting with the U.S. Fish and Wildlife Service over the potential effects to this species.

3.4 Floodplain and Flood Risk

Floodway

22. Barriers on the Tellico spillway will cause more water to overtop the spillway and will disable the power lines. (*Commenters: Jack Hall, Wayne Schell*)

    Response: During the Probable Maximum Flood, a large volume of water would pass over the Tellico Dam emergency spillway, regardless of whether HESCO barriers or permanent floodwalls or raised embankments are present. This floodwater would result in downstream impacts and the power line support structures located downstream could be damaged or destroyed.

Probable Maximum Flood

23. A more detailed definition of the Probable Maximum Flood (PMF) event, including additional details of the possible 'critical meteorological and hydrological event' which could cause the PMF, should be provided in the FEIS. (*Commenters: Nils P. Johannesen, Heinz Mueller - EPA, Dennis T. Stanczuk - HOATV*)

    Response: The definition of the PMF provided in the text was taken from the FERC publication “Engineering Guidelines for the Evaluation of Hydropower Projects” (see http://www.ferc.gov/industries/hydropower/safety/guidelines/eng-guide.asp) and in our judgment is an accurate description of the hypothetical event. The rainfall which would produce the PMF is called the Probable Maximum Precipitation (PMP). PMP was defined in various hydrometeorological reports published by the National Weather Service, and is postulated to occur in a 9 day sequence consisting of 3 days of antecedent rainfall, 3 days of no rainfall, and 3 days of main storm rainfall. The volume of rain is dependent upon the location of interest. For the watershed above Chickamauga Dam, the PMP rainfall sequence would produce about 8 inches of rain in the antecedent storm, and about 16 inches of rain in the main storm.

24. By calling what could be a potentially major flood an 'extremely rare event of unknown probability' TVA appears to be minimizing the potential impacts of such a flood. TVA appears to have been subjected to pressure by the Nuclear Regulatory Commission (NRC) in minimizing the situation. (*Commenter: Nils P. Johannesen*)

    Response: TVA is not attempting to minimize the potential impacts of a PMF. Were the PMF to occur, the associated consequences would be unprecedented, widespread, and devastating. While, as stated before, the probability of such a flood is extremely small, the PMF is the design basis for flood potential at TVA's operating nuclear plants. TVA is under no NRC pressure to minimize the situation.

25. Climate change is a known natural process, but data from the International Panel on Climate Change is disputed. Did a 2009 focus on climate change as exhibited in the Draft Integrated Resource Plan result in the entry of 'extreme' inputs in the deterministic model for the Fort Loudoun and Tellico PMF calculations leading to skewed and disproportionate results leading to the installation of the HESCO barriers inappropriately and the current decision for permanent modifications? Was climate change a strong driver of PMF model inputs? If climate change is a reason behind the PMF calculations, TVA should reconsider and modify the estimates appropriately. (*Commenter: Nils P. Johannesen*)

    Response: The rainfall used to define the PMP for the main river projects such as Tellico, Fort Loudoun, and Watts Bar, was published in the 1965 Weather Bureau Hydrometeorological Report No. 41 (available at http://www.nws.noaa.gov/oh/hdsc/PMP_documents/HMR41.pdf). Climate change was not a driver of the “PMF inputs” used in this study. TVA has for several years recognized the potential impacts of global climate change and has addressed the need for climate change mitigation in its Strategic Plan and Environmental Policy. The 2009 reference to the Integrated Resource Plan process refers to a presentation on the relative degree of uncertainty over costs associated with addressing six broad environmental areas. TVA's Environmental Policy establishes objectives and critical success factors for these six environmental areas. In addition to climate change mitigation, the six include natural resources management, sustainable land use, waste minimization, water resources protection and improvement, and air quality improvement. Relative to the other five environmental areas, the uncertainty of the future costs for climate change mitigation is high and this was a factor in defining the various scenarios analyzed in the IRP.

26. How can the PMF be both 'rare' and an 'event of unknown probability'? 'Rare' indicates the probability is known and it is low. (*Commenters: Nils P. Johannesen, Dennis T. Stanczuk - HOATV*)

    Response: TVA disagrees with the assertion that the probability of an event must be known before it can be described as rare.

27. The claim in the DEIS that probabilistic modeling drawbacks include 'limitations of computational resources' is incorrect and indicates a misunderstanding of Probabilistic Risk Assessment (PRA) analysis. There is suitable computing capability with existing TVA resources or by utilizing additional computing capacity at Oak Ridge. The software is commercially available and requires minimal computing resources. The 'uncertainty of underlying statistical distributions for model input parameters' limitation is misleading as PRA uses well-established algorithms and statistical expressions of uncertainty. TVA should consult with experts and review existing literature on PRA methods and revise the DEIS to use PRA analysis. (*Commenters: Nils P. Johannesen, Dennis T. Stanczuk - HOATV*)

    Response: The language in the DEIS is not intended to infer that a probabilistic analysis cannot be done. TVA stands by its assertion that limitations of computational resources would be a primary drawback to such an analysis. Such limitations do not comprise an insurmountable obstacle. However, it is TVA’s position that we are required to adopt the PMF as the design basis flood for our high hazard dams and our nuclear plants. The PMF by definition is an event that requires employment of a deterministic analysis. A probabilistic risk based assessment could be undertaken. The completion of such an assessment might very well allow TVA to state with some confidence what the expected range of the probability of occurrence of a PMF event at various locations would be. However, since our position is that the PMF is the required design basis for this project, improved knowledge of the probability of the event would not materially change the design basis. A probabilistic analysis would cost many millions of dollars and require a multi-year effort to undertake. There is currently no published guidance on how such an assessment on a complex watershed should be conducted, and no information about how the results of such an analysis would be reviewed.

28. The DEIS should be reissued to include a description and maps (including all drainage areas) of the current hydrogeologic conditions for all dam sites. A description and flood map for the 100- and 500-year storm events showing where new flooding could occur as a result of the HESCO barriers and permanent modifications should also be included. Potential flood zones for each dam drainage area should be mapped showing areas that would be flooded if the new barrier heights are reached. The DEIS should be reissued with an analysis of these potential flooding impacts and a discussion of potential mitigation measures should be included. (*Commenter: Dennis T. Stanczuk - HOATV*)

    Response: The HESCO barriers have been placed well above the 100- and 500-year flood elevations at the dams. Any permanent modifications would also be located above those elevations. Because these modifications are occurring well above the 100- and 500-year flood elevations, there would be no changes in the 100- and 500-year flood elevations and therefore no need to remap the 100- and 500-year floodplains. County floodplain maps are available through the Federal Emergency Management Agency web site at https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1. TVA has developed and maintains emergency action plans for all 49 TVA dams, including the four dams that are the subject of the proposed action. The plans include information on the flooding effects from major flood scenarios on areas downstream from the dams. TVA provides this information to local and state emergency preparedness agencies and works closely with them in utilizing the information for appropriate emergency planning purposes. However, due to security concerns and to the potential for misinterpretation, TVA does not provide this information to the public. TVA considers the information to be “sensitive” as it could be used to impact the safety and security of TVA facilities. In addition, this information is based on events with very small probability of occurrence and is not practical for individual risk assessment and planning.

29. The estimated PMF for Fort Loudoun and Tellico Dams is overly conservative in comparison to historical data, it is many times higher than actual maximum outflows recorded at several locations over the last 143 years. Therefore these estimates for the PMF are unreasonable. (*Commenter: Nils P. Johannesen*)

    Response: TVA agrees that the PMF is a very large flood, much larger than any that have been observed in the region’s known flood history. However, it is the design basis flood for Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams, and TVA is obliged to plan for such an event.

30. The estimated PMF is inaccurate and should be recalculated in the interest of the project funding constraints. Electric customers do not want to see their rates increase to pay for

unnecessary dam modifications that will never be needed and that impact viewsheds. (*Commenter: Nils P. Johannesen*)

Response: See the response to Comment 32 for a discussion of the accuracy of the PMF elevation estimates. The cost of constructing and maintaining the proposed permanent dam modifications has been one of the factors considered in their design.

31. The existing 100- and 550-year flood levels at Tellico Reservoir are 816 and 817 feet respectively, a difference of one foot. How can the new PMF be 16.5 feet above the existing 500 foot level? What causes the disparity? What factors have changed since the initial calculation of the 100- and 500-year flood levels to result in such a significant change in the PMF estimate now? (*Commenter: Nils P. Johannesen*)

    Response: The planned operation of the Fort Loudoun and Tellico projects during extreme event floods is to use the entire allocated storage up to elevation 817 to minimize flooding downstream to the extent possible. At elevation 817, the combined discharge capacity at the two projects is about 570,000 cfs. This discharge capacity is sufficient to pass large floods, including floods much larger than the 500-year, while holding the pool at 817. While elevation 817 is the estimated 500-year flood elevation at Fort Loudoun and Tellico Dams, incrementally larger floods would not cause an increase in the pool level until the discharge capacity of the two dams is exceeded. An elevation frequency curve for these two projects would therefore have a very flat, very long plateau at elevation 817, but then a steady increase from elevation 817 up to the PMF elevation and discharge. This explains why the elevation difference between the estimated 100-year and 500-year event is so slight as compared to the difference between the 500-year and PMF.

32. The PMF calculation is inadequate. Stochastic or probabilistic modeling is a standard method across business, industry, and government for identifying and managing risk. It eliminates problems inherent in deterministic modeling and is a superior method. A Probabilistic Risk Assessment (PRA) should be conducted. Existing PRA analysis estimates the 500-year flood levels to be much lower than the TVA PMF estimate. (*Commenters: Nils P. Johannesen, Dennis T. Stanczuk - HOATV*)

    Response: The PMF is a deterministic event by definition. While one could theoretically use a probabilistic risk assessment to estimate the expected range of the probability of occurrence of the PMF, we do not agree with the contention that a probabilistic approach can be used to determine the magnitude of the PMF. TVA recognizes that recent developments in the field of hydrologic analysis have concluded that there are potentially valuable benefits associated with the use of probabilistic based approaches to the assessment of extreme flood risk. We fully support such developments and see it as our professional obligation to stay current with industry trends. However, TVA's position is that in the current regulatory climate (both with respect to dam safety and the safety of our operating nuclear plants), we are obliged to use the PMF as the design basis flood. Determination of the PMF requires the use of a deterministic analysis. TVA conducted the current PMF analysis using standard, widely accepted hydrologic methods, meeting NRC criteria and maintaining consistency with the Federal Guidelines for Dam Safety. There is not a "standard" probabilistic risk assessment model suitable for licensing requirements which meets NRC criteria; in fact, such criteria do not yet exist. Although some limited probabilistic studies have been performed on smaller reservoir systems for dam safety studies, this type of analysis would be computationally inefficient on a system such as TVA's. In addition, the study would likely only complement the current analysis, not replace it. Estimating a recurrence interval for the PMF does not ensure compliance with Section 10 of the Code of Federal Regulations regarding nuclear plant safety, whereas the deterministic analysis performed by TVA does.

