Floating Houses Policy Review

DRAFT ENVIRONMENTAL IMPACT STATEMENT

JUNE 2015

TENNESSEE VALLEY AUTHORITY

This page intentionally left blank

FLOATING HOUSES POLICY REVIEW
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Tennessee River Valley: Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia

Prepared by:
TENNESSEE VALLEY AUTHORITY
Knoxville, Tennessee

June 2015

COVER SHEET

Floating Houses Policy Review

Proposed action: The Tennessee Valley Authority (TVA) has prepared this Environmental Impact Statement to assess the impacts and address environmental, safety, and socioeconomic concerns associated with the proliferation of floating houses and nonnavigable houseboats on its reservoirs. TVA will decide which of six alternative policies will be used into the future to regulate and manage floating houses and nonnavigable structures on its reservoirs.

Type of document: Draft Environmental Impact Statement

Lead agency: Tennessee Valley Authority

For further information on the EIS, contact:

Matthew Higdon
NEPA Compliance
Tennessee Valley Authority
400 W. Summit Hill Drive, WT 11D
Knoxville, Tennessee 37902
Phone: (865) 632-8051
E-mail: mshigdon@tva.gov

For further information on floating houses, contact:

Robert Farrell
Floating Houses Project Manager
Tennessee Valley Authority
400 W. Summit Hill Drive, WT 11A
Knoxville, Tennessee 37902
Phone: (865) 632-3024
E-mail: fh@tva.gov

Comments due date:

Comments may be submitted online at http://www.tva.gov/floatinghouses or sent to Mr. Higdon at the above address.

Abstract: The Tennessee Valley Authority (TVA) is reviewing its policy on floating houses and nonnavigable houseboats that are designed and used primarily for human habitation. TVA's review is in response to the increased mooring of floating houses (FHs) on its reservoirs, which has implications for navigation, public health and safety, the environment, and public recreation. TVA is considering five alternative policies and has prepared this Environmental Impact Statement (EIS) to assess the potential impacts of implementing each alternative. The alternative policies vary greatly, from allowing additional FHs (Alternative A) to requiring that all FHs be removed from TVA reservoirs (Alternative C). One alternative (Alternative B1) would allow existing, currently unpermitted FHs to remain if new minimum standards are met. Another alternative (Alternative B2) would allow the same, but FHs and nonnavigable houseboats would be removed after a 30-year period. These four alternatives would require TVA to amend its regulations under Section 26a of

the TVA Act. Under one alternative (Alternative D), TVA would enforce current regulations to address FHs. Under each of the action alternatives, TVA would increase enforcement of existing standards and/or establish new standards and requirements to address environmental and safety concerns. TVA also analyzed impacts associated with current management as the No Action Alternative. For most resources, the impacts would be greatest for the No Action Alternative because the increase in the numbers of FHs under this scenario would be greatest.

EXECUTIVE SUMMARY

ES 1. Introduction

The Tennessee Valley Authority (TVA) is a multi-purpose federal agency responsible for managing a range of programs for the use, conservation, and development of the natural resources in the Tennessee Valley including the Tennessee River. In carrying out this mission, TVA operates a system of dams and reservoirs on the Tennessee River and its tributaries—its water control system—in order to manage the water resources of the Tennessee River for the purposes of navigation, flood control, and power production (Figure ES 1). Consistent with those purposes, TVA uses the system to improve water quality and water supply, and to provide a wide range of public benefits including recreation

TVA has prepared this draft Environmental Impact Statement (EIS) to assess the impacts and address environmental, safety, and socioeconomic concerns associated with the proliferation of floating houses (FHs) and nonnavigable houseboats (NNs) on its reservoirs.

This Draft EIS was prepared in accordance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations (40 CFR Parts 1500–1508) and with TVA's procedures for NEPA implementation. The EIS process ensures that the public and other environmental and permitting agencies have opportunities to provide input to the decision that TVA must make about the growth of FHs and the FHs/NNs already located on its reservoirs. The Draft EIS identifies the alternatives TVA is considering, the current environment, and the potential impacts from each alternative.

ES 2. Purpose and Need for Action

TVA is considering how to respond to the increased mooring of FHs on its reservoirs. The increase in FHs has implications for navigation, public health and safety, the environment, and public recreation. Potential actions in response to the proliferation of FHs could include amending its regulations under Section 26a of the TVA Act (18 CFR Part 1304).[1]

Since 1978, TVA has prohibited the mooring on its reservoirs of new NNs that are used primarily for habitation and not for water transportation. In 1971, TVA amended its regulations to prohibit the mooring or anchoring of new NNs on TVA reservoirs. Criteria were established to identify when a houseboat was considered "navigable" and the conditions under which existing NNs would be allowed to remain. Since 1971, TVA has made minor changes to its regulations affecting NNs, most notably in 1978, when TVA updated the prohibition of NNs except for those in existence on or before February 15, 1978. The navigability criteria, however, largely have remained unchanged. FHs are a modern version of the pre-1978 NNs that TVA addressed in its 1971 and 1978 regulatory actions. FHs do not have permits issued by TVA.

Absent taking action, TVA anticipates that the mooring of FHs on its reservoirs will continue to increase. Until now, TVA has discouraged the increased mooring of FHs without using the full scope of its regulatory authority under Section 26a of the TVA Act. TVA is

[1] The Tennessee Valley Authority Act is the legislation passed by Congress in 1933 that established TVA. Section 26a gives TVA jurisdiction to regulate obstructions that affect navigation, flood control, or public lands across, along, or in the Tennessee River or any of its tributaries. Accordingly, TVA's approval is required prior to the construction, operation, or maintenance any dam, appurtenant works, or other obstruction affecting navigation, flood control, or public lands or reservations.

considering the policy implications before deciding how to address the problem. The policy decision addresses the FHs/NNs that are now moored on some TVA reservoirs and would apply to all TVA reservoirs.

TVA already decided in 1971 that the impacts and risks of NNs outweighed their public value. At this time, TVA's preference is to continue to allow NNs with current permits and to permit (i.e., grandfather) the mooring of existing, currently unpermitted FHs on TVA reservoirs but only if the FHs comply with new minimum standards and requirements under development by TVA. Noncompliant FHs/NNs would be removed from TVA reservoirs. Thus, TVA is inclined to select either Alternative B1 or B2 as its final decision but will consider the stakeholders' and public's input on which alternative best meets the agency's purpose and need.

ES 3. Alternatives

NEPA requires that TVA evaluate a reasonable range of alternatives and the alternative of taking no action. With its purpose and need to address the increased mooring of FHs on its reservoirs providing context, TVA began by identifying a broad set of possible management actions (e.g., new standards, enforcement, updating rules and regulations, removal of noncompliant structures, permitting or not permitting new FHs) that could be combined into policy alternatives. This process included consideration of ways to manage existing currently permitted NNs, as well as options for addressing the existence of hundreds of currently unpermitted FHs.

In developing the alternatives, TVA consulted a number of internal resources and TVA staff familiar with FH/NN issues and management of the reservoirs, in addition to resource specialists familiar with the conditions at the marinas with FHs/NNs and their ongoing impacts. TVA also considered comments received in recent years from the public, marina owners, recreationists, landowners, and others who have communicated about FHs/NNs, in addition to comments received during the scoping process.

TVA then identified a set of five policy alternatives to evaluate in detail, in addition to the No Action Alternative. The resulting alternatives range from the complete removal of all NNs and FHs to the continued management of existing NNs and establishment of a permit program for development of existing and/or new FHs.

The identified alternatives include grandfathering existing FHs (permitting them to remain on the reservoirs), removing them after a 30-year sunset period, and immediately removing them. TVA considered varying sunset periods for removal of existing FHs/NNs (e.g., 10, 15, or 20 years) before deciding that limiting the evaluation to immediate removal and removal after a 30-year period would provide the TVA decision maker and the public a sufficient understanding of the consequences of removal over shorter time periods.

The six alternatives are described below. Table ES 1 identifies the six alternatives selected to be carried forward for detailed analysis.

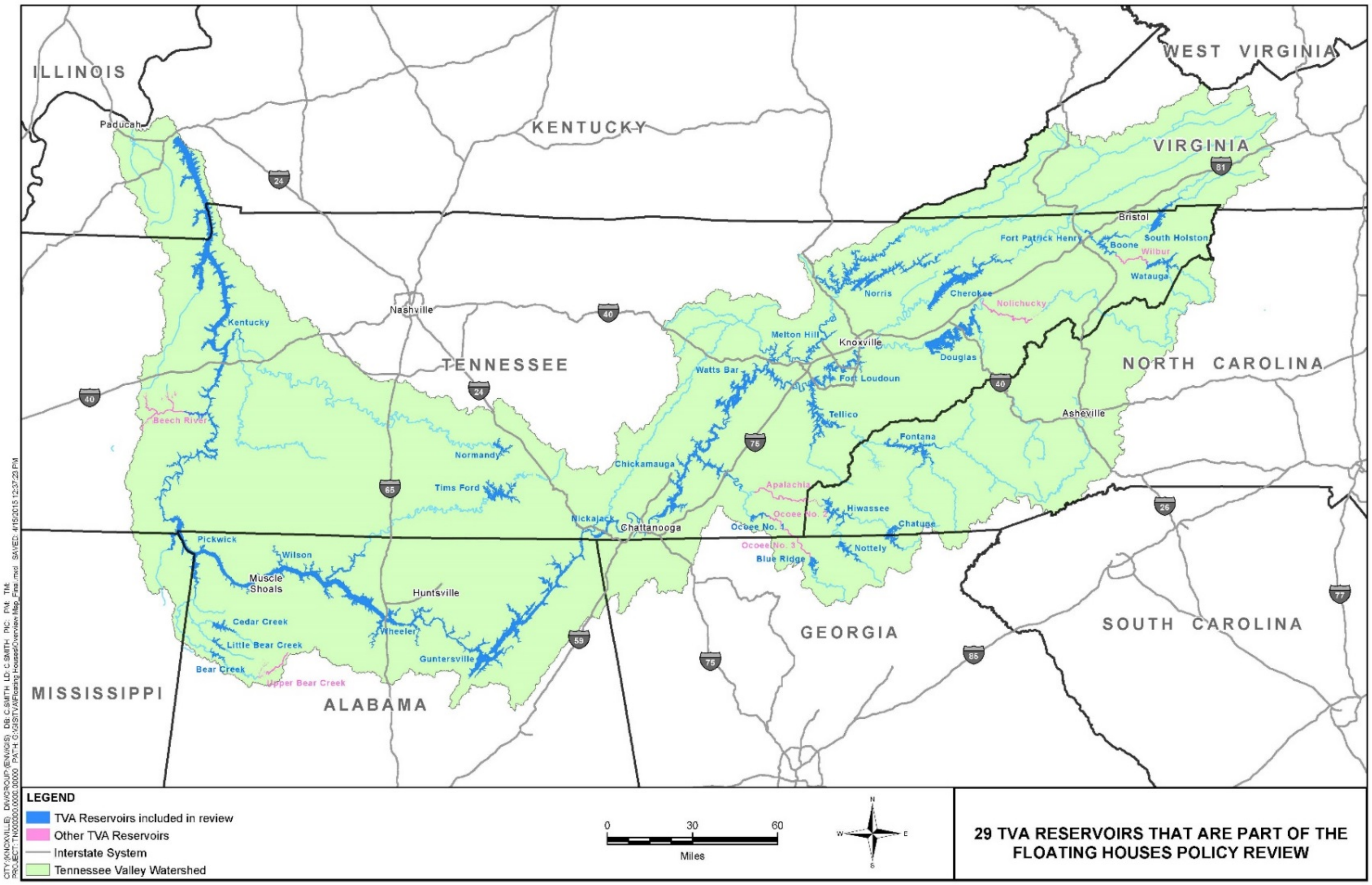


Figure ES 1. Overview map

This page intentionally left blank

Table ES 1. Summary and Comparison of Alternatives

Alternative	Description
No Action Alternative	Current Management
Alternative A	Allow Existing and New Floating Houses
Alternative B1	Grandfather Existing and Prohibit New
Alternative B2	Grandfather but Sunset Existing and Prohibit New
Alternative C	Prohibit New and Remove Unpermitted
Alternative D	Enforce Current Regulations and Manage through Marinas and Permits

ES 3.1 No Action Alternative – Current Management

For the purposes of NEPA and the environmental analysis in this EIS, the No Action Alternative is the baseline against which all action alternatives are compared. Under the No Action Alternative, TVA would continue to use discretion in enforcing its Section 26a regulations and would address specific problems caused by FHs/NNs on a case-by-case basis.

ES 3.2 Alternative A – Allow Existing and New Floating Houses

Under Alternative A, TVA would approve and issue permits for the mooring of existing and new FHs that meet new minimum standards within permitted marina harbor limits. Noncompliant FHs would need to be removed from the reservoir. TVA would change its regulations to set minimum standards for safety and wastewater issues, and TVA would increase its enforcement of these standards. Existing permits issued to NNs would remain valid if the NN complies with its permit conditions. Permitted NNs would not be subject to new standards if they comply with their current permits.

ES 3.3 Alternative B1 – Grandfather Existing and Prohibit New

Under Alternative B1, TVA would approve and issue permits for the mooring of existing FHs that meet new minimum standards within permitted marina harbor limits. Permitted NNs in compliance with their permits would continue to be allowed. TVA would prohibit new FHs and update its regulations to clarify that FHs are deemed nonnavigable and not allowed.

ES 3.4 Alternative B2 – Grandfather but Sunset Existing and Prohibit New

Under Alternative B2, TVA would approve existing FHs that meet new minimum standards and allow mooring within permitted marina harbor limits but would establish a sunset date by which time all FHs must be removed from TVA reservoirs. TVA would prohibit new FHs and update its regulations to clarify that new FHs are prohibited and would establish a date by which existing approved FHs must be removed. For purposes of analysis and this alternative, TVA uses 30 years as the sunset date, but that date could be earlier. TVA would continue to allow existing permitted NNs that are compliant with their permit conditions but would require that they also be removed from TVA reservoirs by the sunset date.

ES 3.5 Alternative C – Prohibit New and Remove Unpermitted

Under Alternative C, TVA would prohibit new and existing FHs. TVA would continue to allow permitted NNs that comply with their current permit conditions. TVA would require removal of all unpermitted FHs and permitted NNs that are noncompliant with their permit conditions within 18 months. TVA would amend its regulations to clarify its navigability criteria. TVA would not issue new standards.

ES 3.6 Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

Under Alternative D, TVA would use its existing Section 26a regulations and property rights to remove existing FHs and noncompliant NNs, and to stop the mooring of new FHs on its reservoirs. TVA also would use the conditions and covenants in its land use agreements with marina operators to implement this approach.

ES 4. Affected Environment

The EIS includes baseline information for understanding the potential environmental, socioeconomic, and recreation impacts associated with the FH/NN policy alternatives under consideration by TVA. It describes the setting and existing conditions of natural, social, and economic resource areas that would be affected by the policy alternatives. The discussion of the affected environment also includes a description of the study area boundaries, current TVA planning policy, and the temporary scope of the EIS.

The following 12 resource areas are discussed in detail:

- Socioeconomics and Environmental Justice
- Recreation
- Public Safety
- Navigation
- Solid and Hazardous Wastes
- Visual Resources
- Land Use
- Cultural Resources
- Water Quality
- Ecological Resources
- Threatened and Endangered Species
- Floodplains

Although the geographic scope of this environmental review is the entire Tennessee River Watershed, specifically TVA's reservoir system and adjacent shoreline and land, particular attention is given to reservoirs with existing commercial marinas, as well as those reservoirs with a reasonable potential to support commercial marinas in the future. The EIS addresses the 29 reservoirs that currently house FHs and NNs or are likely to have additional FHs in the future if current trends continue. In addition to the 29 reservoirs described above, 21 reservoirs currently have no marinas and have low estimates of potential FH development. These reservoirs are identified in Section 1.4.1 and are not discussed further in the EIS. Table ES 2 identifies the 29 reservoirs addressed in the EIS.