33. Use of a probabilistic model rather than deterministic for determining the PMF might resolve the disparity between the 100- and 500-year floods and the 'extremely rare event of unknown probability' of the estimated PMF in the DEIS. (*Commenter: Nils P. Johannesen*)

    Response: See the response to Comment 31. Even if a probabilistic model was developed and employed, there would likely still be large differences between the 100- and 500-year flood elevations and the PMF elevations.

3.5 NEPA Compliance/Adequacy

Adequacy of EIS

34. Negative visual impacts and public safety impacts resulting from the presence of the HESCO barriers and the installation of the permanent barriers are acknowledged in the DEIS, but no mitigation measures are presented or considered. The DEIS analysis is inadequate and incomplete because no mitigation measures are presented to address negative visual impacts (to automobile passengers, persons in wheelchairs on trails, and property owners) and transportation based public safety impacts resulting from the presence of the barriers. The DEIS should be reissued to address these concerns. (*Commenters: Richard Sawinski, Dennis T. Stanczuk - HOATV, Al Weiss*)

    Response: Many of the modifications to the preferred Alternative B described in the Final EIS would reduce the visual impacts of the permanent modifications, as perceived by motorists, visitors to the dam reservations, and nearby property owners. For example, the use of raised embankments instead of floodwalls at Cherokee Dam Segments C-3, C-4, and C-5 would maintain the views of motorists and walkers on the roadways and walkways that would be rebuilt on top of the embankments. At Tellico Dam Segment T-2, a 4.8-foot floodwall would be built on the upstream (reservoir) side and the top of the embankment raised 2 feet. Visitors walking the access roadway on the raised embankment would see a 2.8-foot floodwall, low enough to not restrict the view of the lake for most visitors, including most of those in wheelchairs. TVA has carefully considered the transportation safety impacts in the design of the permanent modifications.

35. The DEIS is inadequate in defining the scope and addressing the environmental and socioeconomic impacts associated with the PMF. Nor does it respond to many of the major concerns raised during the 2011 public scoping. The DEIS should be reissued. (*Commenter: Dennis T. Stanczuk - HOATV*)

    Response: The major concerns raised during the public scoping are summarized in EIS Section 1.5. These concerns have been addressed in the Draft EIS and the Final EIS, and the Final EIS contains additional discussion of some of them. TVA also considered the scoping comments, as well as the comments on the Draft EIS, while finalizing the design of the permanent modifications that comprise the preferred Alternative B.

36. The DEIS should be reissued because the analysis is incomplete and inadequate with respect to visual resource impacts, public safety and transportation, socioeconomic impacts, and cumulative impacts. (*Commenters: Richard Sawinski, Dennis T. Stanczuk - HOATV*)

    Response: The analysis of these issues has been revised and, in some cases, expanded in the Final EIS.

37. TVA solicited input on the dam modifications at an earlier date. Comments and concerns submitted included recommendations for a redefinition of the scope of the DEIS, requests for a presentation/question and answer style public meeting, a discussion of a choice of materials, and questions regarding NEPA/CEQ compliance. Additional comments submitted previously identified the loss of views and presence of visually unappealing barriers as a problem and suggested restoring the views by removing the HESCO barriers as a result of adjusting the hydrologic calculations on which the need for barriers was founded. Comments were submitted but no feedback was received by the general public. The DEIS did not adequately address these previous comments and concerns. Feedback on previous comments and concerns should be provided. The DEIS is inadequate and should be reissued. (*Commenters: Jack Hall, Nils P. Johannesen, Richard Sawinski, Dennis T. Stanczuk - HOATV, Mark F. Werner*)

    Response: The issues identified in this comment have been addressed in the Final EIS.

Information Request

38. Previous statements indicated the NRC directed TVA to protect the Watts Bar Nuclear plant from flooding. The permanent dam modifications will not solve that problem but it will cause flooding of homes on Tellico Lake. The NRC directive to protect the Watts Bar Nuclear plant has been requested previously but has never been presented. In the past it has been mentioned that significant work is being done at the Watts Bar Nuclear Plant to protect it, but no significant information has been shared publically. (*Commenter: Jack Hall*)

    Response: Requests for Nuclear Regulatory Commission (NRC) information should be made directly to the NRC. The “directive” is part of the licensing agreement between the Tennessee Valley Authority (TVA) and the NRC to operate the reactor located at the Watts Bar Nuclear Plant site. Failure to protect against floods as defined in NRC Regulatory Guide 1.59 - Design Basis Floods for Nuclear Power Plants would be a violation of that licensing agreement and require TVA to cease operation of Watts Bar at great expense to the stakeholders of the Tennessee Valley. TVA is developing additional safety measures to protect Watts Bar Nuclear Plant from the maximum flood levels developed in accordance with the regulatory guidance. Modifications to increase the safety margins against the maximum flood levels were recently completed at Watts Bar with additional modifications scheduled in the upcoming months. Some of these modifications are described at http://www.tva.com/environment/reports/fukushima/index.htm.

As stated in the response to Comment 13, the water level in Tellico Reservoir would achieve practically the same height (within an estimated few tenths of a foot) with or without dam modifications. Even with these recently added margin modifications, the raising of Fort Loudoun, Tellico, Cherokee, and Watts Bar Dams is still required. The proposed permanent modifications are to meet additional requirements beyond those needed to protect Watts Bar Nuclear Plant. TVA's dam safety program complies with the Federal Guidelines for Dam Safety. TVA procedures are written to comply with these guidelines. Per these procedures TVA dams are required to withstand flood levels which can be greater than those required to protect Watts Bar Nuclear Plant. TVA is committed to protect the health and safety of the public. We do so by meeting or exceeding all applicable federal guidelines and standards. These include FEMA, FERC, NRC, U.S. Army Corps of Engineers, and Bureau of Reclamation guidelines and standards, as well as our own. Maintaining and operating the 49 TVA dams safely and in accordance with the highest standards is the cornerstone of that commitment.

39. Request that TVA provide documentation of those consultations with CEQ and the Office of General Counsel and the resultant determinations and findings with regard to the installation of the HESCO barriers. (*Commenter: Dennis T. Stanczuk - HOATV*)

    Response: TVA did not consult with the Council of Environmental Quality under the emergency action provisions for National Environmental Policy Act compliance outlined in CEQ's NEPA regulations and TVA's NEPA procedures when TVA installed the HESCO barriers.

NEPA Requirements

40. Is the environmental review conducted for this project, and with respect to the installation of the HESCO barriers, in compliance with TVA's own procedures for compliance with NEPA? Are TVA's procedures as found on their website reflective of the current CEQ and NRC environmental regulations and guidelines? (*Commenter: Dennis T. Stanczuk - HOATV*)

    Response: The EIS for the proposed permanent dam modifications complies with TVA's NEPA procedures and with CEQ's NEPA implementing regulations. NRC's related regulations do not address this type of action proposed by other agencies that does not require an action, as defined under NEPA, by NRC. TVA NEPA procedures include a categorical exclusion for emergency preparedness activities. During its planning for the installation of the HESCO barriers, TVA did not formally document the determination of whether the proposed action qualified for this categorical exclusion.

41. The NEPA process was bypassed for installation of the HESCO barriers and environmental and safety impacts were not analyzed or addressed. The impacts exceed the conditions for a Categorical Exclusion. This comment has been previously submitted but TVA has not provided an adequate response addressing these concerns. (*Commenters: Richard Sawinski, Dennis T. Stanczuk - HOATV*)

    Response: As stated in the response to the previous comment, TVA did formally document the determination whether the proposed installation of the HESCO barriers qualified for a categorical exclusion. TVA did consider highway safety impacts and impacts to visitor use of the four dams when planning the installation of the HESCO barriers and took measures to reduce these impacts. Following its installation, TVA relocated a portion of the HESCO barriers at Fort Loudoun Dam to address a safety concern.

42. What potential environmental and community impacts were considered prior to installation of the HESCO barriers? (*Commenter: Dennis T. Stanczuk - HOATV*)

    Response: See the response to Comment 41 on highway safety and visitor use considerations. TVA did not solicit public input prior to the installation of the HESCO barriers. TVA did, however, notify the public when the barriers were being installed to explain the need for the barriers.

43. Why were the HESCO barriers constructed without notification and proper environmental review in accordance with TVA and NEPA regulations? What was the 'immediate threat?' Has TVA violated the CEQ regulations, and TVA's own regulations on complying with NEPA by installing the HESCO barriers under a Categorical Exclusion? How do the HESCO barriers qualify for an Emergency Preparedness Categorical Exclusion and did TVA consult with CEQ to determine if that approach was appropriate? A Categorical Exclusion is inappropriate if there is substantial controversy and there is such controversy in this case. How did TVA define or describe the emergency and probability of occurrence of that emergency for installation of the HESCO barriers? Was there time to conduct an environmental review prior to installation? Under the CEQ regulations, what 'alternative arrangements' did TVA discuss with CEQ prior to the installation? (*Commenters: Nils P. Johannesen, Dennis T. Stanczuk - HOATV*)

    Response: See the Response to Comments 41 and 42. TVA did not consult with CEQ on alternative NEPA compliance arrangements for taking actions in emergency circumstances.

Public Participation

44. No information about the HESCO barriers has been reported in local newspapers. Public meeting formats have been inadequate. Most people in surrounding counties are unaware of the HESCO barriers and the plans for expensive permanent modifications. (*Commenter: Nils P. Johannesen*)

    Response: TVA undertook extensive efforts to publicize the permanent dam modifications project during public scoping in 2011 and following the issuance of the Draft EIS in 2012. These efforts included advertisements in local newspapers and issuance of press releases to local media. All persons who had participated in the public scoping or otherwise requested to be added to the project contact list were notified by email or mail of the availability of the Draft EIS and the public meeting held to discuss it. Aside from placing advertisements, TVA cannot control which newspapers or other media outlets report on the project. The open house format used during the public meetings is an effective way for explaining the proposed action to attendees and receiving their comments on it.

45. The poster session format of the public meetings was inappropriate and suppressed meaningful public input. A presentation followed by a question and answer session would allow the more non-technical members of the public a better opportunity to assess the project and would allow information to be presented more consistently. This format was

previously requested and a facility offered but was declined. (*Commenter: Dennis T. Stanczuk - HOATV*)

Response: TVA disagrees with the assertion that the meeting format was inappropriate and suppressed meaningful public input. The meetings provided ample opportunity for attendees to discuss the project with TVA staff, have their questions answered, and submit comments for the record. The posters displayed at the public meeting on the Draft EIS were effective in helping attendees understand several aspects of the proposed permanent dam modifications.

Scope of Impact Assessment

46. Access to recreational areas and parking areas can impact public use of these areas. Section 3.12 - Noise indicates that access to certain of these areas may be limited during construction. Additional clarification should be provided in the FEIS, if possible, explaining which areas may be closed or have limited access during construction activities for noise mitigation. (*Commenter: Heinz Mueller - EPA*)

    Response: Additional information on restricted access to recreational areas and parking areas during construction has been added to Final EIS Sections 3.12 - Noise, 3.13 - Transportation, and 3.15 - Recreation.