Table ES 2. Reservoirs with Marinas or Potential for Future Commercial Marinas in the Study Area

Reservoir	Estimated Current Number of Floating Houses and Nonnavigable Houseboats	Number of Marinas	Existing Marina Footprint (acres)
Bear Creek	0	0	0.0
Blue Ridge	12	1	23.7
Boone	133	7	51.6
Cedar Creek	0	0	0.0
Chatuge	0	4	39.2
Cherokee	2	11	130.2
Chickamauga	20	14	172.1
Douglas	0	10	69.0
Fontana	357	6	997.1
Fort Loudoun	100	10	101.8
Fort Patrick Henry	6	1	5.4
Guntersville	12	19	464.3
Hiwassee	30	4	45.2
Kentucky	55	61	658.1
Little Bear Creek	0	0	0.0
Melton Hill	0	1	2.0
Nickajack	30	3	45.5
Normandy	0	0	0.0
Norris	921	24	644.4
Nottely	0	1	4.1
Parksville	0	1	13.5
Pickwick	2	7	112.0
South Holston	117	6	144.9
Tellico	0	4	67.3
Tims Ford	0	1	23.7
Watauga	37	7	109.8
Watts Bar	2	13	148.6
Wheeler	0	5	70.6
Wilson	0	5	14.6
Total	**1,836**	**226**	**4,159**

TVA customized the study area for each resource area to address the potential effects of the FH/NN policy alternatives on that resource area. The analysis in the EIS also includes considerations of the existing reservoir land planning process. This process allocates land to seven land use zones defined in TVA's *Natural Resource Plan* (TVA 2011a). The zones identify the land use of the reservoirs for purposes including recreational, industrial, sensitive resource management, and natural resource conservation. The zones provide a baseline for current conditions as well as planned uses that could be affected by the policy decisions in each alternative.

The temporal scope of the environmental analysis in the EIS extends at least 30 years into the future. This period was selected because it is a typical period used for planning TVA management actions and policies. However, projects beyond 5 to 10 years become increasingly uncertain and speculative.

ES 5. Environmental Consequences

The EIS describes the direct and indirect environmental impacts of the six alternatives as they affect the 12 resource areas.

To complete the environmental analysis, TVA estimated the future number of FHs/NNs under each of the alternatives. As shown in Table ES 3 and discussed in Section 4.1.1 of the Draft EIS, the largest predicted increase in the number of FHs would occur under the No Action Alternative. The second highest increase in the number of FHs on TVA reservoirs over a 30-year period would be under Alternative A. The largest predicted decrease in the number of FHs/NNs would occur under Alternative B2 at the end of the 30-year period. Under Alternative C, permitted NNs would be allowed and all existing FHs would be removed within 18 months from TVA reservoirs, with no further reduction over the 30-year period. Under Alternative B1, approximately 25 percent of the existing FHs/NNs would be removed from TVA reservoirs within the first 18 months, with no further reduction over the remainder of the 30-year period. Under Alternative D, approximately 25 percent of FHs that do not comply with the current regulations would be modified to meet the regulations' criteria for navigation, allowing the modified FHs to remain and new structures to be built (that meet navigation criteria, but with primary design and purpose of habitation) at the same rate assumed under the No Action Alternative, based on marina harbor area capacity.

Table ES 3 Projected Number of Floating Houses and Nonnavigable Houseboats by Alternative

Year	Alternative					
	No Action	**A**	**B1**	**B2**	**C**	**D**
Current	1,836	1,836	1,836	1,836	1,836	1,836
2021	2,365	1,906	1,377	1,377	918	1,337
2045	3,692	3,233	1,377	0	918	2,016

The impacts of each alternative were characterized by one of three impact levels: positive, neutral, or negative. The extent, duration, and intensity of the impact determined the overall level assigned to the impact.

Each of the policy alternatives TVA is considering for management of FHs/NNs has potential positive and negative impacts for all of the resource areas. Many of the alternatives would provide some benefits even if the overall impact of the alternative on the resource area is negative. For example, under Alternative A, the increased number of FHs would affect surface water recreators, but the new standards would result in fewer impacts on water quality experienced by this group of recreators. The full range of impacts is identified in Table ES 4, at the close of this section.

ES 5.1 Temporary and Indirect Impacts

Actions associated with some alternatives would indirectly and/or temporarily affect a number of different resources areas. For example, demolition and removal of unapproved structures associated with Alternatives A, B1, B2, C, and D could indirectly and temporarily affect multiple resource areas—including recreation, solid and hazardous wastes, visual resources, cultural resources, water quality, ecological resources, and threatened and endangered species—due to the use of heavy equipment. Alternatives that involve removal of unapproved structures and prohibition of new structures (Alternatives B1, B2, and C) would result in an overall decrease in FHs/NNs and associated environmental impacts.

ES 5.2 Long-Term Impacts

Under all of the alternatives, the long-term impacts for many of the resource areas—including public safety, navigation, solid and hazardous wastes, land use and farmland, visual resources, ecological resources, threatened and endangered species, and floodplains—would be minor. In general, the alternatives that would result in increased numbers of FHs (No Action Alternative, Alternative A, and Alternative D) would result in negative impacts on these resource areas. The current safety issues from improper mooring and anchoring practices that create recreation boating hazards could increase under these alternatives, but these may be manageable. Similarly, increased number of FHs would degrade the scenic quality of the reservoirs; however, the presence of FHs/NNs is part of the existing conditions and in many cases would be limited to small portions of the reservoir in the vicinity of the marinas.

While there would be positive impacts from the alternatives that result in fewer numbers of FHs/NNs (Alternatives B1, B2, and C), the benefits are expected to minor. For example, minor beneficial impacts on threatened, endangered, or special concern (TES) species would be expected due to fewer FHs/NNs, better management and compliance with existing and new regulations, and expected increases in water quality. This may prove to be beneficial to TES species that use the aquatic environment near marinas. Similarly, there would be beneficial impacts on terrestrial resources along the shoreline due to fewer FHs and improved management under Alternatives B1, B2, and C. However, the potential for change in land use would be minor and may be offset by the areas being redeveloped for other uses.

The following discussion provides additional information related to impacts on socioeconomics, recreation, cultural resources, and water quality; impacts related to these resources under the various alternatives would be more substantial. This discussion is organized by alternatives when the types and magnitude of the impact would be similar.

ES 5.2.1 No Action Alternative, Alternative A, and Alternative D

Different socioeconomics groups would be affected by these alternatives in different ways. FH/NN owners and renters, marinas, and other industries that derive income from FHs/NNs would experience positive impacts from the additional FHs that would be allowed under these alternatives. FH/NN owners would benefit from the increased market value of their FH or increased rental income. Marina owners and associated industries would benefit from increased revenues from expanded visitation and associated demand for services. Under Alternatives A and D, no negative impacts would result to FH owners from requirements to upgrade FHs to meet the new standards. Shoreline property owners, recreational users, and the general public would experience negative impacts from additional FHs allowed under these alternatives. The continued growth of the FH market could depress the value of shoreline property. Increased visual impacts and reductions in water quality and safety would affect recreational users and the owners of shoreline property.

The No Action Alternative, Alternative A, and Alternative D also would affect recreators differently, depending on how they use the reservoirs. FH users would benefit the most from the policies implemented under these alternatives, which would generally result in increased opportunities for recreation. However, the quality of the recreation experience for current FH/NN users may decline based on congestion in the marinas. Surface water and shoreline recreation both would be negatively affected by the increased numbers of FHs and associated impacts on water quality, obstructed views, and limits to the shoreline from expanded marina boundaries.

Many of the activities associated with the No Action Alternative, Alternative A, and Alternative D could adversely affect historic properties in the Area of Potential Effects (APE). Adverse effects could result from damage from increased numbers of FHs sitting on the shoreline during drawdown and increased erosion. Increased FHs may adversely affect known and unknown archaeological sites and architectural resources along the shoreline Once the preferred alternative is identified by TVA, Section 106 consultation will occur regarding the impacts and possible mitigation associated with the selected alternative.

The No Action Alternative would result in the most substantial negative impacts on water quality because it does not affirmatively address current wastewater discharge issues. An increase in the number of FHs is expected to exacerbate water pollution problems, adding to the cumulative wastewater loading to surface waters. Alternative A would result in neutral to beneficial impacts because the new standards would address the wastewater issues. However, some benefits could be offset by the expected increase in the number of FHs. Alternative D would probably result in some adverse impacts on surface water quality because of a lack of new standards coupled with a probable increase in the number of FHs. Alternative D would also probably cause adverse indirect impacts on surface water quality because the growth in FH numbers would increase the amount of pump-out wastewater. This increase in pump-out wastewater would increase loading on local municipal or onsite wastewater treatment systems; in turn, their discharges to surface water would probably increase.

ES 5.2.2 Alternative B1, Alternative B2, and Alternative C

The impacts under Alternatives B1, B2, and C would vary by socioeconomic group. In general, FH/NN owners and renters, marinas, and other industries that derive income from FHs/NNs would experience negative impacts from requirements for reducing FHs/NNs. Under Alternative C, owners of unapproved FHs would experience loss of equity or rental income and would incur costs to remove the structures. Under Alternative C, owners of permitted NNs would benefit due to increased market values and rental prices from the reduced supply of FHs under this alternative. Shoreline property owners, other recreational users, and the general public would experience positive impacts from the reduced numbers of FHs/NNs allowed under Alternatives B1, B2, and C.

The impacts on recreation would also vary by user group. Surface water recreation would improve from the amount of available space, improved water quality, and unobstructed views. Shoreline recreation would also benefit from increased shoreline access in areas where FHs were once moored and from improved views. Under Alternatives B1 and B2, water quality would improve once the new standards are in place. FH recreation would significantly decrease under all of these alternatives, but the quality of recreation could improve for the NNs that are allowed to remain because of less congestion.

The impacts on cultural resources would vary by the location of the resource. Alternatives B1, B2, and C would likely decrease the number of FHs on the TVA reservoirs. This decrease would likely reduce damage from FHs sitting on the shoreline during drawdown and shoreline erosion within the APE, which could reduce the likelihood of adverse effects to inundated historic properties. Once the preferred alternative is identified, Section 106 consultation will occur regarding the impacts and possible mitigation associated with the selected alternative.

Alternatives B1, B2, and C would result in beneficial impacts on surface water quality, with Alternative B1 slightly beneficial, Alternative B2 beneficial in 30 years, and Alternative C beneficial sooner than 30 years. Alternatives B1, B2, and C would cause beneficial indirect impacts on surface water quality because the reduction in FH/NN numbers would reduce the amount of pump-out wastewater. The reduction in pump-out wastewater would reduce loading on local municipal or onsite wastewater treatment systems; in turn, their discharges to surface water might decrease.

ES 6. Potential Standards and Management Actions under Consideration

If TVA selects a future management alternative to allow and permit FHs, this change in policy will require revised or new standards to alleviate and minimize potential environmental and safety issues. Three of the alternatives being considered (Alternatives A, B1, and B2) could involve development of updated standards. The following is a general summary of potential standards and requirements that could be considered.

- Provide ground fault protection (ground fault circuit interrupter [GFCI]) not exceeding 100 milliamperes on any and all power sources. Utility-supplied sources should have GFCI protection at main marina feeder circuit, branch circuits, structure, or individual circuits. All electrical cables that enter the water or otherwise supply FHs shall have GFCI protection at their source. Generators or other non-utility sources should have GFCI protection as close as possible to the power source. The GFCI protection shall disconnect all circuits supplied by the power source.

- Protect exposed electrical cables where feasible by trenching or placing in cable trays or conduit. Underwater cables in shallow water areas that are subject to physical damage by contact with watercraft or propellers shall be protected by conduit or burial, or marked by buoys as appropriate.

- Comply with National Fire Protection Association (NFPA) 70 (National Electric Code) standards for marinas, boatyards, and floating buildings.

- Prohibit unencased Styrofoam flotation on FHs and NNs, and require removal of any existing within a certain time period (i.e., within 18 months).

- Prohibit grey water and black water discharge from FHs on No Discharge reservoirs.

- Treat grey water and black water through a marine sanitation device (MSD) on Discharge reservoirs.

- All FHs and NNs without direct utility connections must be equipped with a holding tank or an approved MSD by an established date to enable proper handling and treatment of black and grey water.

- Allow no expansion of existing structures unless TVA deems that it is essential for compliance with standards (such as additional holding tank capacity).

- If new FHs are allowed (Alternative A), maximum size could be 1,000 square feet and one story, moored in a marina slip with all utilities connected to the slip.

- Minimum separation and spacing requirements within marina harbor limits would be established.

- TVA may consider the exchange and retirement of one or more permitted NNs for a new FH meeting standards, with an equal footprint but no more than 1,000 square feet, including decks and walkways.

- FH owners may be required to pay an annual management fee to TVA or approved marina operators; a security assurance fee or cleanup deposit may also be required.

- Marinas/FH owners must certify that an initial inspection is completed, and then every 5 years document an inspection by TVA or a qualified person that certifies compliance with electrical, sanitary, water supply, flotation, and mooring standards.

- Marinas/FH owners must certify yearly that the structure meets required standards.

- At TVA's request, marinas or structure owners must provide records to document that holding tanks on No Discharge reservoirs are being pumped regularly and that waste is properly disposed of and treated. Detailed records should contain pumping dates and volumes removed during each pump-out service for each FH and NN.

- NNs must be in compliance with current TVA permit conditions. If not, the structure must comply with all new standards and rules for FHs or be removed from the reservoir.

Table ES 4. Summary of Resource Impacts by Alternative

Resource	Alternative					
	No Action Alternative	**Alternative A**	**Alternative B1**	**Alternative B2**	**Alternative C**	**Alternative D**
			Socioeconomics			
Total market value of FH	Doubles in 30 years	Slight initial decrease as FHs are removed that are not upgraded to meet new standards; then an increase over 30 years	25-percent reduction in short period	Elimination of FH market value after 30 years	Major loss of market value over short period; FHs prohibited	Major loss of market value over short period; then an increase over 30 years
FH owner loss of use	No change	Reduced by number of FHs not upgraded to meet new standards	Reduced by number of FHs not upgraded to meet new standards	Greatest loss of use over 30-year period	Major loss of use in short time period	Loss of use for those NNs and FH not compliant with current permit and 26a rules
FH or NN owner costs of upgrading structure to meet standards	No change	Increase in costs	Increase in costs	Greatest increase in costs; then removing all FHs and NNs	Increase in costs for removing all unpermitted FHs and noncompliant NNs	Large increase in costs over short period for removal or upgrading FHs to meet current navigation criteria
Marina owner revenue and employment from FHs and NNs	Increased revenues	Increased revenue over 30 years	Moderate reduction in income over 30 years	Greatest reduction in income over 30 years	Largest reduction in income in shortest period	Reduction in income over short period; then an increase over 30 years

Resource	Alternative					
	No Action Alternative	**Alternative A**	**Alternative B1**	**Alternative B2**	**Alternative C**	**Alternative D**
			Socioeconomics (Continued)			
FH owner rental income	Supply of rentals increases and rental price stays constant or slightly decreases	Slight reduction in rental market and increase in rental price	Reduction in rental income	Gradual reduction over time to 0	Greatest loss over short period	Slight to moderate loss over short period
Renters of FHs and NNs	More options and slightly reduced rental prices	Slightly fewer options and slightly reduced rental prices	Reduced options and slightly higher rental prices	Loss of FH and NN rental options after 30 years	Greatest loss of FH rental opportunities over a short period and likely higher rental prices for remaining NNs	Moderate loss of rental options and likely higher rental prices for remaining NNs
Shoreline property owners	Reduced shoreline property values and reduced enjoyment	Reduced shoreline property values and reduced enjoyment, but impacts primarily near marinas	Slight improvement in shoreline property values and increased enjoyment	Greater improvement in shoreline property values after 30 years and greatest increase in enjoyment	Greatest positive impact on shoreline property owners within 6 months	Moderate positive impact on shoreline property owners in short period
TVA costs	Slight increase in costs for management	Greater costs for management of new standards and removing abandoned structures	Greater costs for management of new standards and removing abandoned structures	Greatest potential costs for removing abandoned structures, spread over 30 years	Increased costs for removing abandoned structures, concentrated in a short period, and increased management costs	Moderate potential cost increase for removing abandoned structures, concentrated in a short period, and increased management costs

Resource	Alternative					
	No Action Alternative	**Alternative A**	**Alternative B1**	**Alternative B2**	**Alternative C**	**Alternative D**
Recreation						
FH and NN users	Greatest increase in number of recreation days	Large increase in number of recreation days	Decrease in number of recreation days	Number of recreation days reduced to 0 after 30 years	Large decrease in number of recreation days over a short period	Moderate or slight increase in number of recreation days after initial reduction
General public using shorelines and open water	Reduced enjoyment and access, and increased congestion	Reduced enjoyment and access, and increased congestion, primarily in marina areas	Slight improvement in access and reduced congestion, primarily in marina areas	Largest positive impact for public over 30 years	Greatest positive impact for public recognized in shortest period	Moderate positive impact for public in short period
Recreational boating and fishing	Greatest reduction in reservoir surface area, access to shoreline, and quality of recreation	Large reduction in reservoir surface area, shoreline access, and quality of recreation; impacts focused in marina areas	Moderate increase in reservoir surface area, shoreline access, and quality of recreation as unpermitted structures are removed	Moderate increase in reservoir surface area, shoreline access, and quality of recreation as unpermitted structures are removed; greater increase after 30 years	Greatest increase in reservoir surface area, shoreline access, and quality of recreation in shortest period	Neutral to slight increase in reservoir surface area, shoreline access, and quality of recreation (depending on number of FHs removed)

Resource	Alternative					
	No Action Alternative	**Alternative A**	**Alternative B1**	**Alternative B2**	**Alternative C**	**Alternative D**
			Recreation (Continued)			
Shoreline recreation access and quality of recreation	Greatest reduction in access to shoreline areas and quality of recreation	Large reduction in access and quality near marinas	Moderate increase in access and quality as unpermitted structures are removed	Moderate increase in access and quality as unpermitted structures are removed; greater increase after 30 years	Greatest increase in access and quality in shortest period	Neutral to slight increase in access and quality (depending on number of FHs removed)
			Public Safety			
Shoreline user and swimmer exposure to electric hazards	No reduction in hazards	Reduced exposure to electrical hazards with enforcement of new safety standards and removal of unpermitted structures	Reduced exposure to electrical hazards with enforcement of new safety standards and removal of unpermitted structures	Reduced exposure to electrical hazards with enforcement of new safety standards and removal of unpermitted structures; greater reduction after 30 years	Greatest reduced exposure to electrical hazards in shortest period with enforcement of new safety standards and removal of unpermitted and noncompliant structures	Reduced exposure to electrical hazards due to removal of unpermitted structures; however, hazards may persist under current regulations
Hazards associated with structural integrity	No reduction in hazards	Reduced hazards due to enforcement of new safety standards	Reduced hazards due to enforcement of new safety standards	Reduced hazards due to enforcement of new safety standards; greater reduction after 30 years	Reduced hazards due to removal of unpermitted and noncompliant structures	Reduction in hazards due to removal of unpermitted structures

Resource	Alternative					
	No Action Alternative	Alternative A	Alternative B1	Alternative B2	Alternative C	Alternative D
Public Safety (Continued)						
Safety hazards from unsafe mooring practices	Increase in safety hazards associated with ropes and cables and poorly secured FHs (similar to current conditions)	Reduced hazards with enforcement of new safety standards	Reduced hazards with enforcement of new safety standards	Reduced hazards with enforcement of new safety standards	Reduced hazards with removal of unpermitted and noncompliant structures	Reduction in safety hazards associated with ropes and cables and poorly secured FHs due to removal of unpermitted structures and enforcement of current mooring regulations
Safety hazards from FHs/NNs dislodging and drifting into commercial navigation channels	No reduction in hazards (similar to current conditions)	No reduction in hazards (similar to current conditions)	Reduced hazards as unpermitted structures are removed	Reductions over time leading to elimination of hazards as all FHs and NNs are removed after 30 years	Reduced hazards as unpermitted and noncompliant structures are removed	Reduced hazards as unpermitted structures are removed
Solid and Hazardous Wastes						
Amount of solid and hazardous waste material generated for handling and disposal	No reduction in amount (similar to current conditions)	Moderate increase in quantity generated due to demolition activities	Moderate increase in quantity generated due to demolition activities	Greatest long-term increase in quantity generated due to demolition activities	Greatest short-term increase in quantity generated due to demolition activities	Short-term increase in quantity generated due to demolition activities

Resource	Alternative					
	No Action Alternative	Alternative A	Alternative B1	Alternative B2	Alternative C	Alternative D
Solid and Hazardous Wastes (Continued)						
Release of solid and hazardous wastes into the environment due to deterioration of aging structures	No reduced potential as structures continue to deteriorate over time (similar to current conditions)	Reduced potential as unpermitted structures are removed	Reduced potential as unpermitted structures are removed	Greatest long-term reduced potential as unpermitted structures are removed; greater reduction after sunset period	Greatest short-term reduced potential as unpermitted and noncompliant structures are removed	Reduced short-term potential as noncompliant FH structures are removed initially
Visual Resources						
Scenic integrity of reservoirs	Reduced as number of FHs increases	Reduced as number of FHs increases, primarily near marinas	Slightly enhanced as unpermitted structures are removed	Slightly enhanced as unpermitted structures are removed; significant enhancement after 30 years	Enhanced in shortest period	Neutral to slightly enhanced (depending on number of FHs removed)
Scenic quality of reservoirs	Reduced as number of FHs increases	Reduced as number of FHs increases, primarily near marinas	Slightly enhanced as unpermitted structures are removed	Slightly enhanced as unpermitted structures are removed; significant enhancement after 30 years	Enhanced in shortest pericod	Neutral to slightly enhanced (depending on number of FHs removed)
Viewshed	Reduced as number of FHs increases	Reduced as number of FHs increases, primarily near marinas	Slightly enhanced as unpermitted structures are removed	Slightly enhanced as unpermitted structures are removed; significant enhancement after 30 years	Enhanced in shortest period	Neutral impact or slightly enhanced (depending on number of FHs removed)

Resource	Alternative					
	No Action Alternative	Alternative A	Alternative B1	Alternative B2	Alternative C	Alternative D
Land Use						
Direct land use change associated with recreational area expansions to accommodate FHs	Increased potential	Increased potential	Slightly reduced potential	Slightly reduced potential	Reduced potential	Slightly reduced potential (depending on number of FHs removed)
Cultural Resources						
Disturbance of benthic or shoreline archaeological sites	Increased potential as number of FHs increases	Increased potential, primarily near marinas	Reduced potential with prohibition of new structures	Reduced potential with prohibition of new structures	Reduced potential with prohibition of new structures	Reduced potential
Incompatibility with historic structures	Increased potential as number of FHs increases	Increased potential, primarily near marinas	Reduced potential with prohibition of new structures	Reduced potential with prohibition of new structures	Reduced potential with prohibition of new structures	Reduced potential with historic structures initially
Water Quality						
Nutrient enrichment of reservoirs	Increased potential	Reduced potential with enforcement of new wastewater standards	Reduced potential with enforcement of new wastewater standards	Reduced potential with enforcement of new wastewater standards	Reduced potential with removal of unpermitted FHs or noncompliant NN structures	Slightly reduced potential with removal of noncompliant structures and rules enforcement

Resource	Alternative					
	No Action Alternative	**Alternative A**	**Alternative B1**	**Alternative B2**	**Alternative C**	**Alternative D**
			Water Quality (Continued)			
Recreational user exposure to human pathogens	Increased potential without enforcement of new wastewater standards	Reduced potential with enforcement of new wastewater standards	Reduced potential with enforcement of new wastewater standards	Reduced potential with enforcement of new wastewater standards	Reduced potential from removal of unpermitted or noncompliant structures	Slightly reduced potential from removal of noncompliant structures and rules enforcement
			Ecological Resources			
Terrestrial resources adjacent to shorelines	Minor adverse impacts	Minor adverse impacts	Minor beneficial impacts	Minor beneficial impacts	Minor beneficial impacts	Minor adverse impacts
Waterfowl and shorebirds	Minor to negligible adverse impacts	Minor to negligible adverse impacts	Minor to negligible beneficial impacts	Minor to negligible beneficial impacts	Minor to negligible beneficial impacts	Minor to negligible adverse impacts
Aquatic resources and aquatic ecological health in and around marinas	Minor to moderate adverse impacts on aquatic habitats	Minor to moderate adverse impacts on aquatic habitats	Minor beneficial impacts on aquatic habitats	Greatest but still minor beneficial impacts on aquatic habitats over time	Minor beneficial impacts on aquatic habitats	Minor to moderate adverse impacts on aquatic habitats
Establishment and spread of invasive terrestrial animals or plant species	Little effect	Little effect	Little effect	Little effect	Little effect	Little effect
Wetlands	Minimal impacts due to resource protection and regulations	Minimal impacts due to resource protection and regulations	Minimal impacts due to resource protection and regulations	Minimal impacts due to resource protection and regulations	Minimal impacts due to resource protection and regulations	Minimal impacts due to resource protection and regulations

Resource	Alternative					
	No Action Alternative	**Alternative A**	**Alternative B1**	**Alternative B2**	**Alternative C**	**Alternative D**
Threatened and Endangered Species						
Threatened, endangered, or special concern species	Minor potential negative effects	Minor potential negative effects	Minor potential beneficial impacts	Minor potential beneficial impacts	Minor potential beneficial impacts	Minor potential negative effects
Critical habitat	No impacts	No impacts	No impacts	No impacts	No impacts	No impacts
Floodplains						
Floodplains and flood risk	Minor adverse impacts on floodplains	Minor adverse impacts on floodplains	Neutral to minor beneficial impacts on floodplains	Neutral to minor beneficial impacts on floodplains	Neutral to minor beneficial impacts on floodplains	Neutral to minor adverse impacts on floodplains

This page intentionally left blank

Table of Contents

List of Appendices

List of Tables

List of Figures

List of Illustrations

Acronyms/Abbreviations

Acronym/Abbreviation	Description
ACM	asbestos-containing material
AMI	Association of Marina Industries
APE	Area of Potential Effects
BMP	best management practice
BOD	biological oxygen demand
CFR	Code of Federal Regulations
CWA	Clean Water Act
DA	Department of the Army
DO	dissolved oxygen
EC	E. coliform
EIS	Environmental Impact Statement
EO	Executive Order
ES	Executive Summary
ESA	Endangered Species Act
FC	fecal coliform
FEMA	Federal Emergency Management Agency
FH	floating house
FRP	Flood Risk Profile
GFCI	ground fault circuit interrupter
gpcd	gallon(s) per capita per day
gpd	gallon(s) per day
GSMNP	Great Smoky Mountains National Park
LMP	Land Management Plan
mg/L	milligram(s) per liter
MS4	municipal separate storm sewer system
MSD	marine sanitation device
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act
NN	nonnavigable houseboat
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NRP	*Natural Resource Plan*
ORDEQ	Oregon Department of Environmental Quality
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
ROS	*Reservoir Operations Study*
RRI	Reservoir Releases Improvement (Program)
RSTE	residential septic tank effluent
SFI	Sport Fishing Index
SMI	Shoreline Management Initiative
TDEC	Tennessee Department of Environment and Conservation
TDS	total dissolved solids
TES	Threatened, endangered, or special concern (species)
TVA	Tennessee Valley Authority
TWRA	Tennessee Wildlife Resources Agency
USACE	US Army Corps of Engineers
USC	US Code
USCG	US Coast Guard
USFWS	US Fish and Wildlife Service
VSMP	Vital Signs Monitoring Program

CHAPTER 1 – PURPOSE AND NEED FOR ACTION

The Tennessee Valley Authority (TVA) is considering how to respond to the increased mooring of floating houses (FHs) on its reservoirs. This could include amending its regulations under Section 26a of the TVA Act. The increase in FHs has adverse implications for navigation, public health and safety, the environment, and public recreation.

TVA already prohibits the mooring of nonnavigable houseboats (NNs) that are used primarily for habitation and not for water transportation on its reservoirs. In 1971, TVA amended its regulations to prohibit the mooring or anchoring of new NNs on TVA reservoirs. Existing NNs were allowed to remain if they met certain conditions. At the same time, TVA established criteria for identifying when a houseboat should be considered "navigable." These criteria were characteristics that TVA determined were indicative of real watercraft (boats or vessels) that were primarily and regularly used to traverse water. Since 1971, TVA has made minor changes to its regulations affecting NNs—most notably in 1978, when TVA updated the prohibition except for NNs in existence on or before February 15, 1978. The navigability criteria, however, largely have remained unchanged. FHs are a modern version of the NNs that TVA addressed in its 1971 and 1978 regulatory actions. FHs do not have permits issued by TVA.

1.1 Purpose and Need

Congress has charged TVA with managing the Tennessee River system and has made TVA the steward of many of the river's resources. One of the most important tools that Congress gave TVA to implement this responsibility is Section 26a of the TVA Act. Section 26a requires TVA's approval prior to the construction, operation, or maintenance of any dam, appurtenant works, or other obstruction affecting navigation, flood control, or public lands or reservations. "Obstruction" is a broad term that includes boat docks, piers, boathouses, buoys, floats, boat launching ramps, fills, water intakes, devices for discharging effluents, bridges, aerial cables, culverts, pipelines, fish attractors, shoreline stabilization projects, channel excavations, and NNs (18 Code of Federal Regulations [CFR] 1304.1). TVA also has custody and control of ("owns") much of the shoreline and inundated land along and under its reservoir system.

Absent taking action, TVA expects that the mooring of FHs on its reservoirs will continue to increase. TVA has seen plans for FH subdivisions on some of its reservoirs. This will consume the available capacities of marinas. At some locations, FHs already have been moored beyond established harbor limits. The impacts on navigation and safety are apparent. In addition, recreational boaters could be affected either because they will be forced out of marinas or because their cost for marina use will increase. The primary, if not sole use, of FHs/NNs is habitation. This means they need electric and sanitation services. Mishandling these services has safety and environmental risks. On the other hand, mooring of FHs/NNs has economic benefits for marina owners and FH developers. FH owners or occupants also are a category of reservoir users, albeit one that TVA decided to restrict in 1971.

Without using the full scope of its regulatory authority, TVA has discouraged the increased mooring of FHs since these issues came to TVA's attention. TVA indicated that it wanted to consider the policy implications before deciding how to address the problem. This policy decision includes addressing the FHs that are now moored on some reservoirs. TVA already decided in 1971 that the impacts and risks of NNs outweighed their public value. As the manager of the Tennessee River system and the owner and steward of reservoir lands, TVA is inclined to affirm this policy decision and take action to prevent new FHs. Input from the public, especially reservoir stakeholders, will help TVA decide what course of action to take. This policy would apply to all TVA reservoirs.

Understanding the terms "Floating Houses" and "Nonnavigable Houseboats"

Floating houses are a modern version of the pre-1978 nonnavigable houseboats. Floating houses are considered to be structures designed and used primarily for human habitation, rather than for the primary purpose of recreational boating or water transportation.

"Nonnavigable houseboat" is the term found in TVA's regulations that refers to early-era floating houses that existed on TVA reservoirs when TVA amended its regulations in 1971 and 1978. At that time, TVA grandfathered and issued permits to the existing nonnavigable houseboats but prohibited new ones going forward.

TVA has prepared this Environmental Impact Statement (EIS) to assess the impacts associated with the increase in FHs on its reservoirs. TVA wants to use this environmental review process to better ascertain the values and concerns of stakeholders; to identify issues, trends, and tradeoffs affecting TVA's policy decision; to formulate, evaluate, and compare policy and management alternatives; to provide opportunities for public review and comment; and to ensure that TVA's evaluation of alternative management and policy strategies reflects a full range of stakeholder input. TVA will carefully consider the substantive comments it receives, and responses to comments will be incorporated into the Final EIS.