47. Details should be provided in the FEIS regarding the impact of staging and borrow areas on all resource areas. Several resource areas in the DEIS, including but not limited to Aquatic Ecology and Flooding/Floodplains, currently lack this discussion. Discussion format should be consistent between sections. (*Commenter: Heinz Mueller - EPA*)

    Response: The impact analyses in the Final EIS have been revised to address the impacts of the staging and borrow areas on all relevant resource areas.

48. In accordance with the CEQ regulations, the DEIS should include a cost-benefit analysis comparing the cost expenditure of millions of dollars constructing facilities with a 30 to 50 year functional expectancy against a 500-year storm event of unknown probability. (*Commenter: Dennis T. Stanczuk - HOATV*)

    Response: CEQ regulations for implementing NEPA (see §1502.23**)** do not require a cost-benefit analysis of a proposed action. The DEIS addresses permanent modifications to prevent the failure of the four dams during the Probable Maximum Flood (PMF). As is typical of large dams, TVA expects to operate and maintain the four dams, including the proposed permanent modifications, for many decades. The purpose and need for the permanent modifications, as explained in FEIS Chapter 1, is not based on the frequency of the PMF.

49. Information regarding the estimated costs of all project alternatives should be included in the FEIS for comparison as cost was a frequent topic during scoping. (*Commenter: Heinz Mueller - EPA*)

    Response: Updated cost comparison information is presented in Final EIS Section 2.4.

3.6 Other

No Conflict with Existing or Proposed Activities

50. The Tennessee Department of Environment and Conservation Division of Remediation reviewed the DEIS and determined there are no active Division of Remediation sites on or adjacent to the project areas. (*Commenter: Michelle B. Walker - TDEC*)

    Response: Comment noted.

Regulation and Permitting

51. Plans for the construction for the individual dam segments should be reviewed by an environmental permitting specialist of the Tennessee Department of Environment and Conservation. (*Commenter: Michelle B. Walker - TDEC*)

    Response: All stormwater pollution prevention plans and Notice of Intent (NOI) applications will be submitted to TDEC for review. All plans and applications will contain construction plans for the individual dam segments.

3.7 Socioeconomics

Impacts

52. The DEIS does not adequately analyze the potential environmental and socioeconomic impacts to existing and future development along Fort Loudoun and Tellico Lakes that would be caused by retention of floodwaters that reach the full PMF elevation. Economic and social impacts could be significant for property owners but are not addressed in the DEIS. What will be the impacts to property owners around the lakes if a PMF occurs at the newly estimated 500-foot level? When and how will property owners be informed of the increased risk? (*Commenters: Nils P. Johannesen, Howard Kastner, Dennis T. Stanczuk - HOATV*)

    Response: The DEIS did not address the economic impact of the PMF event to residents who live along the lake because the comparison of impacts between the base case (with HESCO barriers) to a permanent modification is non-existent and imposes no additional economic burden specifically on those lake residents. Even if the base case had been defined as “prior to HESCO barriers”, the economic impact would have been minimal. This same PMF event, if it were to occur at Tellico Dam without any modifications (temporary or permanent) would exceed the height of the earthen embankment at the dam. Water would continue to rise and cascade over the earthen embankment to a depth of two to three feet (elevation 833), and the embankment would erode to the extent that it completely fails. Thus the water level in Tellico Reservoir would achieve practically the same height (within an estimated few tenths of a foot) with or without modifications. The difference is that the modifications would prevent the sudden failure of Tellico and Fort Loudoun Dams, thereby 1) preventing the loss of the respective reservoirs and 2) reducing the property damage and potential loss of life downstream.

    TVA has no plans to notify homeowners and other stakeholders that they are located within the area inundated by the PMF because of the unlikely probability that a flood of this magnitude can occur. For those areas below the 500-year flood level, the flood probability has not changed and the delineation of the 100-year and 500-year floodplains remains unchanged. For those individuals that live above the 500-year flood elevation, their flood probability likewise has not materially changed. The only difference now is that they have updated information on the PMF. Floods larger than a 500-year flood, up to and including the PMF, have always been a possibility, and the modifications to the dams will not change this. Along TVA's reservoirs, TVA requires all habitable structures to be located above the 500-year flood level to minimize flood risk. Persons may incur whatever risk they choose, either knowingly or unknowingly above this level. Exposure to the PMF flood event is no different on Tellico Reservoir than on any other reservoir throughout the TVA system. In fact, the majority of the downtown area of Chattanooga lies well within the PMF delineation, with no appreciable decrease in property value that we are aware of.

Many property owners have chosen to build their residences as close to 500-year flood level as possible, in order to maximize their view and proximity to the water. As a result, many existing lakefront properties, as well as properties near the lake, were already within the previously defined PMF area prior to the recalculation of the PMF in 2008, and will continue to be within the PMF zone under the revised calculations. Based on historical trends in the area that show values of comparable residences increasing with proximity to the water (without regard to previous PMF calculation), it is unlikely that the revised PMF has had or will have any significant impact on the value of developed property around the reservoirs.

53. The HESCO barriers negatively impact property values, potential real estate sales, and tourism by blocking beautiful views of a desirable place to live. New residents promote growth and encourage commercial business which has broad area-wide impacts. (*Commenter: Richard Sawinski*)

Response: TVA acknowledges that new residents promote growth and encourage commercial business. The HESCO barriers are readily visible from few residential properties on the four reservoirs and TVA is unaware of evidence that the presence of the HESCO barriers has affected the marketability or values of these properties.

Mitigation Measures

54. Should homeowners get flood insurance to protect against an 'unknown probability' PMF? What mitigation measures does TVA propose to offset these increased insurance costs? How strongly will property values be impacted once the probability of the PMF becomes more widely recognized in the area? How will these impacts (property values, insurance costs, potential property loss) be mitigated? The DEIS inadequately addresses the potential impact to property values based on the perception that extreme flooding as defined by the PMF estimate is possible. (*Commenter: Nils P. Johannesen*)

Response: The purchase of flood insurance is a personal choice. TVA does not plan to compensate residents for the purchase of flood insurance. Loudon County, as well as other counties in the vicinity of the four subject reservoirs, participates in the National Flood Insurance Program (NFIP) and as a result homeowners, renters, and business owners can purchase flood insurance. See http://www.floodsmart.gov/floodsmart/pages/choose_your_policy/agent_locator.jsp to learn more about the NFIP and contact an agent. See the response to Comment 52 for additional information relevant to this comment.

The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in a particular drainage area. While it is correct that TVA's most recent PMF calculations (2008) increased from the previously calculated values, PMF elevations (regardless of their value) do not affect property development, are not considered in building code development, and are not commonly used for floodplain management or flood insurance regulations.

Currently, TVA does not allow residential construction along lakes/reservoirs within the 500-year floodplain. However, many property owners have chosen to build their residences as close to the boundary of that zone as possible, in order to maximize their view and proximity to the lake. As a result, many existing lakefront properties, as well as properties near the lake, were already within the previously defined PMF area prior to the recalculation of the PMF in 2008, and will continue to be within the PMF zone under the revised calculations. Based on historical trends in the area that show values of comparable residences increasing with proximity to the lake (without regard to previous PMF calculation), it is unlikely that the revised PMF will have any significant impact on the value of developed property around the lake.

3.8 Transportation

Infrastructure

55. Cumulative impacts associated with concurrent construction of the proposed action and construction of the new Highway 321 bridge are not addressed. (*Commenter: Dennis T. Stanczuk - HOATV*)

    Response: These cumulative impacts are addressed in Chapter 4 of the Draft EIS and the Final EIS.

56. Figure 2-10 (Figure 2-9 in the FEIS) does not show the future configuration of the highway with the new on/off ramps and shoulders. It also does not show the vertical orientation relative to the elevated Highway 321 ramps. Therefore, it is not possible to see what this alternative will truly look like in the future in coordination with the Highway 321 project. This figure should be redesigned. (*Commenter: Richard Sawinski*)

    Response: DEIS Figure 2-10 (Figure 2-9) has been revised in the Final EIS to better illustrate the 4.8-foot concrete floodwall on the upstream side of the current US 321 and the entrance/exit ramps to Highway 444. Most of the roadbed of the entrance/exit ramps adjacent to the reservoir and canal would remain relatively unchanged following the completion of the US 321 relocation project.

57. The DEIS did not address the one-lane traffic issues under the Highway 321 bridge as a result of installation of the HESCO barriers. (*Commenter: Richard Sawinski*)

    Response: A lane of US 321 and the SR 444/Tellico Parkway ramp to US 321 under the US 321 bridge was closed during the installation of the HESCO barriers. This lane was reopened once the barriers were installed and, except for short-term maintenance closure, has remained open since then. The installation of the HESCO barriers did result in the closing of much of the shoulder of the north-bound lane in this area. This shoulder would remain closed following the installation of the proposed permanent dam modifications. Section 3-13 of the Final EIS discusses lane closures during construction.

Safety

58. The DEIS inadequately considers the safety and transportation impacts associated with the current placement of the HESCO barriers. Traffic safety along Highway 444 near dam segment FTL-3 has been impacted by the installation of the HESCO barriers. Placement of the barriers has eliminated a shoulder/safety lane for accident avoidance or emergency pull-off. An accident in this location would create a traffic hazard and delay. The placement of the HESCO barriers also creates a safety hazard for pedestrians. These impacts have not been adequately evaluated. TVA should evaluate adding mitigation measures to include a shoulder/emergency pull-off lane along dam segment FTL-3 on Highway 444 (and other appropriate places) and implement this change in coordination with the permanent floodwall modifications proposed in Alternative B. The DEIS should be revised to address these impacts and mitigation measures with respect to safety and transportation. (*Commenters: Richard Sawinski, Dennis T. Stanczuk - HOATV, Robert S. Van Fleet*)

    Response: TVA has carefully considered the impacts to safety and transportation during the planning of the proposed permanent dam safety modifications. The potential for impacts to safety and transportation is greatest in the vicinity of Fort Loudoun Segment FTL-3. While delaying the construction of the floodwall in this area until TDOT completed the US 321 relocation project would have reduced these impacts, this is not possible due to the overlapping schedules of the two projects. This also would not have eliminated the need to close parts of the ramp between Highway 444 and US 321 during construction of the floodwall. Under either action alternative, TVA would implement traffic control and other methods to reduce safety and transportation impacts during construction. TVA has also designed the floodwall to maximize the roadway width once construction is completed.

3.9 Visual Resources

Impacts

59. A number of the photographs and figures in the DEIS disregard the prospective of the automobile passenger and create the false impression that there is no visual impact. (*Commenter: Richard Sawinski*)

    Response: The photographs in the Final EIS have been revised and additional photographs added to better show the views of motorists.

60. Dam segments FTL-3, T-1, and T-4 are located at or near the primary traffic access points from U.S. Highway 321 to Fort Loudoun and Tellico Lakes. This area is recognized under Tennessee's Scenic Highways/Tennessee Parkways/National Scenic Byways Program to preserve the scenic beauty of Tennessee. Limited locations along Highway 444 are available for lake views and installation of the HESCO barriers has limited these

viewpoints further. The beautiful vistas are one of the reasons residents live in the area, and they inspire future property owners to generate economic growth. The DEIS inadequately analyzes the negative visual impact for passengers in automobiles on Highway 444 and for socioeconomic impacts on the area. TVA should modify the analysis for Alternative B to consider corrective actions or mitigation measures to restore views from Highway 444. (*Commenter: Richard Sawinski*)

> *Response:* Additional information on the visual impacts perceived by travelers on Highway 444, as well as on other highways in the vicinity of the four dam reservation, has been included in the Final EIS. The preferred Alternative B has also been modified to reduce and mitigate some of the visual impacts. Once the TDOT US 321 relocation project is complete, the proposed permanent dam modifications would have little impact on views from the portion of US 321 that crosses the Tellico Dam reservation and is designated as part of the Great Smoky Mountains Byway. Aside from the restricted view from the Highway 444 – US 321 ramps, the proposed permanent modifications have relatively little effect on views of the Tellico Reservoir from Highway 444.

61. Installation of permanent modifications do not resolve the visual impacts that were created when the HESCO barriers were installed. There is no adequate explanation for why they are needed. (*Commenter: Jack Hall*)

> *Response:* The need for the permanent modifications is explained in Chapter 1 of the Final EIS. The permanent modifications proposed in the preferred Alternative B will reduce some of the visual impacts created by the HESCO barriers.

62. The Contingent Valuation Method (CVM) should be used to estimate the impacts to visual resources and socioeconomics associated with implementation of the proposed action. If CVM is not used, TVA should explain why and should define and utilize and acceptable alternate method to value these attributes. (*Commenter: Dennis T. Stanczuk - HOATV*)

> *Response:* Neither CEQ's NEPA implementing regulations nor TVA's NEPA procedures specifically require the analysis of nonmarket values in EISs. TVA acknowledges the commenter's recommendation that the Contingent Valuation Method (CVM) be used to estimate the nonmarket value of several environmental attributes. CVM is an economic approach that involves surveying individuals on their willingness to pay (WTP) for a hypothetical program or their willingness to accept (WTA) compensation for a reduction in a program/attribute. The approach is considered controversial because no actual payments take place, and individuals who like a particular program/attribute could over-report the amount they'd be willing to pay, while those against a particular program/attribute could under-report. Contingent valuation is not the only method for determining non-market values of attributes such as hiking trails or views. The Bureau of Land Management, which routinely deals with scenic issues, developed an Instruction Memorandum describing when and how to consider nonmarket values in resource management planning. A key issue BLM cited for supporting the consideration of nonmarket values is: "A proposed action is likely to have a significant direct or indirect effect (as defined at 40 CFR 1508.8 and 1508.27), and the quality or magnitude of the effect can be clarified through the analysis of nonmarket values."

In response to public comments, TVA has modified the preferred Alternative B to minimize the visual impacts to less-than-significant. Moreover, the updated proposed action would result in very few long-term adverse impacts to recreational use of the areas in question, less in fact, than the no action alternative. Therefore, given the nature of the anticipated impacts to these resources, further assessment of nonmarket values of environmental attributes would not provide additional information useful in TVA's decision making process.

63. The HESCO barriers are visually unappealing and mar the beautiful views of the lakes and the mountains at key access points. They should be removed or replaced as quickly as possible. If permanent modifications are necessary they should be minimized to the extent possible to minimize visual impacts. (*Commenters: Sandi Ammon, Richard Sawinski, Mark F. Werner*)

    Response: Comment noted. The minimization of visual impacts was a major factor in the design of the permanent dam safety modifications under the preferred Alternative B. Design features reducing visual impacts include, depending on the particular location, use of earthen embankments instead of floodwalls, use of a combination of concrete barriers and raised embankments, placement of concrete floodwalls on the downstream side of embankments, and application of a pattern to concrete floodwalls.

64. The HESCO barriers are visually unappealing. (*Commenter: Howard Kastner*)

    Response: Comment noted. See the Response to Comment 63.

Mitigation Measures

65. A privately funded toll-based road could help off-set costs associated with restoring lake views. Costs should be kept at a reasonable amount, perhaps a nickel or less, per trip. This would likely be acceptable to most people in return for restoring views of the lake. (*Commenter: Richard Sawinski*)

    Response: The 2007 Tennessee Tollway Act provided the state the option of using tolls to pay for new highways, bridges, or additional highway lanes constructed after 2007. It does not allow the conversion of current roads or bridges to toll roads. Therefore, converting Highway 444 to a toll road to fund construction that would restore views of the reservoir is not feasible.

66. If permanent modifications are necessary they should blend in with the environment. Concrete floodwalls should be made visually less obtrusive through the use of earth tones, natural colors, or texturing. In areas where floodwalls would have high visibility, involve the community in making the walls visually appealing. School groups or classes could paint murals on the walls. The walls could be cast concrete with bas reliefs of scenes or abstract designs. Examples could include the sun, boats, or the view you would see if the wall was not present. (*Commenters: Unknown, Ronald Wendoloski*)

    Response: The preferred Alternative B minimizes the use of concrete floodwalls and, after further design and engineering analyses, has been modified from the DEIS to further reduce the length of concrete floodwalls and increase the use of earthen embankments. The concrete floodwalls would have a natural gray finish which would blend with other concrete dam features and rock riprap on existing embankments. As part of the preferred Alternative B, TVA proposes to use a textured and/or patterned finish to portions of floodwalls that would be readily visible to visitors on nearby roads and walkways.

67. The roadway at dam segments FTL-3, T-1, and T-4 should be raised in conjunction with installation of the permanent barrier modifications. This would restore some of the lake views for automobile passengers while also meeting TVA's design elevation requirements. The roadbed could be raised in the following locations. (1) An approximately 0.3 mile portion of Highway 444 could be raised to at or above 834.8 feet elevation. Doing so may make it possible to tie the proposed permanent floodwall and T-1 Canal Saddle Dam into the elevated roadway berm and therefore eliminate the proposed gap closure barrier between dam segments FTL-3 and T-1. This would restore views for automobile passengers while meeting TVA's elevation requirements. (2) The short road segment that extends beyond the end of dam segment T-4 on Saddle Dam No. 3 should be raised to provide passing automobiles a view of Tellico Lake. (3) Depending on the vertical and horizontal configurations associated with the new Highway 321 bridge connection tie-ins, consider raising the roadway to restore views of the lake for automobile passengers near dam segment FTL-3. TVA should work with the Tennessee Department of Transportation to fund and implement these changes to the roadway elevation to minimize impacts to visual resources. (*Commenters: Richard Sawinski, Richard Sawinski, Dennis T. Stanczuk - HOATV*)

    Response: Following completion of the new US 321 bridge, the roadbed would no longer be adjacent to the northern half of Segment FTL-3. The southern half of the proposed FTL-3 floodwall would be adjacent to the roadway connecting eastbound SR 444 traffic to northbound US 321. TVA discussed raising this roadbed with the Tennessee Department of Transportation. Due to concerns about maintaining adequate clearance between the roadbed and the US 321 bridge over the Tellico canal, this was not feasible. Raising SR 444 in the vicinity of Segments T-1 and T-4 is not economically feasible.

68. The view along Highway 444 could be improved by cutting down some of the 'volunteer' trees and brush scrub that has grown up in proximity to the Tellico Saddle Dam 3 between the highway and the water. (*Commenter: Richard Sawinski*)

    Response: Some of these trees were planted to correct a severe erosion problem on the steep slope between Highway 444 and the reservoir and their removal could result in new erosion problems. Prior to planting the trees, TVA attempted to control the erosion by other methods that were not effective. The reservoir remains visible from Highway 444 at two locations within half a mile to the south of Saddle Dam 3 and at Saddle Dam 1 about 0.8 miles to the north.

69. TVA could consider creating a wayside viewing area at the south end of the saddle dam where there is a muddy pull-out location. Creating a viewing area here by putting in a parking lot and trimming some vegetation would be a way of 'giving views back' and would clean up a currently unsightly area. (*Commenter: Richard Sawinski*)

    Response: TVA acknowledges that creating a viewing area at the unmaintained roadside pull-off about 250 feet south of Tellico Saddle Dam 3 (Segment T-4) could mitigate some of the visual impacts of the proposed permanent dam modifications. As noted in the previous comment response, some of the vegetation between the highway and the reservoir in this area was planted to control erosion. The volume of traffic on the adjacent two-lane Tellico Parkway is high and vehicles frequently travel at a high rate of speed. Due to the configuration of the roadway, the sight distance of northbound traffic is limited due to the rise in the roadway just south of Saddle Dam 3. These factors could make ingress and egress to the proposed viewing area difficult. TVA has no plans to construct the roadside viewing area suggested by the commenter.

3.10 Water Resources

Water Resources Impact Assessment

70. The proposed action would not create a significant impact on programs regulated under the Tennessee Department of Environment and Conservation's Ground Water Management Section, Safe Dams Program, or Water Well Program. (*Commenter: Michelle B. Walker - TDEC*)

    Response: Comment noted.

4.0 AGENCY COMMENT LETTERS

Rec'd 11/21/12

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE, TENNESSEE 37243-0435

ROBERT J. MARTINEAU, JR.
COMMISSIONER

BILL HASLAM
GOVERNOR

November 16, 2012

Via First Class Mail and Electronic Mail to cpnicholoson@tva.gov

Charles P. Nicholson
Senior Manager, NEPA Interface
Tennessee Valley Authority
400 West Summit Hill Drive, WT 11D
Knoxville, TN 37902-1499

Mr. Nicholson:

Please find enclosed the Tennessee Department of Environment and Conservation's (TDEC) comments on the Tennessee Valley Authority's (TVA) Draft Environmental Impact Statement (DEIS) for proposed dam safety modifications at Cherokee, Fort Loudon, Tellico, and Watts Bar Dams in Grainger, Jefferson, Loudon, Rhea and Meigs counties, Tennessee. TVA proposes to remove temporary, stonefilled HESCO barriers that were installed in 2009 and replace them with permanent dam modifications in the form of a combination of concrete floodwalls, raised earthen embankments or earthen berms and gap closure barriers. TVA notes that it is replacing the temporary HESCO barriers as requested by the Nuclear Regulatory Commission. TDEC has the following comments on the DEIS:

TDEC's Division of Water Resources has reviewed the DEIS and it addresses all the relevant impacts and issues relating to water quality. TDEC appreciates TVA's commitment to utilizing best management practices to avoid and/or mitigate impacts to water resources. As TVA notes, coverage under a Construction General Permit may be required. Although TVA notes that an Aquatic Resource Alteration Permit (ARAP) would not be needed and no construction will occur in the water, such a permit may be necessary if the projects involve work that is being done along the banks. TDEC requests TVA review the individual dam projects and the associated construction work and contact TDEC if there are questions as to whether an ARAP is required.

Additionally, the Water Quality Branch of the Division of Water Resources also reviewed the DEIS and the project, as proposed, does not pose a significant impact on programs regulated under the Ground Water Management Section, the Safe Dams Program or the Water Well Program.

The Division of Remediation has reviewed the DEIS and its project files and concluded that there are no active Division of Remediation sites on or adjacent to the areas shown.

Please contact me should you have any questions regarding these comments.