The EIS process ensures that the public and other environmental and permitting agencies have opportunities to provide input to the decision that TVA must make about the number of FHs and the FHs/NNs already located on its reservoirs. This EIS was prepared in accordance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality (CEQ) regulations (40 CFR Parts 15001508), and with TVA's procedures for NEPA implementation.

1.2 Background

In 1971, TVA amended its Section 26a regulations to prohibit all new NNs except for those in existence before November 21, 1971. In 1978, the rules for NNs were clarified to better distinguish between navigable and nonnavigable structures, and the prohibition was carried forward. At that time, TVA issued permits to ("grandfathered") the existing NNs. The rules were once again amended in 2003 to add a provision governing sanitation for NNs. In its 2003 rulemaking, TVA also broadened the criteria to determine whether NNs are moored at appropriate locations.

A "nonnavigable houseboat" under TVA current regulations means any houseboat not in compliance with the following criteria:

- Built on a boat hull or on two or more pontoons
- Equipped with a motor and rudder controls located at a point on the houseboat with forward visibility over a 180-degree range
- Compliant with all applicable state and federal requirements relating to vessels
- Registered as a vessel in the state of principal use
- State registration numbers clearly displayed on the vessel

Despite the prohibition on mooring of new FHs on its reservoirs, new FHs have been moored on TVA reservoirs. Some FH developers and owners have asserted that their houses have been designed to meet the criteria for navigability in TVA's regulations. Whether or not this is true, these FHs are designed and used primarily for human habitation at a fixed location rather than for regularly traversing water. These FHs are not in any real sense watercraft. TVA estimates that presently a total of 1,836 FHs and NNs on 16 TVA reservoirs (930 FHs and 906 NNs). These structures are most prevalent on Norris and Fontana Reservoirs, with approximately 900 on Norris Reservoir and approximately 350 on Fontana Reservoir.

1.3 General Description of Floating Houses

"Floating houses" are considered to be unpermitted structures designed and used primarily for human habitation. These structures are not designed or used for the primary purpose of recreational boating or water transportation. Existing structures vary greatly in size, quality of construction, number of stories, and level of built-in amenities and appliances. For instance, some structures may consist of only a small room while other structures are large, multi-level structures with characteristics that are indistinguishable from common houses on land (e.g., with fully-furnished kitchens, living and dining rooms, multiple bedrooms, full bathrooms, washers and dryers, central heating and air systems, rainwater gutters, water heaters, hot tub Jacuzzis, vinyl siding, and/or gabled roofs with shingle or metal panel roofing). These structures have been built on a variety of floating bases such as commercial-grade marine flotation, pontoons, unencased Styrofoam, boat hulls, and barrels. For examples of FHs and NNs on TVA reservoirs, see Figures 1.3-1 and 1.3-2.

Figure 1.3-1. Examples of floating houses/ nonnavigable houseboats

Figure 1.3-2. Additional examples of floating houses/nonnavigable houseboats

Some marinas provide electrical service for their customers; in other situations, electrical service and supply lines are individually metered. FH/NN structures in a slip or dock facility may have utilities such as electrical, water supply, and sewage service connected to the dock (Figure 1.3-3).

Figure 1.3-3. Electrical connection at dock

Independently moored structures away from the shoreline typically have electrical lines run from land under water to individual structures (Figures 1.3-4, 1.3-5, 1.3-6, and 1.3-7) or to a floating junction that feeds several FHs/NNs (Figure 1.3-8).

Figure 1.3-4. Onshore electrical junction for underwater lines to floating houses

Figure 1.3-5. Onshore electrical junction for underwater lines to floating houses

Figure 1.3-6. Electrical underwater lines to floating houses, exposed due to low water levels during winter drawdown

Figure 1.3-7. Electrical connection to floating house from underwater electrical line

Overhead electrical lines are also used to connect to structures moored close along the reservoir shoreline (Figures 1.3-9 and 1.3-10). Generators and small solar panels are used for some structures, particularly on reservoirs where land-based electrical service is not available. Liquid propane gas tanks are also used as a fuel source option for FH/NN structures (Figure 1.3-11). In addition to the provision of potable water lines and connections at dock facilities, other water supply options include hauling portable water containers and the use of reservoir water intakes.

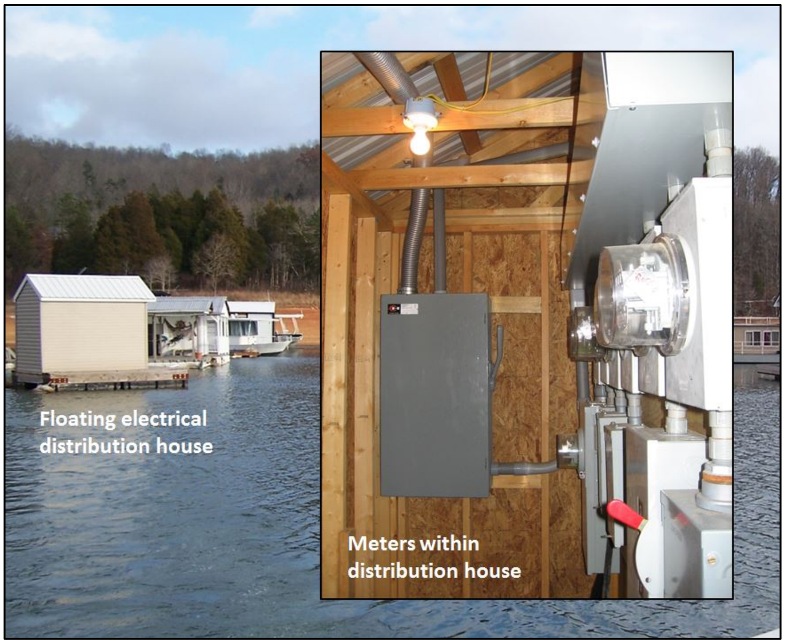


Figure 1.3-8. Floating electrical distribution house for multiple floating houses

Figure 1.3-9. Overhead electrical lines connection to floating houses

Figure 1.3-10. Overhead electrical lines on floating platform

Figure 1.3-11. Propane tanks as floating house fuel source

The methods for collecting and removing waste from FHs/NNs vary. In a few situations, waste is directly collected through sewer lines and pumped to a land-based septic system or municipal sewer system where such utility connections are available (Figure 1.3-12).[2]

[2] The Clean Water Act addresses the pollution of U.S. waters. Section 312 of the Act defines a process in which sewage discharge may be controlled through the establishment of areas in which discharges of sewage from vessels are not allowed (known as "No Discharge" zones). The U.S. Environmental Protection Agency, upon application by the State, designates these zones. Generally, all freshwater lakes and similar freshwater impoundments or reservoirs with no navigable connections with other waterbodies, and rivers not capable of interstate vessel traffic, are by definition considered No Discharge zones. See Section 3.10.

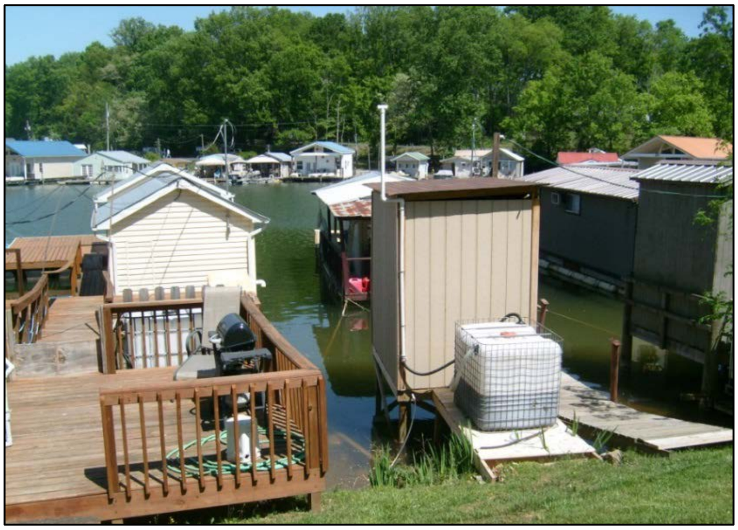


Figure 1.3-12. Shore-based sewage holding tank

The use of holding tanks on No Discharge reservoirs for containing and pumping out waste is a more common arrangement. Waste from individual FHs/NNs is collected from holding tanks by a pumper boat (Figures 1.3-13, 1.3-14, 1.3-15, and 1.3-16) and off-loaded to a tank truck for proper disposal and treatment in a septic system or sewage treatment plant. Grey water from showers, bathroom sinks, and washing machines is typically discharged directly to the reservoir from most FHs/NNs (Figures 1.3-17, 1.3-18, and 1.3-19).[3] On some FHs/NNs, however, grey water is retained in holding tanks and pumped out with black water, particularly on Fontana Reservoir where it is required by local county ordinances.

On Discharge reservoirs, black water from some FHs/NNs is contained and treated through a marine sanitation device (MSD) and then discharged similar to vessels with toilets, if the marina does not have a policy prohibiting treated discharges. Marinas on both Discharge and No Discharge reservoirs typically provide sewage pump-out facilities and services, or arrange for contractors to provide this service.

Mooring and anchoring of FHs/NNs are handled through different methods depending on site conditions, available marina facilities, and reservoir operational patterns. As shown in Illustrations A and B, some structures are moored to a dock or in a slip; and many are moored near the shoreline at piers or tied to trees (Figure 1.3-20) or posts on the reservoir bank. A large number of FHs/NNs are independently moored away from the shoreline in a marina harbor limit without foot access from a dock or pier. Many of these independently moored structures are connected by cables to weighted anchors on the reservoir bottom or to buoy lines. Buoy lines are generally wire cables spanning a long distance underwater, to which multiple FHs/NNs connect.

[3] Generally, "grey water" is defined as wastewater generated from residential bathroom sinks, bathtubs, showers, clothes washers, and laundry trays. "Black water" is normally defined as water from toilets, urinals, bidets, kitchen sinks, dishwashers, and garbage disposals. (GA 2014; Metcalf and Eddy 2006.)

Figure 1.3-13. Sewage pumper boat at marina

Figure 1.3-14. Holding tank pump-out system

Figure 1.3-15. Sewage capture at floating house

Figure 1.3-16. Sewage capture at floating house and grey water discharge pipe

Figure 1.3-17. Wastewater discharge pipe in red circle

Figure 1.3-18. Wastewater discharge pipe in red circle

Figure 1.3-19. Derelict floating house with unknown wastewater disposal

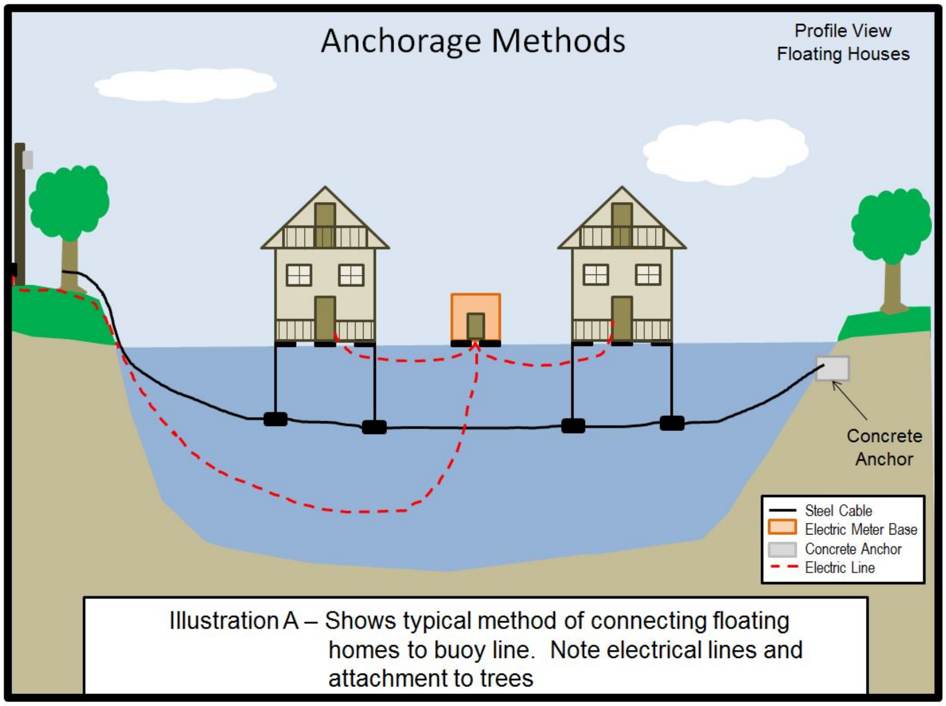


Illustration A, Anchorage methods

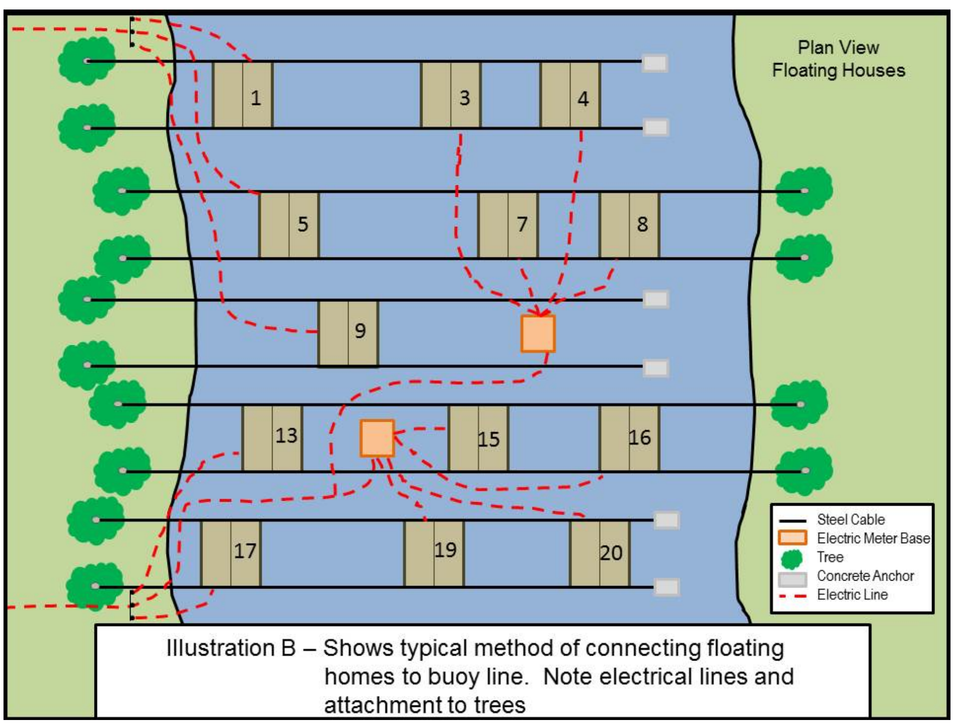


Illustration B, Anchorage methods

Figure 1.3-20. Anchoring to tree on shore

Figure 1.3-21. Floating house on constructed pedestal on Boone Reservoir, at winter reservoir level

On some tributary reservoirs, FHs/NNs are moored above constructed cribs or pedestals so the structure can settle at a level position when reservoir levels drop and avoid sitting on the reservoir bottom (Figure 1.3-21). In many cases, FH/NNs settle on the reservoir bottom and shoreline when reservoir levels drop (Figure 1.3-22).

Figure 1.3-22. Nonnavigable houseboats and floating houses on Fontana Reservoir shoreline, at winter reservoir level

Most FHs/NNs moored on TVA reservoirs are within commercial marina harbor limits. As defined in TVA’s regulations at 18 CFR 1304.404, "marina harbor limits" are the lakeward limits of commercial harbor areas determined and designated by TVA on the basis of the size and extent of facilities at the dock; navigation and flood control requirements; optimum use of lands and land rights owned by the United States; carrying capacity of the reservoir area in the vicinity of the marina; and the environmental effects associated with the use of the harbor. The landward limits of commercial marina harbor areas are determined by the extent of land rights held by the dock operator. The mooring of buoys, slips, or breakwaters, and permanent anchoring is prohibited beyond the lakeward extent of harbor limits.

According to the regulations, TVA may, at its discretion, reconfigure harbor limits based on changes in circumstances, including but not limited to, changes in the ownership of the land base supporting the marina. In some cases, marina operations have expanded beyond the harbor limits approved and permitted by TVA (Illustration C and Figure 1.3-23).

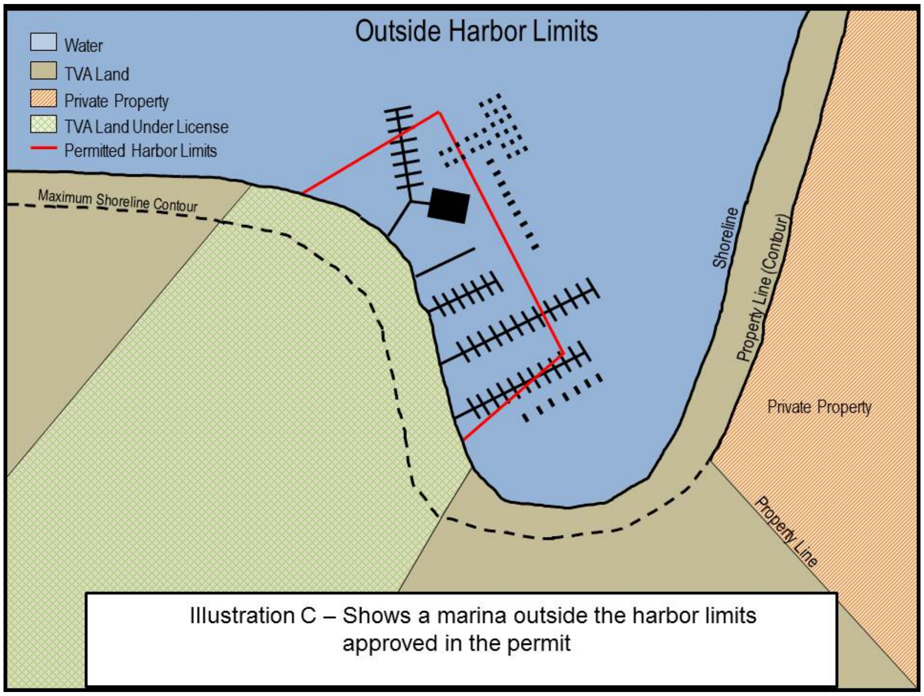


Illustration C, Illustration of a marina with facilities outside approved harbor limits

Figure 1.3-23. Marina with floating houses outside of approved harbor limits (blue area denotes approved harbor limit, grey area denotes actual area in use)

1.4 Scope of Analysis

This EIS addresses the impacts of TVA's proposed policy alternatives on the natural and human environment in the context of other TVA-approved policies and plans for TVA reservoirs and lands, and in the context of TVA's regulatory requirements and permitting processes (summarized in Sections 1.5 and 1.6 below). These include, but are not limited to, TVA's *Natural Resource Plan* (NRP) (TVA 2011a) and its associated *Comprehensive Valleywide Land Plan* (TVA 2011c); reservoir-specific land management plans; the Shoreline Management Policy; and TVA Section 26a regulations (Appendix A), permitting process, and procedures for NEPA compliance.

The geographic scope of this environmental review is the entire Tennessee River Watershed, specifically TVA's reservoir system and adjacent shoreline and land. Particular attention is given to reservoirs with existing commercial marinas and those reservoirs with a reasonable potential to support commercial marinas in the future. Reservoirs with "a reasonable potential to support commercial marinas" are those reservoirs where TVA's land use planning analyses indicate that the reservoir has sufficient shoreline and sufficient size to support a commercial marina, and that this use is consistent with the recreational and management goals for that reservoir. These reservoirs are shown in Figure 1.4-1, and information about each is provided in Table 1.4-1.

1.4.1 Reservoirs Included in the Analysis

Twenty-nine reservoirs currently have FHs or NNs, or are likely to have these structures in the future if current trends continue. Table 1.4-1 provides the general characteristics of these reservoirs. Table 1.4-2 identifies the estimated number of FHs/NNs on the 29 TVA reservoirs considered to have the potential to see increases in the number of these structures.

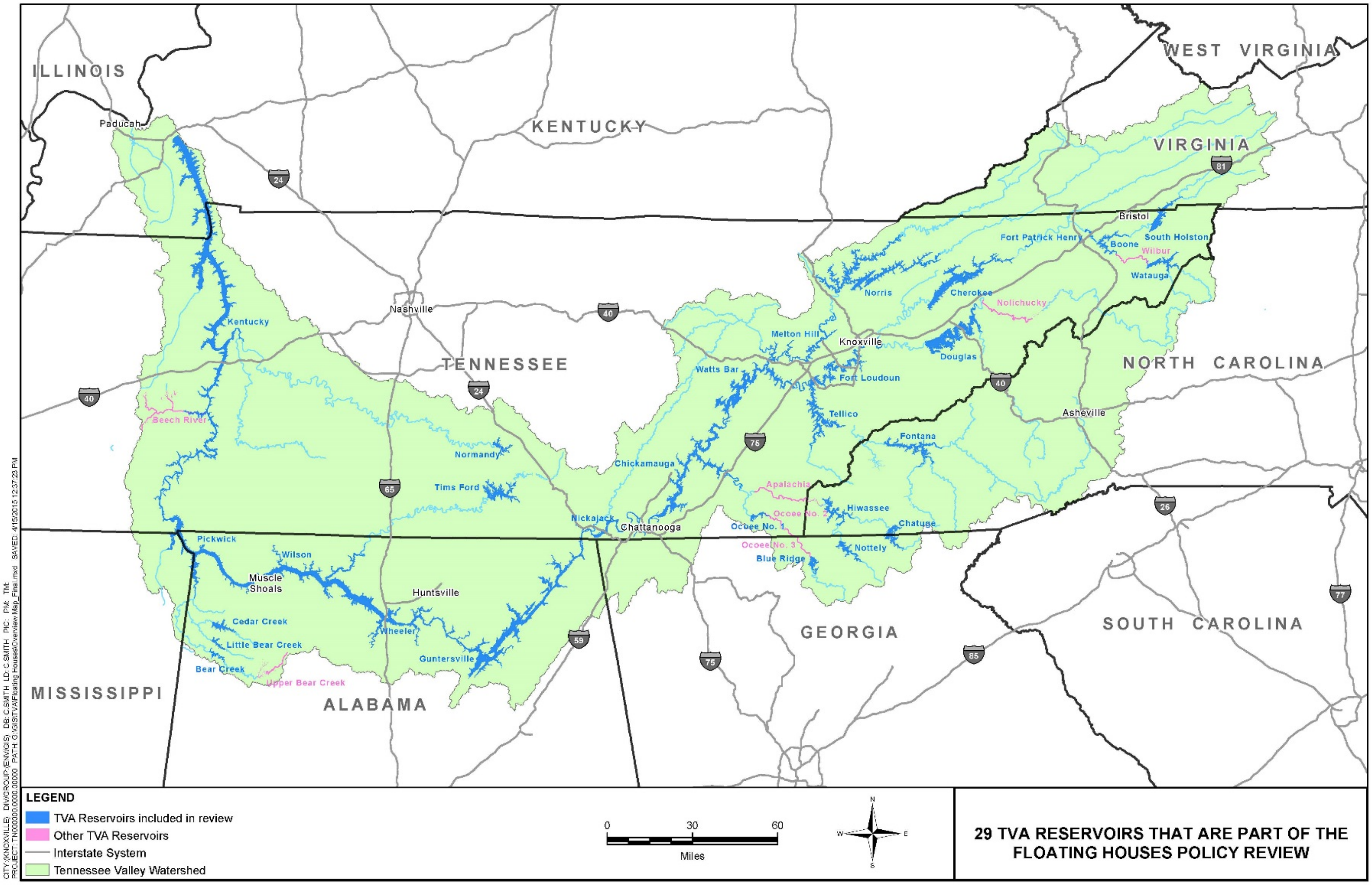


Figure 1.4-1. Overview map

This page intentionally left blank

Table 1.4-1. Summary of TVA Reservoirs with Existing Marinas or the Reasonable Potential to Support Commercial Marinas in the Future

TVA Reservoirs with Marinas or Potential for Marinas	Current Estimated Number of Floating Houses and Nonnavigable Houseboats	Number of Existing Marinas (Private and Commercial)	Existing Marina Footprint (acres)	Reservoir Acreage (acres)	Reservoir Length (miles)	Reservoir Shoreline Length (miles)	Total Shoreland Acreage within ¼-Mile Buffer [a] (acres)	Total Acreage of TVA Reservoir Land with Land Use Plans [b] (acres)
Bear Creek	0	0	0.0	651	12	52	6,090	2,285
Blue Ridge	12	1	23.7	3,220	11	68	6,410	470
Boone	133	7	51.6	4,130	32.7	127	13,767	881
Cedar Creek	0	0	0.0	4,007	9	83	8,435	2,744
Chatuge	0	4	39.2	6,700	13	128	11,397	3,070
Cherokee	2	11	130.2	28,780	54	395	44,120	8,735
Chickamauga	20	14	172.1	36,240	58.9	784	69,320	9,864
Douglas	0	10	69.0	28,420	43.1	513	36,956	2,055
Fontana	357	6	997.1	10,230	29	238	25,879	927
Fort Loudoun [c]	100	10	101.8	14,600	60.8	378	36,068	
Fort Patrick Henry	6	1	5.4	840	10.4	31	3,392	283
Guntersville	12	19	464.3	67,900	75.7	889	84,601	41,190
Hiwassee	30	4	45.2	5,870	22.2	165	18,022	1,007
Kentucky	55	61	658.1	160,300	184.3	2,064	165,914	41,597
Little Bear	0	0	0.0	1,437	6	45	5,031	1,176
Melton Hill	0	1	2.0	5,470	44	193	19,456	2,584
Nickajack [c]	30	3	45.5	10,370	46.3	179	21,744	
Normandy [c]	0	0	0.0	3,127	17	72	8,529	
Norris	921	24	644.4	33,840	129	809	89,353	27,993
Nottely	0	1	4.1	3,970	20.2	102	10,580	828
Parksville (Ocoee 1)	0	1	13.5	1,930	7.5	47	4,878	77
Pickwick	2	7	112.0	43,100	52.7	491	46,384	17,269
South Holston	117	6	144.9	7,600	23.7	182	14,281	2,267
Tellico	0	4	67.3	15,560	33.2	357	35,168	12,860
Tims Ford	0	1	23.7	10,500	34.2	309	24,570	3,103
Watauga	37	7	109.8	6,440	16.3	105	12,238	1,132
Watts Bar	2	13	148.6	39,090	95.5	722	69,695	16,216
Wheeler [c]	0	5	70.6	67,070	74.1	1,027	89,148	
Wilson [c]	0	5	14.6	15,500	15.5	166	17,578	
Total	**1,836**	**226**	**4,159**	**636,892**	**1,231**	**10,719**	**999,004**	**203,849**

Note: "A reasonable potential to support commercial marinas" means that TVA's land use planning efforts indicate that shoreline use is allocated to Zone 1 Private Use or Zone 6 Developed Recreation.
[a] Amount shown for all land owners.
[b] Does not include land owned by other entities.
[c] Data from Section 7.7 of the *Natural Resource Plan* (TVA 2011a).

This page intentionally left blank

Table 1.4-2. Reservoirs, Number of Floating Houses and Nonnavigable Houseboats, and Probability of Increases

Reservoirs with Marinas or Potential for Future Marinas	Probability of Increase in Number [a]				Estimated Current Number of Floating Houses and Nonnavigable Houseboats
	High	Moderate	Low	Very Low	
Bear Creek				X	0
Cedar Creek			X		0
Blue Ridge		X			12
Boone	X				133
Chatuge		X			0
Cherokee		X			2
Chickamauga	X				20
Douglas		X			0
Fontana	X				357
Fort Loudoun	X				100
Fort Patrick Henry		X			6
Guntersville	X				12
Hiwassee		X			30
Kentucky	X				55
Little Bear			X		0
Melton Hill		X			0
Nickajack	X				30
Normandy			X		0
Norris	X				921
Nottely		X			0
Parksville (Ocoee 1)			X		0
Pickwick	X				2
South Holston	X				117
Tellico		X			0
Tims Ford		X			0
Watauga	X				37
Watts Bar	X				2
Wheeler	X				0
Wilson		X			0

[a] Estimated by TVA Public Outreach and Recreation Staff, November 2014, based on assessment of available Zone 1 and 6 reservoir land for marina development and expansion, demand trends, and build-out for residential shoreline development; and historical demand for NNs and FHs.

Thirteen reservoirs have an estimated high probability of future increases in the number of FHs (Table 1.4-3). In descending order by current number of FHs/NNs, they are Norris, Fontana, Boone, South Holston, Fort Loudon, Kentucky, Watauga, Nickajack, Chickamauga, Guntersville, Pickwick, Watts Bar, and Wheeler Reservoirs.

Table 1.4-3. Reservoirs with a High Potential for Increasing Numbers of Floating Houses and Nonnavigable Houseboats by Reservoir Type

Reservoir	Current Estimated Number of Floating Houses and Nonnavigable Houseboats	Reservoir Type
Norris	921	Tributary
Fontana	357	Tributary
Boone	133	Tributary
South Holston	117	Tributary
Fort Loudoun	100	Mainstem
Kentucky	55	Mainstem
Watauga	37	Tributary
Nickajack	30	Mainstem
Chickamauga	20	Mainstem
Guntersville	12	Mainstem
Pickwick	2	Mainstem
Watts Bar	2	Mainstem
Wheeler	0	Mainstem

Five reservoirs have 100 or more FHs/NNs, as well as a high expectation for future increases: Norris, Fontana, Boone, South Holston, and Fort Loudoun. Four of these reservoirs are tributary reservoirs (Norris, Fontana, Boone, and South Holston).

The estimates for current numbers of FHs/NNs on the other eight reservoirs with a high probability of increasing numbers are much smaller, ranging from 55 on Kentucky Reservoir down to none on Wheeler Reservoirs. An additional 11 reservoirs have an estimated moderate probability of future increases in the number of FHs. Of the 11 reservoirs, 8 are tributary reservoirs and 3 are run-of-the-river or mainstem reservoirs.

In addition to the 29 reservoirs described above, 21 reservoirs currently have no marinas and have low estimates of potential FH development. If FHs become an issue on these reservoirs, potential impacts would be similar to those addressed on the 29 reservoirs.

The following reservoirs are not discussed further in the EIS:

- Apalachia
- Beech River Projects (Beech Reservoir, Dogwood Reservoir, Cedar Reservoir, Lost Creek Reservoir, Pin Oak Reservoir, Pine Reservoir, Red Bud Reservoir, Sycamore Reservoir)
- Bristol Flood Control Projects (Beaver Creek and Clear Creek)
- Nolichucky
- Normandy
- Ocoee 2
- Ocoee 3
- Upper Bear
- Wilbur
- Raccoon Mountain
- John Sevier
- Doakes Creek
- Great Falls

1.5 Decision to be Made

TVA must decide how to address environmental, safety, and socioeconomic concerns associated with the increasing numbers of FHs on its reservoirs.

TVA will make a policy decision incorporating input and comments from the public and from state and federal natural resource management and regulatory agencies. Although TVA will consider a variety of management alternatives during the review, the resultant strategy would likely involve revising current TVA regulations related to NNs (at 18 CFR 1304.1), clarification or establishment of criteria to identify permissible floating structures, establishment of minimum safety and environmental standards, and identification of enforcement mechanisms.

For any TVA decision that would change its existing policy (i.e., any alternative other than the No Action Alternative) on FHs/NNs, TVA would follow the policy decision, as needed, with formal rulemaking and development of administrative requirements or guidance to implement the selected policy.