Sincerely,

Michelle B. Wa

Michelle B. Walker
Director, Office of Policy and Planning
Phone: (615) 532-9668

cc: Mary Parkman, TDEC, Office of General Counsel
Regan McGahen, TDEC, Division of Water Resources
Scotty D. Sorrells, TDEC, Division of Water Resources
Robert A. Binford, TDEC, Division of Remediation

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Richard B. Russell Federal Building
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ER 12/735
9043.1

November 8, 2012

Charles P. Nicholson
Manager, NEPA Compliance
Tennessee Valley Authority
400 W. Summit Hill Drive, WT 11D
Knoxville, TN 37902-1499

Re: Comments and Recommendations on the Draft Environmental Impact Statement (DEIS) for Tennessee Valley Authority's Dam Safety Modifications at Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams, Tennessee

Dear Mr. Nicholson:

The United States Department of the Interior has reviewed the Tennessee Valley Authority's (TVA) Draft Environmental Impact Statement (DEIS) for TVA's Proposed Dam Safety Modifications at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams, Tennessee. We offer the following comments. The purpose of the proposed action is to permanently correct identified safety deficiencies at these dams. In 2009, TVA implemented precautionary "temporary" measures and installed stone-filled HESCO baskets, a multi-cellular gabion used for flood control, on top of the earth embankments at the four dams and strengthened the downstream embankment of Watts Bar Dam with a concrete mat structure to minimize the potential effect of a Probable Maximum Flood (PMF) event. These measures were intended to prevent dam overtopping, possible impacts to downstream embankments and provide additional floodwater storage capacity. The PMF is defined as the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in a particular drainage area. TVA's more recent updated modeling of flood conditions during a PMF event showed the maximum floodwater elevations are higher than previously calculated, indicating that a worst-case scenario, winter storm could cause flows to overtop the subject dams even with the floodgates wide open, possibly resulting in dam failure. Failure of any of the dams would result in loss of stored water for navigation, impacts to fish and wildlife resources, loss of recreational opportunities, and possible property damage, personal injury and loss of life. Failure could also result in additional failures to downstream dams. The proposed "permanent" dam safety modifications would allow the dams to safely pass the PMF floodwaters and prevent potential damage to the dams from overtopping floodwaters.

TVA has identified three alternatives that consider the level of risk reduction to the public, constructability, potential environmental impacts and cost. The first, Alternative A (the No Action Alternative), is the current existing condition at the Cherokee, Fort Loudoun, Tellico, and Watts Bar Dam sites. Under this alternative, TVA would continue to use HESCO baskets to minimize the potential for failure of the four dams and prevent increased flooding at downstream locations, including TVA's nuclear plants during the PMF.

The second potential alternative, identified by TVA as Alternative B (the Preferred Action Alternative), would involve removal of the HESCO baskets and permanent modifications to each of the four dam. These modifications would include installing a combination of concrete floodwalls, raised earthen embankments or earthen berms, and gap closure barriers (gate-like barriers used to close gaps between the floodwalls.

The third alternative, identified by TVA as Alternative C (the second Action Alternative), would involve removal of the HESCO baskets, allowing the permanent concrete mat structure installed in the downstream embankment of Watts Bar Dam to remain in place and installing permanent dam modifications at each of the four dam structures. The potential modifications would consist entirely of concrete floodwalls and gap closure barriers, but would not include any embankments or berms.

TVA has indicated under the "The Affected Environment and Environmental Consequences" of the DEIS that the No Action Alternative (Alternative A) would result in fewer impacts than the Preferred Action Alternative (Alternative B), but it is not an adequate long-term solution for addressing the purpose and need of the proposed project. TVA further indicated that: (1) Alternatives B and C, the action alternatives, consist of permanent modifications to the dams along the same alignments and at the same heights, and therefore, are generally similar in nature, and (2) differences in potential impacts associated with Alternative B versus Alternative C would be negligible for the majority of resource areas, including "Wetlands" and "Threatened and Endangered Species".

TVA indicated in the DEIS that field surveys were conducted to determine if wetlands were present within the immediate project area of each dam. No wetlands were found at site-specific areas where dam modifications are proposed or in proposed construction yard or borrow areas in the near vicinity. A survey of the National Wetlands Inventory found no wetlands in, or immediately adjacent to the proposed project areas. The nearest wetlands to the proposed project sites include a small, freshwater emergent wetland approximately 0.25- mile southeast of the proposed Fort Loudoun dam modification and a small, forested wetland approximately 0.75-mile southeast of the proposed Watts Bar Dam project area. Based on the absence of wetlands within the four areas where permanent dam modifications are proposed, TVA determined that no direct or indirect impacts would result from the No Action or Action alternatives.

Within a 10-mile radius of one or more of the four subject dams in the DEIS, TVA identified: (1) 11 federally endangered aquatic mollusk species, including Anthony's riversnail (*Athearnia anthonyi*), birdwing pearlymussel (*Lemiox rimosus*), dromedary pearlymussel (*Dromus dromas*), fanshell (*Cyprogenia stegaria*), fine-rayed pigtoe (*Fusconaia cuneolus*), orange-foot pimpleback (*Plethobasus cooperianus*), pink mucket (*Lampsilis abrupta*), ring pink (*Obovaria retusa*), rough pigtoe (*Pleurobema plenum*), shiny pigtoe pearlymussel (*Fusconaia cor*) and white wartyback (*Plethobasus cicatricosus*), (2) one federally threatened aquatic fish species, the snail darter (*Percina tanasi*), and (3) two proposed for federal listing as endangered aquatic species, including the sheepnose (*Plethobasus cyphyus*) and spectaclecase (*Cumberlandia monodonta*). TVA further noted that no listed aquatic species are known or likely occur on or in the immediate vicinity of the proposed borrow areas and that no critical habitat has been designated in the proposed project areas for any federally listed species. TVA determined that 7 of the identified federally listed aquatic species (snail darter, dromedary pearlymussel, fanshell, orangefoot pimpleback, pink mucket, shiny pigtoe and white wartyback) and the two proposed for federal listing as endangered aquatic species (sheepnose and spectaclecase) are known to occur in the immediate vicinities of the dams based on their habitat requirements, collection records and population status, or are likely to occur in the upper tailwaters downstream of one or more of the dams based on records since the 1970s.

TVA indicated in the DEIS that no federally listed terrestrial fauna are known or likely to occur on or in the immediate vicinities of the four dams or proposed borrow areas. No federally listed terrestrial animal species were observed during field surveys of the proposed project areas in May 2011. TVA stated that the federally endangered gray bat (*Myotis grisescens*) has been documented as occurring in Meigs and Rhea counties, where Watts Bar Dam is located, and Grainger and Jefferson counties, where Cherokee Dam is located. All gray bat records from these counties are greater than three miles from the dams. TVA determined that no caves, which gray bats are known to inhabit throughout the year, were identified within the proposed project areas during field surveys. TVA further stated that, reservoirs and tailwaters adjacent to each of the project areas provide suitable foraging habitat for gray bats.

TVA indicated in the DEIS that the federally endangered Indiana bat (*Myotis sodalis*) has been reported as wintering in a cave in Jefferson County and a cave in Grainger County. TVA stated that both of these caves are more than three miles from Cherokee Dam, and the Grainger County population is likely extirpated. TVA determined that there are no summer records of Indiana bats from the immediate vicinities of any of the four subject dams and indicated that no suitable winter caves or summer roosting habitats were identified during field surveys of the proposed project areas.

TVA also indicated in the DEIS that the bald eagle (*Haliaeetus leucocephalus*), currently afforded certain levels of protection under the Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668c), enacted in 1940, and the Migratory Bird Treaty Act of 1918 (16 U.S.C., Chapter 7, Subchapter II), nests in the four counties where the dams are located (Grainger, Jefferson, Loudon, Meigs and Rhea). TVA noted that: (1) the closest documented active bald eagle nest to Fort Loudoun and Tellico dams is approximately 1,400 feet from Tellico Dam, at the junction of the Tennessee and Little Tennessee rivers, (2) a pair of bald eagles have built two nests approximately one mile downstream of Cherokee Dam in recent years, (3) all bald eagle nests in Meigs and Rhea counties are more than three miles from Watts Bar Dam, with the exception of Tellico Saddle dams No. 2 and No. 3, located approximately 1.4 miles south of Tellico Dam, (4) no suitable forested perching and nesting habitat occurs in the immediate vicinities of any of the sites where proposed permanent dam modifications would occur, and (5) all of the reservoirs and their tailwaters provide suitable foraging habitat.

TVA indicated in the DEIS that no federally listed plants or candidate plant species, proposed for listing, are known to occur in the five counties where the dams are located. TVA found no listed or candidate plant species during field surveys of the proposed project vicinities in May 2011 and have determined, based on habitats present, that none are likely to occur.

TVA conducted an analysis to determine any potential direct or indirect impacts that could occur to federally listed species as a result of implementing any of the three alternatives presented in the DEIS (discussed under 3.8.2 Environment Consequences, pages 3-40 through 3-42 in the DEIS) and made the following determinations: (1) under Alternative A (the No Action Alternative), no direct or indirect impacts would occur to aquatic fauna, terrestrial fauna, or aquatic and terrestrial flora because none of the HESCO baskets occur in water or would require stream disturbance, the status and conservation of terrestrial species would continue to be determined by other actions and changes that would occur in the area over time (i.e., population trends, land use and development, air/water/soil quality, recreational patterns, and cultural, ecological and educational changes), and neither rare plants or habitat to support rare plants were found in the where HESCO baskets are currently in place; (2) under Alternative B (the Preferred Action Alternative), no direct or indirect impacts to listed aquatic species are anticipated because construction best management practices (BMPs) would minimize significant runoff of sediment or pollutants during construction and establishment of vegetative cover on the earthen berms would prevent erosion and runoff from those areas after construction. The use of standard BMPs to control to siltation during construction and establishment of vegetative cover on the berms would minimize adverse effects on aquatic organisms which constituent part of the food supply for terrestrial listed species reported in the vicinities of the dams. TVA will resurvey areas surrounding Tellico Saddle dams No. 2 and No. 3 for bald eagle nests prior to scheduling proposed construction work. If an active eagle nest is located within 660 feet of either site (in accordance with guidelines in the BGEPA), TVA will schedule construction activities to avoid the December 16 – May 31 bald eagle nesting season. With the adoption of this measure, TVA anticipates no direct or indirect impacts to federally listed terrestrial species under Alternative B. TVA anticipates no direct or indirect impacts to federally listed plants under Alternative B because no listed plants or their habitats occur in the project areas where HESCO baskets would be replaced with floodwalls and berms; (3) under Alternative C (the second Action Alternative), no direct or indirect impacts on federally listed aquatic species are anticipated because no work would occur in the water, and there is little potential for sediment runoff into forebays and tailwaters of the subject dams from construction of the floodwalls (compared to Alternative B, which included earthen embankments). No suitable gray bat or Indiana bat habitat was identified in the proposed project area. TVA will resurvey areas surrounding Tellico Saddle dams No. 2 and No. 3 for bald eagle nests prior to scheduling proposed construction work. If an active eagle nest is located within 660 feet of either site, TVA will schedule construction activities to avoid the December 16 – May 31 bald eagle nesting season. With the adoption of this measure, TVA anticipates no direct or indirect impacts to federally listed terrestrial species under Alternative C. TVA anticipates no direct or indirect impacts to federally listed plants under Alternative C because no listed plants or their habitats occur in the project areas where HESCO baskets would be replaced with floodwalls.