TVA's policy decision would not specifically authorize any new marinas or FHs. Rather, the resultant Floating Houses Policy would establish the general framework for management of existing and new FHs. The development of new marinas is a separate process that depends on a number of factors, including demand, the location of appropriately zoned shorelines at TVA-owned and privately owned lands, the results of environmental reviews, and required permits (see below).

1.6 Related Plans and Programs

This EIS builds on other existing plans, policies, and related NEPA environmental reviews. The following are relevant to this EIS because they may affect or be affected by related TVA policies, or they were included in and used as a basis for the analyses presented herein.

1.6.1 Shoreline Management Policy and the Shoreline Management Initiative Final EIS

In November 1998, TVA issued a Final EIS on its policy regulating permitting activities and allowable residential uses for TVA-owned lands and easement properties along 11,000 miles of shoreline in the Tennessee River system. The Shoreline Management Initiative (SMI) EIS (TVA 1998) was the basis for TVA's Shoreline Management Policy, which established a management and environmental planning and review process, including individual reservoir land management plans (LMPs) and procedures for implementing the Section 26a permitting program that affect and are affected by the reservoir operations policy. The SMI EIS is the source of some of the land use and shoreline development projections used in this EIS. Some of the management measures resulting from the SMI EIS are relevant to the conclusions about environmental consequences.

1.6.2 Natural Resource Plan and EIS

TVA developed the NRP (TVA 2011a) to guide its natural resource stewardship efforts. The NRP addresses TVA's management of biological, cultural, and water resources; recreation; reservoir lands planning; and public engagement. The NRP's goal is to integrate the objectives of these resource areas, provide for the optimum public benefit, and balance sometimes conflicting resource uses. The NRP will also guide TVA in achieving the objectives of its Environmental Policy for a more systematic and integrated approach to natural resource stewardship.

In developing the NRP, TVA completed an EIS, which describes the potential resource management programs and activities; alternative approaches to TVA's resource management efforts; and the environmental impacts of the alternatives, including the alternative comprising the NRP.

As part of the NRP, TVA developed a *Comprehensive Valleywide Land Plan* (TVA 2011c) that TVA uses to guide resource management and administration decisions on the approximately 293,000 acres of TVA-managed property around 46 reservoirs. This plan informs the most suitable uses for the land under TVA's control by identifying areas for project operations, sensitive resource management, natural resource conservation, industrial/commercial development, developed recreation, and shoreline access. TVA's current reservoir land planning process allocates land to seven land use allocation zones as follows:

- Zone 1 – Non-TVA Shoreland/Flowage Easement
- Zone 2 – TVA Project Operations
- Zone 3 – Sensitive Resource Management

- Zone 4 – Natural Resource Conservation
- Zone 5 – Industrial
- Zone 6 – Recreation
- Zone 7 – Shoreline Access (private water-use facilities)

Detailed definitions of the seven zones are provided in Appendix B, which is from TVA's NRP (TVA 2011a).

1.6.3 Reservoir Operations Study and EIS

In 2004, TVA completed a *Reservoir Operations Study* (ROS) and associated EIS to review the policy that guides the day-to-day management of the Tennessee River and reservoir system. Consistent with the operating priorities established by the TVA Act, the reservoir operations policy sets the balance of trade-offs among competing uses of the water in the system. The policy directs how reservoir levels rise and fall, when changes in reservoir levels occur, and the amount of water flowing through the reservoir system at different times of the year. However, because TVA must respond to widely varying conditions in the operation of its reservoir system that are largely beyond TVA's control, its operations policy is basically a guideline and is implemented in a flexible manner. Because the ROS EIS (TVA 2004) was a programmatic review of TVA's operations throughout the Tennessee River Valley, the EIS provides information about region-wide reservoir operations and data for specific reservoirs, as well as a description of potential environmental impacts relating to the operations of its reservoirs.

1.6.4 Environmental Assessments and Environmental Impact Statements for Land Management Plans

Environmental Assessments and EISs were completed for LMPs, including those at the following TVA reservoirs: Melton Hill, Boone, Tellico, Tims Ford, Guntersville, Cherokee, Bear Creek, Norris, and Pickwick, Douglas-Nolichucky Tributary, Northeastern Tributary, and Mountain Reservoirs. These LMPs were developed in a manner consistent with implementation of TVA's Shoreline Management Policy, as established in the SMI. Of the LMPs completed, several address reservoirs with higher numbers of FHs/NNs.

Similar to past LMPs, future LMPs would be developed with participation by public agencies and officials, and by private organizations and individuals. By providing a clear vision of how TVA will manage public land and by identifying land for specific uses, a reservoir land plan minimizes conflicting land uses and guides decisions on requests for use of public land. Many of the land plans are available at
http://www.tva.gov/environment/land/land_mgmt_plans.htm

1.6.5 TVA Act Section 26a

The TVA Act is the legislation passed by Congress in 1933 that established the Tennessee Valley Authority. As noted above, Section 26a of that Act requires obtaining TVA's approval before any construction activities can be carried out that affect navigation, flood control, or public lands along the shoreline of the TVA lakes or in the Tennessee River or its tributaries. Section 26a is designed to ensure that construction along the shoreline and in waters of the Tennessee River system does not negatively affect TVA's management of the river system. Likewise, any construction should not interfere with TVA's ability to carry out what the Act describes as the "unified development and regulation of the Tennessee River."

TVA reviews proposals for shoreline construction activities to ensure that they are compatible with TVA's integrated management of the river system, including flood control, navigation, land use, recreation, power generation, and water resources. TVA implements Section 26a through its regulations at 18 CFR Part 1304. Subpart B of 18 CFR Part 1304 covers the Regulation of Nonnavigable Houseboats.

1.7 Related Environmental Reviews and Consultation Requirements

TVA's policy decision on FHs/NNs does not require any other specific permits or approvals. If TVA determines that it is necessary to promulgate new regulations to implement the policy decision, TVA would undertake a rulemaking process to establish the new regulations after the Final EIS is issued and a decision is made.

The development of any future marinas, however, would require permits, environmental reviews, and agency consultation. Any proposed marina or marina expansion would require approval from TVA under Section 26a and a permit from the US Army Corps of Engineers (USACE) under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act (CWA). State certifications also would be required under CWA Section 401(a)(1). Finally, additional local and state permits associated with sewage treatment, construction, and utility service may be necessary.

TVA is consulting with the State Historic Preservation Officers (SHPOs) of the seven states in the TVA region as well as with federally recognized Indian tribes, in compliance with Section 106 of the National Historic Preservation Act (NHPA), to address the potential adverse effects to historic properties of TVA's new policy. This consultation was initiated on April 30, 2015. Depending on the impacts of a proposed marina or other shoreline construction activity, TVA may need to consult with SHPOs under the NHPA, and the US Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA). These proposed actions also would require site-specific NEPA reviews.

1.8 Scoping and Public Involvement

During the scoping period for the EIS, TVA published a Notice of Intent (NOI); held public meetings at five locations; facilitated meetings with interested groups; sent notifications to a broad range of federal, state, and local agencies; established a Floating Houses EIS website; and provided a number of means for the public to provide comments verbally, in writing, and by phone message.

During the public comment period on the Draft EIS, TVA expects to conduct additional public meetings. Once the public and other agencies have reviewed the document, TVA will make revisions, if necessary, and publish a Final EIS. TVA will make a final decision after the Final EIS is published.

1.8.1 Notice of Intent

On April 30, 2014, TVA published the NOI in the Federal Register announcing that it planned to prepare either an Environmental Assessment or an EIS to assist TVA in deciding how to address FHs. The NOI initiated a 90-day public scoping period, which concluded in late July 2014.

1.8.2 Scoping Meetings

During the scoping period, TVA conducted five public meetings in May and June 2014, at locations across the Tennessee River Valley, to provide information, solicit input, discuss options, and identify related issues. The meetings were advertised in local newspapers, by press releases, and on the project website. The meeting dates, locations, and number of attendees are presented in Table 1.8-1.

Table 1.8-1. Public Scoping Meeting Attendance

Date (2014)	Location	Number of Attendees
May 22	Jasper, TN – Marion County Commission Building	1
May 29	Parsons, TN – Decatur County Convention Center	22
June 3	Bryson City, NC – Swain County Administration Building	72
June 23	Kingsport, TN – Warrior's Path State Park	35
June 24	LaFollette, TN – Ball Farm Event Center	77

TVA used an open-house format for these meetings. At each meeting, TVA personnel gave at least one presentation to the public about the review, the NEPA process, TVA policies, and related issues. The presentation was posted to TVA's Floating Houses EIS website. Attendees were invited to visit information booths and to speak with TVA specialists about their questions and concerns. Attendees were provided a variety of materials relating to the TVA review and were invited to submit comments formally. Comment forms and boxes were provided, and at least one court reporter was on hand at each meeting to record attendees' verbal comments.

1.8.3 Meetings with Interested Groups

Early in the public scoping period, TVA met with two local power companies (distributors of the electricity from TVA's power system) and marina owner groups that had expressed an interest in TVA's management of FHs and the environmental review. Because TVA coordinates routinely with these groups in managing its reservoirs, these groups had previously communicated an ongoing interest in the Floating Houses Policy. The following meetings occurred prior to or in the initial weeks of the public scoping period:

- Norris Marina Owners Association (April 8 and May 13, 2014)
- Powell Valley Electrical Cooperative (May 7, 2014)
- Marina owners of the Upper Holston Reservoirs (May 8, 2014)
- Lafollette Utilities Board (May 9, 2014)

TVA documented issues and recommendations from these meetings in the *TVA Floating Houses Policy Review Environmental Impact Statement Scoping Report* (TVA 2015a) that is available at TVA's Floating Houses EIS website.

1.8.4 TVA's Floating Houses EIS Website

TVA established a website (www.tva.gov/floatinghouses) as a platform for additional public outreach. It is intended for use as a central location for distributing information to the public. The Floating Houses EIS website includes:

- An overview of TVA's concerns and relevant issues
- Pertinent laws and regulations
- Photographs of FHs and related structures
- A description of the NEPA process
- Contact information for the TVA project lead
- Web links to other state and federal agencies involved in the review
- Presentation materials that TVA provided at the public meetings

Also included is a list of "Frequently Asked Questions" that addresses in greater detail 13 questions that members of the public may frequently ask.

In addition to the ability to submit written comments, TVA provided the public two web-based means to submit comments during the scoping period. First, TVA established an email address to provide a project-specific mailbox to which the public could submit comments or questions. The email address (fh@tva.gov) will be used throughout the duration of the project. Second, a web-based comment submittal form was available to the public during the scoping period, as part of TVA's Comment Management website. This form was available to the public only during the 90-day scoping period and will be available during the comment period on the Draft EIS. Comments received via email and the website comment forms are included in the *TVA Floating Houses Policy Review Environmental Impact Statement Scoping Report* (TVA 2015a).

1.8.5 Summary of Scoping Feedback

During the public scoping period, TVA identified and communicated to the public and other agencies a number of environmental, safety, and socioeconomic concerns. TVA solicited feedback during the scoping period on these issues and asked participants to bring new issues or information about other concerns to TVA's attention.

Participants submitted a variety of comments and opinions regarding future management of FHs and NNs that ranged in scope from prohibit and remove all such structures to grandfather and approve existing ones. Concerns expressed related to water quality, electrical safety, access to public shoreline, growth and size of FHs, the need for standards and the enforcement of those standards, and impacts on businesses and personal investments.

TVA received agency letters of response from the USFWS Gloucester, Virginia and Asheville, North Carolina Field Offices; USACE Wilmington District, Asheville, North Carolina Regulatory Division Office; Virginia Department of Game and Inland Fisheries, Richmond, Virginia; Virginia Department of Historic Resources, Richmond, Virginia; Virginia Department of Environmental Quality, Richmond, Virginia; and Kentucky State Historic

Preservation Office, Frankfort, Kentucky. These agencies expressed interest in TVA's review process and requested that TVA keep them apprised of progress and opportunities to provide additional input. In its letter, the USFWS Asheville Field Office provided more detailed input regarding TVA's review, expressing concern with the proliferation of floating structures and their effects on fish and wildlife species, and providing specific recommendations regarding the scope of the environmental analysis and the type of mitigation measures that should be considered.

The public scoping comments and input received by TVA are included in their entirety in the *TVA Floating Houses Policy Review Environmental Impact Statement Scoping Report* (TVA 2015a). The following is a brief summary of the most prevalent issues and comments expressed during the 90-day scoping period:

- Safety related to electrical systems and proper anchoring and mooring.
- Water quality and the need for proper management of wastewater (black water and grey water).
- Need for clearer regulations and stronger policing and enforcement.
- Minimum standards (safety and environmental) should be established for FHs and NNs.
- Need for an inspection and certification system; TVA should charge FH owners to support the required oversight and management to implement the system.
- Permit (grandfather) existing FHs that meet new minimum standards and continue to allow existing NNs to be maintained.
- FHs are important financially to marinas and the local and regional economies; FH owners have made significant investments.

The number of comments by general category is summarized below. Note that commenters may have identified several issues or concerns, or made more than one recommendation or suggestion. Because an attempt was made to count each issue or recommendation separately by a general descriptive category or theme, the number of comments exceed the number of commenters.

- Management and policy alternatives and recommendations – 78
- Standards, rules, and enforcement – 69
- Environmental impacts and water quality – 61
- Economic and financial impacts – 59
- Anchoring and mooring practices – 22
- Safety – 20

As noted above, stakeholder comments were documented at the public meetings by court reporter transcripts and written comment cards. Online comments were submitted to TVA's Comment Management website and the Floating Houses Review email message address. Written comments were also mailed, and issues and recommendations were documented from stakeholder telephone calls and meetings with marina owners and associations, power distributors, local officials, and stakeholders. The number of comments submitted to TVA during the scoping period is listed in Table 1.8-2.

Table 1.8-2. Public Comments Received during Scoping

Method of Submittal	Number of Comments
Comments submitted at TVA's website	19
Email messages	22 [a]
By mail	1
By phone	9
Court reporter – Jasper, TN	1
Court reporter – Parsons, TN	2+
Court reporter – Bryson City, NC	7
Court reporter – Kingsport, TN	3
Court reporter – LaFollette, TN	13

[a] A total of 38 messages from 28 individuals was submitted, only 22 of which pertained specifically to TVA's floating houses review.

1.9 Environmental Impact Statement Overview

This Draft EIS consists of seven chapters and five appendices, as outlined below:

- Chapter 1 describes the purpose and need for the policy review; background; the decision to be made; scope of the analysis; related plans and programs; scoping and public involvement; required permits, environmental reviews, and consultation requirements; and an EIS overview.

- Chapter 2 provides a description of the process by which a full range of potential policy alternatives were developed and refined and a description of the alternatives selected for detailed analysis in this EIS.

- Chapter 3 describes the existing environment of the potentially affected reservoir and shoreline resources.

- Chapter 4 describes the potential environmental consequences of each policy alternative; the cumulative impacts of alternatives identified in this EIS, in consideration of other major actions in the region of influence; and a range of potential mitigation measures to offset potential adverse impacts.

- Chapter 5 contains the literature cited.

- Chapter 6 contains a list of preparers.

- Chapter 7 contains a Draft EIS distribution list.

- Appendix A includes relevant portions of TVA's Section 26a regulations (from 18 CFR 1304 Subpart B)
- Appendix B defines the TVA Land Management Zones.
- Appendix C contains county-based socioeconomic information, including population, income and employment, housing, government services, and minority and low income data.
- Appendix D shows the projected number of FHs/NNs by reservoir for years 2021 and 2045.
- Appendix E is an analysis of marina harbor limit maps and aerial photography for selected commercial marinas.

This page intentionally left blank

CHAPTER 2 – ALTERNATIVES

The purpose of this EIS is to analyze, in a programmatic manner, the environmental impacts anticipated to result from alternative policies that TVA could adopt to respond to the increased mooring of FHs and NNs on its reservoirs. Because FHs are a type of NN, the action TVA takes is expected to apply to these structures as well. This chapter describes the six alternatives considered in detail in this EIS, as well as the process used to develop the alternatives. The alternatives encompass a variety of approaches for the management of FHs/NNs.