Regarding our review of the DEIS, we offer the following comments and recommendations:

(1) TVA has indicated that two aquatic species, the sheepnose and spectaclecase, are proposed for federal listing as endangered species under 3.8.1.1. Aquatic Fauna (pages 3-35 through 3-38) in the DEIS. The status of these two species has recently changed, and both are currently listed as federal endangered species. Therefore, we recommend that TVA make an effect determination based upon the current status of the sheepnose and spectaclecase.

(2) TVA has indicated that, "no critical habitat has been designated in the project areas for any of the federally listed species" under 3.8.1.1. Aquatic Fauna (page 3-36, first paragraph) in the DEIS. However, the status of federally designated critical habitat was not included or described under 3.8.1.2. Terrestrial Fauna or 3.8.1.3. Aquatic and Terrestrial Flora in the DEIS. We recommend that the status of critical habitat for terrestrial animals and plants in the proposed project vicinities also be included under 3.8.1.2. and 3.8.1.3., respectively.

(3) Under 3.8.1.2. Terrestrial Fauna of the DEIS (page 3.38, first paragraph), the third sentence states, "the only listed terrestrial animal documented within three miles of one or more of the four dams is the bald eagle (*Haliaeetus leucocephalus*)". The fourth and fifth sentences describe the species as being delisted and indicate that, "the bald eagle remains protected under the BGEPA the Migratory Bird Treaty Act (MBTA)". The fourth and fifth sentences accurately depict the current status of the species. However, the third sentence needs to be revised because the bald eagle is no longer listed.

(4) Under 3.8.1.2. Terrestrial Fauna of the DEIS (page 3.38, first paragraph), the first sentence states, "No listed terrestrial fauna are known or likely to occur on or in the immediate vicinity of the four dams or the proposed borrow areas". Yet, under 3.8.2.2. Alternative B – Combination Floodwalls and Embankments/Berms, <u>Terrestrial Fauna</u>, at the end of the second sentence (page 3-41), reference is made to, "terrestrial ETSC species reported from the vicinity of the dams". The inconsistencies between these two sentences needs to be rectified and listed terrestrial species status accurately described.

(5) We request that TVA coordinate frequently and early with the Department regarding the proposed action to remain in compliance with section 7 of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act of 1918.

(6) TVA indicated in the DEIS that the Grainger County population of gray bats is likely extirpated. However, the cave in Grainger Country, which TVA makes reference to as a cave that has been used by grey bats in the past for wintering, has not been recently resurveyed to our knowledge. Therefore, the more appropriate characterization of the current grey bat status in Grainger County would be to state, "the use of the Grainger County cave by grey bats has not been documented in recent years", rather than indicating that the population is likely extirpated.

Thank you for the opportunity to comment on this project. If you have any questions regarding our comments, please contact Todd Shaw on (931) 525-4985 or via email at ross_shaw@fws.gov. I can be reached on (404) 331-4524 or by email at joyce_stanley@ios.doi.dov.

Sincerely,

Joyce Stanley, MPA
Regional Environmental Protection Specialist

cc: Jerry Ziewitz – FWS
Brenda Johnson - USGS
Anita Barnett – NPS
Li-Tai Sikiu Bilbao – OSMRE
OEPC - WASH

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

November 16, 2012

Mr. Charles P. Nicholson
NEPA Compliance Manager
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902

Subject: EPA NEPA Review Comments on TVA's DEIS for "Dam Safety Modifications at Cherokee, Fort Loudon, Tellico and Watts Bar Dams"; CEQ #20120315

Dear Mr. Nicholson:

The U.S. Environmental Protection Agency (EPA) has reviewed the subject Tennessee Valley Authority (TVA) Draft Environmental Impact Statement (DEIS) in accordance with our responsibilities under Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. It is our understanding that TVA proposes to implement permanent solutions to minimize the potential effects of the Probably Maximum Flood (PMF) event at the Cherokee, Fort Loudon, Tellico and Watts Bar Dams.

The PMF event is defined in the EIS as the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in a particular drainage area.[1] To minimize the potential effects of the PMF event, TVA implemented precautionary measures and installed stonefilled HESCO barriers at all four dams in 2009. In a January 25, 2012 letter the Nuclear Regulatory Commission (NRC) stated that the "*The NRC staff is unable to conclude that these sand baskets were designed to withstand impacts from large debris during a flood. If a design flood were to occur, there is a high likelihood that significant debris would accompany the flood waters which could impact the baskets. There is the potential for this debris to damage the baskets or push the individual baskets apart causing a breach.*"[2] In this DEIS, TVA explores permanent solutions for replacement of the stonefilled HESCO barriers at all four dams.

Alternatives

TVA analyzed three alternatives in the DEIS including the no-action alternative:

- **Alternative A**: No Action Alternative

[1] p. iii of DEIS
[2] p. 1-7 of DEIS

- **Alternative B (preferred):** Permanent Modifications of Dam Structures: Concrete Floodwalls and Earthen Embankments/Berms

- **Alternative C:** Permanent Modifications of Dam Structures: All Concrete Floodwalls

Under both Alternatives B and C, the concrete floodwalls and/or earthen embankments would vary in height from 2.3 feet to 6.6 feet depending on the location.[3] EPA appreciates that TVA identified the agency preferred alternative (Alternative B) in the DEIS.

TVA chose to combine discussions of the affected environment and environmental consequences into Chapter 3. TVA provided analysis of the proposed action's impact on the following resource areas: Geology and Soils, Water Resources, Air Quality and Greenhouse Gas Emissions, Flooding and Floodplains, Wetlands, Aquatic Ecology, Terrestrial Ecology, Threatened and Endangered Species, Land Use, Socioeconomics and Environmental Justice, Cultural and Historic Resources, Noise, Transportation, Visual Resources, Recreation, Solid and Hazardous Waste, and Public Safety. The summary table (ES-1) in the executive summary provides a clear and concise overview of the alternatives discussed in the EIS and the potential impacts on different resource areas. EPA encourages resource agencies to uses these types of tables to summarize impacts of proposed actions.

EPA Recommendations

Probable Maximum Flood (PMF) Event Discussion:
The PMF event is the real driving force of the proposed action by TVA. If not for estimates of the PMF event causing elevations at the dams that would cause water to flow over the top of the them, TVA would not have pursued the temporary solution of the HESCO barriers or the permanent solutions proposed in this DEIS. EPA believes the description of the PMF event and how the PMF elevation is determined should be very clear. It is stated in the DEIS that the PMF is "defined as the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in a particular drainage area."[4] EPA recommends a more detailed definition of the PMF event be provided in the FEIS. EPA recommends that the additional details include examples of a "critical meteorological and hydrological" event.

Public Comments:
EPA appreciates TVA's efforts to categorize and summarize the significant public comments on this proposed action. EPA notes that the majority of the commenters requested that the HESCO barriers be removed and a significant number of commenters were concerned about the adequacy of the HESCO barriers. These public positions

[3] p. iii of DEIS
[4] p. 1-1 of DEIS

appear to reinforce TVA's preferred alternative of removal of the HESCO barriers and implementation of a permanent solution.

Engineering Constraints:
In the discussion section of the alternatives in the DEIS it is stated that "Due to site and engineering constraints, floodwalls were selected as the permanent modification type for five of the six Cherokee Dam segments."[5] EPA recommends that these "engineering constraints" at the Cherokee Dam site be further explained in the FEIS.

Cost Estimates for Alternatives:
Minimal information is provided with regard to the cost of maintaining the existing HESCO barriers and the construction of the permanent solutions described in Alternatives B and C. EPA recommends providing additional details regarding the estimated cost of all Alternatives in the FEIS. Based on Table 1-2, cost of these projects is listed as the fourth most commented on issue during scoping.

Staging and Borrow Areas:
No discussion was provided for the impact of the staging and borrow areas for several resource areas (Aquatic Ecology, Flooding / Floodplains, etc.). EPA recommends that additional details be provided in the FEIS regarding the impact of staging areas and borrow areas on these resources. Using a consistent format for the environmental consequences section would be helpful for the reader.

Noise Impact Mitigation:
Noise impacts associated with the projects at all the dams are discussed in great detail in Chapter 3 - Section 3.12. When discussing mitigation associated with noise impacts, it is stated in the DEIS that "With implementation of mitigation measures such as limiting access to certain recreation areas during construction, noise impacts would be minimized to a certain extent."[6] TVA states in other areas of the DEIS that it is somewhat unclear on which areas may have limited access. Since access to recreational areas and parking areas can impact the public use of these areas, EPA recommends that TVA provide additional clarification (if available) in the FEIS on areas proposed to be closed during construction or limited access for noise mitigation.

EPA DEIS Rating

EPA commends TVA for its efforts to develop an EIS that provides the public with a clear set of alternatives for permanent solutions to the PMF event. EPA request that TVA provide specific responses to our comments in a dedicated section in the FEIS. EPA rates this DEIS as an "LO" (Lack of Objection).

[5] p. 2-4 of DEIS
[6] p. 3-84 of DEIS

EPA appreciates the opportunity to review the DEIS. Should TVA have questions regarding our comments, please feel free to contact Dan Holliman of my staff at 404/562-9531 or holliman.daniel@epa.gov.

Sincerely,

Heinz J. Mueller
Chief, NEPA Program Office
Office of Policy and Management

APPENDIX C

CONSULTATION CORRESPONDENCE

TVA

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

September 20, 2011

Mr. E. Patrick McIntyre, Jr.
Executive Director
Tennessee Historical Commission
2941 Lebanon Road
Nashville, Tennessee 37243-0442

Dear Mr. McIntyre:

TENNESSEE VALLEY AUTHORITY (TVA), PERMANENT DAM MODIFICATIONS AT CHEROKEE, FT. LOUDOUN, TELLICO & WATTS BAR DAMS, GRAINGER, JEFFERSON, LOUDON, RHEA, AND MEIGS COUNTIES, TENNESSEE

TVA proposes to develop permanent solutions for dam safety modifications to replace interim measures that were put into place at Cherokee, Ft. Loudoun, Tellico, and Watts Bar dams. TVA is currently considering two action alternatives: Action Alternative A: permanent modifications to dam structures; and Action Alternative B: removal of the existing HESCO baskets before the end of their useful life. Proposed permanent modifications (Action Alternative A) would consist of the installation of concrete barriers and/or the widening of existing earthen embankments. TVA earlier installed interconnected, fabric-lined, sand-filled HESCO baskets along the tops of earthen dams at each of the four dams. The HESCO baskets effectively raised the profiles of each dam three to four feet. Under Action Alternative B, these HESCO baskets would be removed.

No cultural resources have been identified in any of the APEs. The National Register of Historic Places (NRHP) eligibility of the four dams has not been previously evaluated.

TVA finds that the proposed actions under Action Alternative A have no potential to affect archaeological resources due to the fact that the proposed permanent dam modifications would be installed on the surface of extensively disturbed ground. The majority of the affected area at Cherokee Dam consists of artificial ground that was put into place during dam construction, when excavation to depths of up to 45 feet took place. The entire Ft. Loudoun affected area consists of road shoulders, which are composed of pavement on artificial fill, and lacks undisturbed native soils. The entire Tellico Dam affected area consists of constructed embankments, with the exception of the approximately 320-foot long corridor along the entrance drive to Tellico Recreation Area. This corridor consists of the road shoulder, which was affected by cut and fill activities during road construction. During the construction of Watts Bar Dam, portions of the affected area closest to Highway 68 were subject to very extensive cut and fill operations and the construction of the east dam embankment. The portion of the affected area adjacent to the Watts Bar Dam Recreation Area was also affected by construction activities, although to a lesser extent. Due to these ground-disturbing activities, the potential for intact archaeological resources in the Watts Bar affected area is very low. Based on all the above considerations, TVA finds that there is little or no potential for intact archaeological resources at any of the four dams under Action Alternatives A and B. Therefore TVA considers that Action Alternatives A and B have no potential to affect archaeological resources.

TVA identified the APE for architectural resources (for both action alternatives) as the dams themselves including the powerhouses. TVA contracted with TRC Environmental Corporation (TRC) to evaluate the NRHP eligibility of each of the four dams. Enclosed is one copy of the draft report titled *Phase I Architectural Assessment for the Proposed Safety Modifications at Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams, Grainger, Jefferson, Loudon, Rhea, and Meigs Counties, Tennessee*, and one electronic copy on CD.

TRC recommends that Cherokee, Ft. Loudoun, and Watts Bar dams be considered eligible for the NRHP under eligibility criteria A and C for historical and architectural significance. TVA finds that there would be no effects to any of these dams from the No Action Alternative and Action Alternative B. TRC finds that although there would be visual effects to Cherokee, Ft. Loudoun, and Watts Bar dams from Action Alternative A, the effects would not be adverse. TRC recommends that the low profile of the proposed floodwall at Cherokee Dam (four feet) would not compromise the integrity of the dam or diminish its architectural and historic significance. TRC recommends that the three project sites associated with Ft. Loudoun Dam will be largely outside the visual line-of-sight to the dam, and the nearest of these project areas is partially hidden by the presence of the US-321 Bridge. TRC recommends further that the low profile of the proposed floodwall at Fort Loudon Dam (four feet) will not compromise the integrity of the dam or diminish its architectural or historical significance. TRC recommends that the low profile of the proposed flood wall at Watts Bar Dam (four feet) will not compromise the integrity of the dam or diminish its architectural or historical significance, and that the flood wall will not stand out as a visual intrusion to the historic setting of the dam, which has been compromised by the construction of the cooling towers of the Watts Bar Nuclear Plant. TRC recommends that Tellico Dam is ineligible for the NRHP.

TVA has reviewed the enclosed report and agrees with the recommendations of the authors. Pursuant to 36 CFR Part 800.5(b), we are seeking your concurrence with TVA's findings and recommendations that no historic properties would be adversely affected by the proposed undertaking.

Should you have any questions or comments, please contact Richard Yarnell in Knoxville, Tennessee, at wryarnel@tva.gov or (865) 632-3463.

Sincerely,

K Pilarski

Kim Pilarski, Acting Manager
Cultural Compliance
Environmental Permits and Compliance
WT 11D-K

SCC:JSB
Enclosure
cc: Ms. Jennifer Barnett (Enclosure)
Tennessee Division of Archaeology
1216 Foster Avenue, Cole Bldg. #3
Nashville, Tennessee 37210

Cynthia M. Anderson, LP 5D-C
Charles L. Bach, WT 10C-K
Kelly R. Baxter, WT 11C-K
Brenda E. Brickhouse, LP 5U-C

D. Mark Hastings, WT 6A-K
Susan J. Kelly, LP 5U-C
Anita E. Masters, LP 5U-C
Kenneth P. Parr, LP 5U-C
EDMS, WT 11D-K

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

September 29, 2011

Ms. Kim Pilarski
Tennessee Valley Authority
400 West Summet Hill Dr.
Knoxville, Tennessee, 37902-1499

RE: TVA, PERMANENT DAM MODIFICATIONS/CHEROKEE, FT. LOUDOUN, TELLICO, AND WATTS BAR DAMS, GRAINGER, JEFFERSON, LOUDON, RHES, AND MEIGS COUNTIES

Dear Ms. Pilarski:

In response to your request, received on Wednesday, September 21, 2011, we have reviewed the documents you submitted regarding your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicant for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800. You may wish to familiarize yourself with these procedures (Federal Register, December 12, 2000, pages 77698-77739) if you are unsure about the Section 106 process. You may find additional information concerning the Section 106 process and the Tennessee SHPO's documentation requirements at. http://www.tennessee.gov/environment/hist/federal/sect106.shtml

Considering available information, we find that the Area of Potential Effects contains three cultural resources eligible for listing in the National Register of Historic Places: Cherokee, Ft. Loudoun, and Watts Bar Dams. We further find that the project as currently proposed will NOT ADVERSELY AFFECT ANY PROPERTY THAT IS ELIGIBLE FOR LISTING IN THE NATIONAL REGISTER OF HISTORIC PLACES. Therefore, this office has no objection to the implementation of this project. Please direct questions and comments to Joe Garrison (615) 532-1550-103.
We appreciate your cooperation.

Sincerely,

E. Patrick McIntyre, Jr.

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jyg

Nicholson, Charles P

From:	Ezzell, Patricia Bernard
Sent:	Monday, June 25, 2012 4:20 PM
To:	Nicholson, Charles P
Subject:	FW: TVA, PREPARATION OF ENVIRONMENTAL ASSESSMENT OR ENVIRONMENTAL IMPACT STATEMENT FOR PERMANENT DAM MODIFICATIONS AT CHEROKEE, FORT LOUDOUN, TELLICO, AND WATTS BAR DAMS, TENNESSEE

From: Ezzell, Patricia Bernard
Sent: Tuesday, July 05, 2011 9:56 AM
To: 'rallen@cherokee.org'; 'Tyler B. Howe'; 'Lisa Larue'; 'Kirk Perry'; 'LaDonna Brown'; 'aberryhill@muscogeenation-nsn.gov'; 'tisham@muscogeenation-nsn.gov'; 'espain@muscogeenation-nsn.gov'; 'Bryant J. Celestine'; 'Augustine Asbury'; 'kialegeetribal@yahoo.com'; 'CHARLES COLEMAN'; 'Jennifer Pietarila'; 'hellis@astribe.com'; 'Robin Dushane'; 'Kim Jumper'
Cc: 'russtown@nc-cherokee.com'; 'Gingy Nail'; 'annemullins@semtribe.com'
Subject: TVA, PREPARATION OF ENVIRONMENTAL ASSESSMENT OR ENVIRONMENTAL IMPACT STATEMENT FOR PERMANENT DAM MODIFICATIONS AT CHEROKEE, FORT LOUDOUN, TELLICO, AND WATTS BAR DAMS, TENNESSEE

Good Morning,
I hope this email message finds you well. This email provides notification that the Tennessee Valley Authority (TVA) intends to prepare an environmental assessment (EA) or an environmental impact statement (EIS) addressing the impacts of various alternatives for implementation of permanent modifications to the existing dam facilities at Cherokee, Fort Loudoun, Tellico, and Watts Bar dams in Tennessee. On June 14, 2011, TVA published a notice of intent in the *Federal Register* to prepare an EA or EIS. The level of review will be determined after the public scoping process has been completed.

TVA appreciates scoping comments or input that you have on particular issues that should be addressed in the EA or EIS. Comments on the scope of this EA or EIS should be submitted no later than August 5, 2011. The current schedule calls for having a draft EIS available by late summer (2011). You will be notified when the draft EA or EIS is available for comment.

Background information and an online comment form are available at the TVA Web site, http://www.tva.com/environment/index.htm. If you have questions or need additional information, please do not hesitate to contact me in Knoxville, Tennessee, at (865) 632-6461 or pbezzell@tva.gov.

Sincerely,

Pat

Pat Bernard Ezzell
Program Manager
Tribal Liaison and Corporate Historian
Tennessee Valley Authority
400 W. Summit Hill Drive
460 WT 11D-K
Knoxville, Tennessee 37902
Phone: (865) 632-6461
E-mail: pbezzell@tva.gov

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

May 15, 2013

Mr. Mary Jennings
Field Supervisor
U. S. Fish and Wildlife Service
446 Neal Street
Cookeville, Tennessee 38501

Dear Ms. Jennings:

REQUEST FOR ENTRY INTO AN INDIANA BAT CONSERVATION MEMORANDUM OF AGREEMENT (MOA): TENNESSEE VALLEY AUTHORITY PERMANENT DAM SAFETY MODIFICATIONS AT CHEROKEE, FT. LOUDON, TELLICO, AND WATTS BAR DAMS, GRAINGER, HAMBLEN, JEFFERSON, LOUDON, MEIGS, AND RHEA COUNTIES, TENNESSEE

TVA evaluates its dam safety program regularly and modifies its dams as needed to ensure the structural integrity of TVA dams and the safety of the public. TVA and other federal agencies responsible for dam safety prepare for a worst-case flooding event in order to protect against dam failure, major property damage, impacts to critical facilities and possibly loss of life. TVA's most recent probable maximum flood calculations indicate that a worst-case winter storm could cause water to go over the top of some dams even with the flood gates wide open, damaging the structure itself; possibly causing dam failure. Failure of any dam would result in loss of stored water for navigation, impacts to fish and wildlife resources, loss of recreational opportunities, and possible property damage, personal injury, and loss of life. Failure of any one of these dams also could result in failures to downstream dams in TVA's water control system.

To minimize the potential effects of a severe flooding event predicted by revised probable maximum flood modeling, precautionary measures have been implemented on top of the earth embankments at four (Cherokee, Fort Loudoun, Tellico, and Watts Bar) dams. These measures included raising dam elevations about 3 to 4-feet by placing interconnected, fabric lined, sand-filled HESCO containers in order to safely pass predicted worst-case floodwaters, avoid dam overtopping and possible impacts to the downstream embankment, and provide additional floodwater storage capacity. The HESCO basket liners have a life span of approximately five years and would need to be replaced or maintained to ensure their integrity. The downstream embankment of Watts Bar Dam has also been strengthened with concrete matting.

TVA must now develop permanent solutions for the precautionary measures that were put in place to correct safety deficiencies identified at Cherokee, Ft. Loudoun, Tellico and Watts Bar Dams. The safety deficiencies are the inability of the dam to safely pass floodwaters greater

Ms. Mary Jennings
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than a 14,000-year flood event without failing – a probable maximum flood. A 14,000-year flood event is a flood event that has a 1 in 14,000 chance of occurring in any given year. The need for proposed action is to prevent the impacts associated with dam failure.

According to a query of TVA's Regional Natural Heritage Database, 16 species listed as endangered or threatened according to the provisions of the Endangered Species Act are either known or are believed to occur in the counties associated with the project areas. These include two mammals, one fish, and 13 mussels. See accompanying Table 1 for listing of species.