2.1 Description of Alternatives

With its purpose and need to address the increased mooring of FHs on its reservoirs, TVA began the alternatives development process by identifying a broad set of possible management actions (e.g., new standards, enforcement, updating rules and regulations, removal of noncompliant structures, permitting or not permitting new FHs) that could be combined into policy alternatives. This process included consideration of how to manage existing and currently permitted NNs, as well as options for addressing the existence of hundreds of currently unpermitted FHs. Floating Houses Policy alternatives were devised to address the proliferation of these structures that has resulted in unanticipated uses of the reservoir system and has raised concerns about impacts on public health and safety, the environment, and public recreation. The policy would apply to all TVA reservoirs.

TVA consulted a number of internal resources and TVA staff familiar with FH issues and management of the reservoirs, in addition to resource specialists familiar with the conditions at the marinas with FHs and their ongoing impacts. TVA also considered comments received in recent years from the public, marina owners, recreationists, landowners, and others who have communicated about FHs, in addition to comments received during the scoping process.

TVA then identified a set of five policy alternatives to evaluate in detail, in addition to the No Action Alternative, which must be addressed in accordance with applicable regulations. The resulting alternatives range from requiring the complete removal of all NNs and FHs to continued management of existing NNs and establishment of a permit program for development of new FHs.

The identified alternatives include grandfathering existing FHs (allowing them to remain on the reservoirs), removing them after a 30-year sunset period, and immediately removing them. TVA considered varying sunset periods for removal of existing FHs (e.g., 10, 15, or 20 years) before deciding that limiting the evaluation to immediate removal and removal after a 30-year period would provide the TVA decision maker and the public a sufficient understanding of the consequences of removal, including after shorter sunset periods. If something sufficiently different and important is associated with an interim removal period, TVA would appreciate comments about this.

During the scoping process, the public made suggestions regarding how TVA should administratively implement a new Floating Houses Policy. For instance, TVA received input on how to implement a fee structure, what the fee should be, how many days existing NN permit holders who are not in compliance should be given to upgrade their structures, the terms of agreements with marina operators, the frequency of inspections, and the spacing between structures. Some commenters, including NN permit holders, requested that TVA address a number of issues, including the need to regulate rates and services provided by operators to NN permit holders. TVA did not incorporate these specific suggestions into alternatives because of the programmatic nature of this review. TVA's administrative measures, if applicable (e.g., fee structures, time periods, and inspection schedule) are better addressed at the implementation stage.

Other comments suggested taking an action that TVA determined to be outside the scope of the review and, therefore, were not carried into an alternative. In its letter to TVA, the USFWS Asheville Office suggested that TVA designate sensitive areas on its reservoirs during this policy review. This suggestion was not considered further because TVA, as part of its NRP, has already developed shoreline zone designations and allocations (see Chapter 1) for its reservoirs, including Zone 3 Sensitive Resource Management areas. The USFWS Asheville Office also suggested administrative actions to implement a new policy and suggested mitigation measures that TVA is considering in this EIS.

Table 2.1-1 identifies the alternatives selected for detailed analysis, and Table 2.1-2 describes how each alternative would address current NNs, existing and/or new FHs, marina operations, and standards and enforcement.

Table 2.1-1. Alternatives Selected for Detailed Analysis

Alternative	**Description**
No Action Alternative	Current Management
Alternative A	Allow Existing and New Floating Houses
Alternative B1	Grandfather Existing and Prohibit New
Alternative B2	Grandfather but Sunset Existing and Prohibit New
Alternative C	Prohibit New and Remove Unpermitted
Alternative D	Enforce Current Regulations and Manage through Marinas and Permits

Table 2.1-2. Comparison of Floating Houses Policy Alternatives

Alternative	Permitted Nonnavigable Houseboats [a, b]	Existing Floating Houses	New Floating Houses	Marina Operations	Standards and Enforcement
No Action – Current Management [b]	NNs compliant with valid permits allowed; enforcement discretionary	Enforcement discretion used for noncompliant structures; emerging FH problem areas addressed as needed [c]	New FHs not allowed [d]	Harbor limits for marinas may be periodically adjusted if justified [e]	Current regulations not updated and rely on 18 CFR 1304
Alternative A – Allow Existing and New Floating Houses	NNs compliant with valid permits allowed and not subject to new standards; noncompliant [f] structures subject to new standards or removal at owner's expense within 18 months; exchange program [g]	Permit existing FHs; must meet new standards and be in marina limits [h]; upgrades required to achieve compliance or removal at owner's expense within 18 months	Permit new FHs [i] at marinas on all TVA reservoirs that meet new standards for safety, electrical, and discharge issues, and that are moored within marina harbors in a slip with dock- and land-based utilities	Harbor limits for marinas may be periodically adjusted if justified [e]	New standards to address safety and water/waste issues established and enforced for sewage, registration and fees, flotation, electric, maximum size, and minimum spacing/ separation
Alternative B1 – Grandfather Existing and Prohibit New	NNs compliant with valid permits allowed and not subject to new standards; noncompliant [f] structures subject to new standards or removal at owner's expense within 18 months; exchange program [g]	Permit existing FHs; must meet new standards and be in marina limits [h]; upgrades required to achieve compliance or removal at owner's expense within 18 months.	No new FHs allowed	Harbor limits for marinas may be periodically adjusted if justified [e]	New standards to address safety and water/waste issues established and enforced for sewage, registration and fees, flotation, electric, maximum size, and minimum spacing/ separation

Alternative	Permitted Nonnavigable Houseboats [a, b]	Existing Floating Houses	New Floating Houses	Marina Operations	Standards and Enforcement
Alternative B2 – Grandfather but Sunset Existing and Prohibit New	NNs compliant with valid permits allowed and not subject to new standards; noncompliant structures subject to new standards or removal at owner's expense within 18 months; NNs must be removed after 30 years; [k] exchange program [g]	Permit existing FHs for 30 years; must meet new standards and be in marina limits [i]; upgrades required to achieve compliance or removal at owner's expense within 18 months; all FHs removed after 30 years[l]	No new FHs allowed	Harbor limits for marinas may be periodically adjusted if justified [e]	New standards to address safety and water/waste issues established and enforced for sewage, registration and fees, flotation, electric, maximum size, and minimum spacing/ separation
Alternative C – Prohibit New and Remove Unpermitted Floating Houses	NNs compliant with valid permits allowed; noncompliant [f] structures subject to removal at owner's expense within 18 months	Existing FHs within or outside of marinas must be removed at owner's expense within 18 months; TVA updates regulations with prohibition [m]	No new FHs allowed	Harbor limits for marinas may be periodically adjusted if justified based on marina-specific conditions	No new standards to address safety and waste/water issues; active enforcement of NN permit conditions
Alternative D – Enforce Current Regulations and Manage through Marinas and Permits	NNs compliant with valid permits allowed; noncompliant [f] structures subject to removal at owner's expense within 18 months	Allow existing FHs meeting five criteria in 18 CFR 1304.101(a) [n]; otherwise, removal at owner's expense within 18 months	No new FHs allowed	Existing marina harbor limits will be consistently enforced to move all structures and vessels into approved harbor areas.	Actively enforce current regulations (18 CFR 1304.101[a])

FHs = Floating houses
NNs = Pre-1978 permitted nonnavigable houseboats

[a] Permits issued for NNs under the 1978 regulations are valid if compliant with current permit. Currently, not all permitted NNs comply with every regulation, especially those pertaining to sewage disposal, disrepair, and staying within harbor limits.
[b] TVA is using discretion in not enforcing against NNs that are not compliant with 18 CFR 1304.101, pending completion of the Floating Houses review.
[c] For example, on November 15, 2010, TVA notified Norris Reservoir marina owners to stop construction and installation of FHs.

[d] Although current regulations forbid new NNs and FHs, TVA recognizes that—as in the past—new FHs would be developed on TVA reservoirs, especially at Norris and Fontana, and that new FHs would eventually appear at reservoirs that do not currently have FHs.
[e] Adjustments would be based on marina-specific considerations, consistent with TVA land use allocations and meeting Standard Conditions and Requirements in permits and Land Use Agreements.
[f] Not in compliance with current valid permit or deemed unsafe or derelict.
[g] An exchange program would be established allowing exchange and retirement of NNs for a new FH structure with size restrictions (no change in footprint or 1-story/1,000 square feet).
[h] Existing, currently unpermitted FHs that are outside of marina areas would be required to be moved to a marina. Currently permitted NNs at dispersed locations would be allowed to stay.
[i] New FHs would be allowed throughout the TVA region at marinas that have valid TVA permits and land rights.
[j] TVA enforcement and agreements with marina owners would ensure that no new FHs are constructed on TVA reservoirs.
[k] NN permits would be subject to a sunset date after a 30-year period, after which the NNs would be removed from TVA reservoirs at the owner's expense.
[l] 30-year sunset period based on the general lifespan/expectancy of materials and structures and estimated depreciation of value; after 30 years, FHs would be removed at the owner's expense.
[m] TVA would update regulations to clarify the prohibition of NNs with a clearer prohibition on FHs used for human habitation.
[n] If structures meet the five criteria in 18 CFR 1304.101(a), they would not be termed "floating houses" and would be considered a "houseboat" and a vessel.

This page intentionally left blank

2.1.1 Potential Updated Standards

If TVA selects a future management alternative to allow and permit FHs, this change in policy will require revised or new standards to alleviate and minimize potential environmental and safety issues. Three of the alternatives being considered (Alternatives A, B1, and B2) could involve development of updated standards. The following list is a general summary of potential standards that could be considered.

- Provide ground fault protection (ground fault circuit interrupter [GFCI]) not exceeding 100 milliamperes on any and all power sources. Utility-supplied sources should have GFCI protection at main marina feeder circuit, branch circuits, structure, or individual circuits. All electrical cables that enter the water or otherwise supply FHs shall have GFCI protection at their source. Generators or other non-utility sources should have GFCI protection as close as possible to the power source. The GFCI protection shall disconnect all circuits supplied by the power source.

- Protect exposed electrical cables where feasible by trenching or placing in cable trays or conduit. Underwater cables in shallow water areas that are subject to physical damage by contact with watercraft or propellers shall be protected by conduit or burial, or marked by buoys as appropriate.

- Comply with National Fire Protection Association (NFPA) 70 (National Electric Code) standards for marinas, boatyards, and floating buildings.

- Prohibit unencased Styrofoam flotation on FHs and NNs, and require removal of any existing within a certain time period (i.e., within 18 months).

- Prohibit grey water and black water discharge from FHs on No Discharge reservoirs.

- Treat grey water and black water through a marine sanitation device (MSD) on Discharge reservoirs.

- All FHs and NNs without direct utility connections must be equipped with a holding tank or an approved MSD by an established date to enable proper handling and treatment of black and grey water.

- Allow no expansion of existing structures unless TVA deems that it is essential for compliance with standards (such as additional holding tank capacity).

- If new FHs are allowed (Alternative A), maximum size could be 1,000 square feet and one story, moored in a marina slip with all utilities connected to the slip.

- Minimum separation and spacing requirements within marina harbor limits would be established.

- TVA may consider the exchange and retirement of one or more permitted NNs for a new FH meeting standards, with an equal footprint but no more than 1,000 square feet, including decks and walkways.

- FH owners may be required to pay an annual management fee to TVA or approved marina operators; a security assurance fee or cleanup deposit may also be required.

- Marinas/FH owners must certify that an initial inspection is completed, and then every 5 years document an inspection by TVA or a qualified person that certifies compliance with electrical, sanitary, water supply, flotation, and mooring standards.

- Marinas/FH owners must certify yearly that the structure meets required standards.

- At TVA's request, marinas or structure owners must provide records to document that holding tanks on No Discharge reservoirs are being pumped regularly and that waste is properly disposed of and treated. Detailed records should contain pumping dates and volumes removed during each pump-out service for each FH and NN.

- NNs must be in compliance with current TVA permit conditions. If not, the structure must comply with all new standards and rules for FHs or be removed from the reservoir.

2.2 Alternatives Evaluated in Detail

The six alternatives selected to be carried forward for detailed analysis are described below. The alternatives and their corresponding management actions are summarized in Table 2.2-1.

2.2.1 No Action Alternative – Current Management

Under the No Action Alternative (see Table 2.2-1), TVA would continue to use discretion in enforcing its Section 26a regulations (Appendix A provides TVA Section 26a regulations pertinent to FHs/NNs) and would address specific problems caused by FHs/NNs on a case-by-case basis.

For the purposes of NEPA and the environmental analysis in this EIS, the No Action Alternative is the baseline against which all action alternatives are compared. In describing the No Action Alternative, TVA had to make a number of assumptions about how and where the moorings of FHs would occur. Also required were assumptions about the ongoing level of compliance with existing regulations, particularly in regard to permitting of new FHs and safety and water/waste issues (e.g., electrical standards, discharge of sewage [black water] and grey water). These assumptions were made in light of known trends in the increase in the number of FHs, surveys conducted by TVA, and observations on compliance with existing standards.

Assumptions made for the future under the No Action Alternative include the following:

- Current safety, electrical, mooring, and water quality issues would persist in the absence of new standards and could increase as more FHs are moored on reservoirs.

- Not all NNs comply with every permit requirement (especially those pertaining to sewage disposal, disrepair, and mooring within harbor limits), and this would continue.

- New FHs would be moored on TVA reservoirs, in a manner similar to recent trends, especially at Norris and Fontana Reservoirs; most, but not all, would be at existing or new marinas.

- Marinas on reservoirs that currently have no FHs would likely begin developing or accommodating FHs.

Table 2.2-1. No Action Alternative – Current Management

TVA Management Actions
Permitted Nonnavigable Houseboats: • Permits issued to NNs under current regulations would remain valid if the NN complies with its permit. • TVA would take enforcement action against noncompliant NNs on a case-by-case basis as resources permit.
Existing Floating Houses: • TVA would continue to use its discretion when to make FHs comply with 18 CFR 1304.101, Nonnavigable Houseboats. • TVA would continue to use discretion to address specific FH problems.
New Floating Houses: • TVA would not change its existing regulations that prohibit new NNs or FHs on its reservoirs.
Marina Operations: • Harbor limits for all marinas would be periodically adjusted if justified (with fees adjusted accordingly) based on marina-specific considerations, including any problems caused by the mooring of FHs.
Standards and Enforcement: • Current regulations would not be changed, and TVA would continue to rely on 18 CFR 1304, Regulation of Nonnavigable Houseboats and its property rights to address FH problems.

2.2.2 Alternative A – Allow Existing and New Floating Houses

Under Alternative A (see Table 2.2-2), TVA would approve and issues permits for mooring of existing and new FHs that meet new minimum standards within permitted marina harbor limits. Noncompliant FHs would need to be removed from the reservoir. TVA would change its regulations to set new minimum standards for safety and wastewater issues, and TVA would increase its enforcement of these standards. Existing permits issued to NNs would remain valid if the NN complies with its permit conditions. Permitted NNs would not be subject to new standards if they comply with their current permits.

Assumptions made for the future under Alternative A include:

- Implementation and enforcement of the new standards on new and existing FHs would address safety, electrical, and wastewater discharge issues.
- Marinas on every TVA reservoir may eventually accommodate at least some FHs.
- Permitted NNs could continue to discharge grey water in both No Discharge and Discharge reservoirs, unless prevented by other state or federal regulations.[4]

[4] Based on anecdotal information, many owners of permitted NNs and unpermitted FHs routinely discharge all of their grey water without any treatment directly into the reservoir, even if they are located on a No Discharge reservoir.