TVA has determined that construction of the earthen embankments at each of the dams would have no effect on gray bat (*Myotis grisescens)*, snail darter (*Percina tanasi)*, Anthony's riversnail (*Athearnia anthonyi)*, spectaclecase (*Cumberlandia monodonta)*, fanshell (*Cyprogenia stegaria)*, dromedary pearlymussel (*Dromus dromas)*, shiny pigtoe pearlymussel (*Fusconaia cor)*, fine-rayed pigtoe (*Fusconaia cuneolus)*, pink mucket (*Lampsilis abrupta)*, birdwing pearlymussel (*Lemiox rimosus)*, ring pink (*Obovaria retusa)*, white wartyback (*Plethobasus cicatricosus)*, rough pigtoe (*Pleurobema plenum)*, sheepnose (*Plethobasus cyphyus)*, or orange-foot pimpleback (*Plethobasus cooperianus)* because these species do not occur in areas identified for development of these embankments. No streams were documented within the proposed embankment areas. Use of appropriate Best Management Practices (BMPs) to prevent or minimize any sediment runoff into the nearby river system would further ensure that there is no potential to affect individuals or populations of these species in areas downstream of the project area.

The project could affect potentially suitable habitat for Indiana bat. Habitat assessments were completed at the four dams on March 27 and 29, 2013 with the following results:

- Cherokee Dam - two suitable snags were identified within the wooded area proposed for clearing on the downstream side of the proposed embankment (Figures 1-8).
- Tellico Dam - two locations were assessed.
    - At Saddle Dam 1, two large live white oaks suitable for Indiana bats occur on the edge of the area to be cleared (Figures 9-16).
    - At Saddle Dam 2, high quality habitat in the form of snags and suitable live trees is present in the wooded area proposed to be cleared for construction of the raised embankment (Figures 17-24). A minimal amount of clearing would occur to improve the access road to this site. No suitable trees would be affected along the access road.
- Ft. Loudon Dam - no suitable habitat occurs in the area proposed for the earthen embankment (Figure 25).
- Watts Bar Dam - although the habitat assessment (Figures 26-33) identified a single potentially suitable roost tree in otherwise unsuitable summer habitat for Indiana bat, the actual footprint for the earthen embankment at Watts Bar is narrower than depicted in the associated maps and does not include the one identified roost tree (Figure 34).

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A total of 1.89 acres (4 individual trees at Cherokee and Tellico Dams totaling 0.36 acres, plus 1.53 acres of habitat at Tellico Dam) of potentially suitable summer habitat occurs within the combined project footprints at the two Dams. The potential effect of the project on Indiana bat would be the clearing of 1.89 acres of forested habitat.

Under normal circumstances, TVA would conduct summer surveys for Indiana bat prior to implementing proposed actions in an effort to first avoid and then minimize impacts to endangered species. Given the safety hazards associated with failure of any of these dams, however, TVA is required to implement proposed actions within a certain time frame and thus is working under an accelerated implementation schedule. TVA therefore proposes to compensate for the loss of this potential habitat by entering into a Conservation Memorandum of Agreement with the Service. TVA would contribute to the Indiana Bat Conservation Fund established by the Tennessee Ecological Services (TNES) office in order to satisfy its Endangered Species Act Section 7a (2) responsibilities regarding this species.

TVA needs to begin actions as soon as possible, with removal of habitat subsequently needing to occur during the window of time in which Indiana bats occupy summer habitat (April 1 - August 15). To minimize direct impacts to non-volent juveniles (June 1-July 31) that may be present in trees identified as potentially suitable for summer roosting, TVA would remove the four individual trees (two at Cherokee Dam and two at Tellico Dam) prior to June 1 and remove the 1.53 acre block of habitat at Tellico Dam after July 31. Prior to removal of the four individual trees, TVA would conduct emergence counts at sunset to determine if bats are present, and would conduct acoustic surveys in association with the habitat block between May 5 and July 31, in an effort to gain site-specific documentation regarding presence of the species. If Indiana bats are present in either individual roost trees or detected in the block of habitat, TVA would notify the TN ES office. TVA would take actions to flush any bats present in these trees prior to removal. However, trees would still be removed as proposed even if occupied at the time of survey.

REQUESTED INFO FOR CONSIDERATION OF INDIANA BAT CONSERVATION MOA
Table 2. ESA Coordination History with the TN Ecological Services Office (TN ES)

Date	Location /Type of correspondence	Participants	Discussion topic
April 15, 2013	Request via email for in-person meeting between TN ES office and TVA staff	Mary Jennings, Peggy Shute, Dave Pelren (TN ES), Holly LeGrand(TVA)	Request for meeting to discuss PMF project and Indiana bats
April 26, 2013	Preliminary discussion via telephone	Mary Jennings, John (Bo) Baxter	Suggested path forward
May 1, 2013	In-person meeting, TN ES office, Cookeville, TN	Mary Jennings, Peggy Shute, Dave Pelren (TN ES), John (Bo) Baxter, Holly LeGrand, Andy Powell (TVA)	Feasibility of utilizing MOA for proposed actions in combination with emergence and summer surveys for Indiana bat.

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Coordinates of project sites with potentially suitable habitat:

Cherokee Dam: Latitude 36.1570643814313; Longitude: -83.5098463560665
Tellico Dam, Saddle Dam 1: Latitude: 35.7821206667453; Longitude: -84.2482752309905
Tellico Dam, Saddle Dam 2: Latitude: 35.7641626881297; Longitude: -84.2654596307857

Discussion of forested habitat within the project boundary:

Cherokee Dam: The areas proposed for earthen embankments at Cherokee Dam are located in Jefferson County, TN. The sites are predominantly a park-like mosaic with both savannah-like oak and cedar stands and closed groves of oak woods. Black oak, scarlet oak, post oak and sycamore are species present in the canopy. Other than two snags on the project periphery, non-exfoliating live species comprise the project areas. No forested areas in the proposed project area had structural characteristics indicative of old growth forest.

Tellico Dam, Saddle Dam 1: The site is predominantly open grass, with young cedar growing on the periphery. Two large live white oaks also are on the periphery.

Tellico Dam, Saddle Dam 2: This 1.53 acre block is primarily middle-aged second growth deciduous forest with shagbark hickories and scarlet and white oaks. Four suitable snags were identified. This site is surrounded by 421 acres forested habitat similar in composition and structure.

Completion of the project, as currently proposed, would result in clearing of 1.89 acres of forest. Within the 1.89 acres, six snags and 26 live trees were identified as potentially suitable summer roosting habitat for Indiana bats across the project sites at Cherokee and Tellico Dams.

Amount of potentially suitable Indiana bat habitat to be removed and methods for calculating amount to be removed:

TVA staff systematically walked the project footprints March 27 and 29, 2013. Project footprints were provided by project staff. The four individual trees (two at Cherokee Dam and two at Tellico Dam (Saddle Dam 1) were multiplied by 0.09 acres, resulting in 0.36 acres. This was added to the 1.53 acres of habitat at Tellico Dam (Saddle Dam 2), totaling 1.89 acres.

Based on the current rate of $3700 per acre, and the intent to clear the 1.89 acres between April 1 and August 15, which is associated with a mitigation factor of 2.0, the total mitigation cost would be $13,986.

Site maps: Enclosed (Figures 1-6, 9-14, 17-22, 25-31, 34)

Time of year forested habitat would be removed: April 1 - August 15

Official name of applicant entering MOA: Keith McMillion

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Address of applicant: Tennessee Valley Authority, LP5 N411, 1101 Market Street Chattanooga, TN 37402-2801

Contact name and number: John T. (Bo) Baxter, Manager, Endangered Species Act Compliance, 865-632-3360.

TVA has determined the project would affect potential Indiana bat summer habitat, but these effects would be mitigated by actions carried out as part of the MOA. TVA respectfully requests concurrence for this determination.

Sincerely,

John T. (Bo) Baxter
Manager, Endangered Species Act Compliance
Environmental Permits and Compliance

Enclosures

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

May 21, 2013

Mr. E. Patrick McIntyre, Jr.
Executive Director
Tennessee Historical Commission
2941 Lebanon Road
Nashville, Tennessee 37243-0442

Dear Mr. McIntyre:

TENNESSEE VALLEY AUTHORITY (TVA), PHASE I CULTURAL RESOURCES SURVEY, WATTS BAR DAM BORROW AREA, RHEA COUNTY, TENNESSEE

In order to widen the existing earthen embankments at Watts Bar Dam, TVA proposes to use dirt excavated from a potential borrow area located west of the dam in Rhea County. The proposed work is part of TVA's development of permanent solutions for dam safety modifications at Cherokee, Ft. Loudoun, Tellico, and Watts Bar dams (the "undertaking"). In a letter dated September 20, 2011, TVA conducted section 106 consultation with your office regarding the proposed undertaking. TVA received concurrence of no adverse effect to historic properties by a letter from your office dated September 29, 2011.

TVA identified the area of potential effects (APE) for archaeology as the proposed borrow area, which measures approximately 7.25 acres. The APE for architectural resources includes a 0.5-mile (0.8-km) area centered on the ca. 7.25-acre borrow area as well as any areas where the proposed project will alter existing topography or vegetation in view of a historic resource.

TVA contracted with TRC Environmental Corporation (TRC) to conduct a Phase I cultural resources survey of the APE for the proposed project. Prior to the field survey, TRC conducted archival research at the Tennessee Division of Archaeology and Tennessee Historical Commission (THC). The records search identified no previously recorded archaeological sites within the project APE. An examination of THC survey records revealed no previously recorded architectural properties within the APE.

Following the archival search, TRC conducted the Phase I cultural resources survey in April of 2013. Enclosed are two copies of the draft report titled *Phase I Cultural Resources Survey of a Proposed 7.25 Acre Borrow Area Near the Watts Bar Dam, Rhea County, Tennessee*, along with three CDs containing digital copies.

The archaeological survey included field inspection of the APE via systematic shovel testing at 30-m (100-ft) intervals and visual examination of exposed ground surfaces and any terrain with a slope greater than 20 percent. No previously unrecorded archaeological resources were identified as a result of the survey. Shovel testing revealed a generally consistent soil profile

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throughout the APE and no archaeological materials were recovered. The architectural survey identified no architectural resources within the APE.

Based on the results of the archaeological and architectural surveys, TVA finds that there are no historic properties present within the APE.

Pursuant to 36 CFR Part 800.3(f)(2), TVA is consulting with federally recognized Indian tribes regarding properties within the proposed project's APE that may have religious and cultural significance.

Pursuant to 36 CFR Part 800.4(d)(1), we are seeking your concurrence with TVA's findings that no historic properties would be affected by the proposed undertaking.

Should you have any questions or comments, please contact Richard Yarnell in Knoxville, Tennessee, at (865) 632-3463 or wryarnell@tva.gov.

Sincerely,

Clinton E. Jones
Senior Manager, Biological and Cultural Compliance
Environmental Permits and Compliance
WT 11B-K

Enclosures
cc (Enclosures):
Ms. Jennifer Barnett
Tennessee Division of Archaeology
1216 Foster Avenue, Cole Bldg. #3
Nashville, Tennessee 37210