Table 2.2-2. Alternative A – Allow Existing and New Floating Houses

TVA Management Actions
Permitted Nonnavigable Houseboats: • Existing permits issued to NNs under 1978 regulations would remain valid if the NN complies with its permit conditions. • Permitted, compliant NNs would not be subject to new standards unless they violate their permits or are deemed unsafe or derelict; in such an event, the NN would need to comply with the new standards within 18 months or be taken off the reservoir. • A compliant, permitted NN could be replaced with a new FH structure with size restrictions (i.e., no change in footprint or 1-story/1,000 square feet). • TVA would allow currently permitted, compliant NNs at dispersed locations to stay at those locations.
Existing Floating Houses: • TVA would approve and issue permits for mooring of existing FHs within marina harbor areas that meet new minimum standards at their existing footprint size. • Existing FHs outside of marina harbor areas would need to be moved within harbor areas and issued a permit, or would be taken off of the reservoir. • Existing FHs that do not meet the new minimum standards would have 18 months to meet the standards or would be taken off of the reservoir.
New Floating Houses: • TVA would approve and issue permits for mooring of new FHs that are within marina harbor areas, moored at dock slips with land-based utilities, and meet the new minimum standards and size restrictions (1 story and maximum 1,000 square feet); new FHs would be allowed on all TVA reservoirs.
Marina Operations: • Harbor limits for all marinas would be periodically adjusted if justified (with fees adjusted accordingly) based on marina-specific considerations, including any problems caused by the mooring of FHs.
Standards and Enforcement: • TVA would establish and actively enforce new standards to address safety and water/waste issues. [a] TVA would amend its regulations to clarify its navigability criteria.

[a] On No Discharge reservoirs, grey water from FHs would be contained and properly disposed of with sewage.
On Discharge reservoirs, grey water from FHs would be treated through a certified marine sanitation device.
Charge annual registration fee and/or security assurance cleanup deposit.
All raw Styrofoam replaced with encased or marine-grade flotation.
Electrical ground fault protection and compliance with National Fire Protection Association (NFPA) 70 (National Electric Code) standards for marinas, boatyards, and floating buildings.
Minimum separation and spacing within marina harbor areas.

2.2.3 Alternative B1 – Grandfather Existing and Prohibit New

Under Alternative B1 (see Table 2.2-3), TVA would permit existing FHs that meet minimum standards and allow them to be moored within permitted marina harbor limits. Permitted NNs in compliance with their permits would continue to be allowed. TVA would prohibit new FHs and update its regulations to clarify that FHs are deemed nonnavigable and not allowed.

Table 2.2-3. Alternative B1 – Grandfather Existing and Prohibit New

TVA Management Actions

Permitted Nonnavigable Houseboats:

- Existing permits issued for NNs under 1978 regulations would remain valid as long as the NN complies with its permit.
- Permitted, compliant NNs would not be subject to new standards unless they violate their permits or are deemed unsafe or derelict; in such an event, the NN would need to comply with the new standards within 18 months or would be removed from the reservoir.
- A compliant, permitted NN could be replaced with a new FH with size restrictions (i.e., no change in footprint or 1 story/1,000 square feet).
- TVA would allow permitted, compliant NNs currently moored at dispersed locations to stay at those locations.

Existing Floating Houses:

- TVA would approve and issue permits for mooring of existing FHs within marina harbor areas that meet new minimum standards at their existing footprint size. The permits would be terminated (sunset) after 30 years.
- Existing FHs moored outside of marina harbor areas would need to be moved back into those harbors and issued a permit.
- Existing FHs that do not meet TVA's new standards would have 18 months to meet the new minimum standards or would be removed from the reservoir.

New Floating Houses:

- TVA would prohibit new FHs.
- TVA enforcement and agreements (e.g., permit conditions) with marina owners would ensure that no new FHs are moored on TVA reservoirs.

Marina Operations:

- Harbor limits for all marinas would be periodically adjusted if justified (with fees adjusted accordingly) based on marina-specific considerations, including any problems caused by the mooring of FHs.

Standards and Enforcement:

- TVA would establish and actively enforce new standards to address safety and water/waste issues. [a] TVA would amend its regulations to clarify its navigability criteria.

[a] On No Discharge reservoirs, grey water from FHs would be contained and properly disposed of with sewage.
On Discharge reservoirs, grey water from FHs would be treated through a certified marine sanitation device.
Charge annual registration fee and/or security assurance cleanup deposit.
All raw Styrofoam replaced with encased or marine-grade flotation.
Electrical ground fault protection and compliance with National Fire Protection Association (NFPA) 70 (National Electric Code) standards for marinas, boatyards, and floating buildings.
Minimum separation and spacing within marina harbor areas.

TVA would establish and enforce new standards to address safety and water/waste issues. Permitted, compliant NNs would not be subject to new standards as long as they comply with their permit conditions.

Assumptions made for the future under Alternative B1 include the following:

- Permitted, compliant NNs would continue to discharge grey water to both No Discharge and Discharge reservoirs, unless prevented by other state or federal regulations.
- TVA enforcement and agreements (e.g., permit conditions) with marina owners would ensure that no new FHs are moored on TVA reservoirs.

2.2.4 Alternative B2 – Grandfather but Sunset Existing and Prohibit New

Under Alternative B2 (see Table 2.2-4), TVA would approve existing FHs that meet minimum standards and allow mooring within permitted marina harbor limits but would establish a sunset date (30 years), by which time all FHs must be removed from TVA reservoirs. TVA would prohibit new FHs. TVA would update its regulations to clarify that new FHs are prohibited and establish a date by which existing, approved FHs must be removed. TVA would continue to allow currently permitted NNs that are compliant with their permits but would require that they be removed from TVA reservoirs by the 30-year sunset date.

TVA would establish and enforce new standards to address safety and water/waste issues. Permitted, compliant NNs would not be subject to new standards as long as they comply with their permit conditions.

Assumptions made for the future under Alternative B2 include the following:

- TVA enforcement and agreements (e.g., permit conditions) with marina owners would ensure that no new FHs are moored on TVA reservoirs.
- All NNs and FHs would be removed from TVA reservoirs after 30 years.

Table 2.2-4. Alternative B2 – Grandfather but Sunset Existing and Prohibit New

TVA Management Actions
Permitted Nonnavigable Houseboats: • Existing permits issued for NNs under 1978 regulations would remain valid as long as the NN complies with its permit conditions but would be terminated (sunset) after 30 years. • Permitted, compliant NNs would not be subject to new standards unless they violate their permits or are deemed unsafe or derelict; in such an event, the NN would need to comply with the new standards within 18 months or would be removed from the reservoir. • A compliant, permitted NN could be replaced with a new FH with size restrictions (i.e., no change in footprint or 1 story/1,000 square feet). • TVA would allow permitted, compliant NNs currently moored at dispersed locations to stay at those locations.
Existing Floating Houses: • TVA would approve and issue permits for mooring of existing FHs within marina harbor areas that meet new minimum standards at their existing footprint size. The permits would be terminated (sunset) after 30 years. • Existing FHs moored outside of marina harbor limits would need to be moved back into those harbors and issued a permit. • Existing FHs that do not meet the new minimum standards would have 18 months to meet the standards or would be removed from the reservoir.
New Floating Houses: • TVA would prohibit new FHs. • TVA enforcement and agreements (e.g., permit conditions) with marina owners would ensure that no new FHs are moored on TVA reservoirs.
Marina Operations: • Harbor limits for all marinas would be periodically adjusted if justified (with fees adjusted accordingly) based on marina-specific considerations, including any problems caused by the mooring of FHs.
Standards and Enforcement: • TVA would establish and actively enforce new standards to address safety and water/waste issues. [a] TVA would amend its regulations to clarify its navigability criteria and establish sunset requirements.

[a] On No Discharge reservoirs, grey water from FHs would be contained and properly disposed of with sewage.
On Discharge reservoirs, grey water from FHs would be treated through a certified marine sanitation device.
Charge annual registration fee and/or security assurance cleanup deposit.
All raw Styrofoam replaced with encased or marine-grade flotation.
Electrical ground fault protection and compliance with National Fire Protection Association (NFPA) 70 (National Electric Code) standards for marinas, boatyards, and floating buildings.
Minimum separation and spacing within marina harbor areas.

2.2.5 Alternative C – Prohibit New and Remove Unpermitted

Under Alternative C (see Table 2.2-5), TVA would prohibit new and existing FHs. TVA would continue to allow permitted NNs that comply with their current permit conditions. TVA would require removal of all unpermitted FHs and noncompliant, permitted NNs. TVA would amend its regulations to clarify its navigability criteria. TVA would not issue new standards as new standards would not apply to permited NNs and therefore are unnecessary.

Assumptions made for the future under Alternative C include the following:

- TVA enforcement and agreements (e.g., permit conditions) with marina owners would ensure that no new FHs are moored on TVA reservoirs.

Table 2.2-5. Alternative C – Prohibit New and Remove Unpermitted

TVA Management Actions
Permitted Nonnavigable Houseboats: • Permits issued for NNs under 1978 regulations would remain valid as long as the NN complies with its permit. • NNs not in compliance with a current permit or deemed unsafe or derelict must be brought into compliance or be removed within 18 months.
Existing Floating Houses: • Existing FHs would need to be removed from TVA reservoirs within 18 months.
New Floating Houses: • TVA would prohibit new FHs. • TVA enforcement and agreements (e.g., permit conditions) with marina owners would ensure that no new FHs are constructed on TVA reservoirs.
Marina Operations: • TVA may periodically adjust harbor limits for all marinas if justified (with fees adjusted accordingly) based on marina-specific considerations.
Standards and Enforcement: • TVA would not develop new standards to address safety and waste/water issues. • TVA would amend its regulations to clarify its navigability criteria.

2.2.6 Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

Under Alternative D (see Table 2.2-6), TVA would use its existing Section 26a regulations and property rights to remove existing FHs and noncompliant NNs, and to stop the mooring of new FHs on its reservoirs. TVA also would use the conditions and covenants in its land use agreements with marina operators to accomplish this.

Table 2.2-6. Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

TVA Management Actions
Permitted Nonnavigable Houseboats: • Permits issued for NNs under 1978 regulations would remain valid as long as the NN complies with its permit. • NNs not in compliance with a current permit or deemed unsafe or derelict must be brought into compliance or be removed within 18 months.
Existing Floating Houses: • TVA would take action to remove existing FHs not meeting the five navigable houseboat criteria identified in Section 26a regulations: Subpart B – Regulation of Nonnavigable Houseboats (Section 1304.101).
New Floating Houses: • TVA would prohibit new FHs. • TVA enforcement and agreements (e.g., permit conditions) with marina owners would ensure that no new FHs are moored on TVA reservoirs that do not meet navigation criteria (TVA anticipates that some FHs would be modified to meet the navigation criteria and that new structures designed and used for habitation would be built that meet the navigation criteria).
Marina Operations: • TVA would restrict marina mooring and operations to the existing, approved marina harbor limit space. All structures and vessels would be moved within the approved harbor limit. TVA would not allow future harbor limit adjustment or expansion for any marina with noncompliant NNs or FHs.
Standards and Enforcement: • TVA would actively enforce its current regulations that are applicable to FHs/NNs and use its property rights to remove and prevent the mooring of FHs.

Assumptions made for the future under Alternative D include the following:

- TVA's use of its Section 26a authority and property rights, and its enforcement of marina harbor limits and land use agreements with marina operators would stop the mooring of new FHs and result in the removal of existing FHs over time.
- Marina mooring and operations would be restricted to the currently approved marina harbor limit space.
- Current safety, electrical, mooring, and water quality issues would persist in the absence of new standards.

2.3 Comparison of Alternatives

To complete the environmental analysis, TVA estimated the future number of FHs/NNs under each of the alternatives. As shown in Table 2.3-1 and discussed in Section 4.1.1, the largest predicted increase in the number of FHs would occur under the No Action Alternative. The second highest increase in the number of FHs on TVA reservoirs over a 30-year period would take place under Alternative A. The largest predicted decrease in the number of FHs would occur under Alternative B2, which would require the removal of all structures by the end of the 30-year period. Under Alternative B1, approximately 25 percent of the existing FHs/NNs would be removed within the first 18 months. Under Alternative C, approximately half of the existing FHs/NNs would be removed from TVA reservoirs within 18 months, with no further reduction over the 30-year period. Under Alternative D, approximately 25 percent of FHs that do not comply with the current regulations would be modified to meet the regulations' criteria for navigation, allowing the modified FHs to remain and new structures to be built (that meet navigation criteria but with primary design and purpose of habitation) at the same rate assumed under the No Action Alternative, based on marina harbor area capacity.

Table 2.3-1 Projected Number of Floating Houses and Nonnavigable Houseboats by Alternative

Year	Alternative					
	No Action	A	B1	B2	C	D
Current	1,836	1,836	1,836	1,836	1,836	1,836
2021	2,365	1,906	1,377	1,377	918	1,337
2045	3,692	3,233	1,377	0	918	2,016

Actions associated with some alternatives would indirectly or temporarily affect a number of different resources areas. For example, demolition and removal of unapproved structures associated with Alternatives A, B1, B2, C, and D would indirectly and temporarily affect multiple resource areas—including recreation, solid and hazardous wastes, visual resources, cultural resources, water quality, ecological resources, and threatened and endangered species—due to the use of heavy equipment. Alternatives that involve the removal of unapproved structures and prohibition of new structures (Alternatives B1, B2, and C) would result in an overall decrease in FHs/NNs and associated environmental impacts.

A summary of impacts by alternative and by resource area is presented in Table 2.3-2.

2.4 Identification of Mitigation Measures

NEPA and its implementing regulations require that an EIS identify appropriate mitigation measures for the adverse impacts potentially resulting from a proposed action. Under NEPA, mitigation measures are actions that could be taken to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse effects on the environment (40 CFR 1508.20). TVA considered potential mitigation in several ways.

First, TVA considered mitigation measures as an integral part of its alternatives analysis. TVA identified and considered ways in which the impacts from FHs/NNs could be mitigated —ranging from immediate removal of all FHs to permitting them permanently or over a

30-year sunset period. The alternatives included a number of individual measures under permitting, management, marina operations, standards, and enforcement that could reduce or eliminate ongoing and potential future impacts—including those measures brought forth to TVA by the public during scoping. The five action alternatives and the No Action Alternative represent a full range of reasonable measures for addressing mitigation as part of the policy alternatives development.

Second, TVA considered mitigation by adopting other means, not part of the alternatives, that could be used to avoid, reduce, or minimize adverse environmental impacts. It is important to remember that none of the policy alternatives would specifically authorize any new marinas or FHs (see Section 1.4, Decision to be Made). The ultimate policy decision would not authorize any on-the-ground actions or waive environmental review for subsequent individual actions. Therefore, it is not possible at this time to identify specific mitigation measures to be implemented. Site-specific concerns and the development of additional mitigation measures would be need to be addressed in project-level reviews, such as when new marinas were developed.

Finally, in addition to its broad management actions, TVA has site-specific regulatory and review processes that identify actions to avoid or reduce potential adverse impacts that may result from specific actions under any of the FH/NN policy alternatives. As more fully described in Section 1.6, Related Permits, Environmental Reviews, and Consultation Requirements, under Section 26a, TVA must review construction proposals to ensure that shoreline construction activities are compatible with all aspects of TVA's integrated management of the river system. Permit approvals for construction under Section 26a are considered federal actions and therefore are subject to NEPA requirements and other federal laws. Related environmental reviews that occur under Section 26a include the ESA Section 7 consultation process to address impacts on threatened and endangered species, the NHPA Section 106 consultation process to address impacts on cultural resources; and the NEPA review process itself that would identify measures to mitigate, reduce, or avoid impacts on wetlands, floodplains,and other important natural resources. All are subject to the identification of, and possible conditioning with, required measures to mitigate potential adverse impacts.

2.5 The Preferred Alternative

At this time, TVA's preference is to continue to allow NNs with current permits and to permit (i.e., grandfather) the mooring of existing, currently unpermitted FHs on TVA reservoirs—but only if the FHs comply with new standards and requirements under development by TVA. Noncompliant FHs/NNs would be removed from TVA reservoirs. Thus, TVA is inclined to select either Alternative B1 or B2 as its final decision but will consider the stakeholders' and public's input on which alternative best meets the agency's purpose and needs.

This page left intentionally blank.

Table 2.3-2. Summary of Resource Impacts by Alternative

Resource	Alternative					
	No Action Alternative	**Alternative A**	**Alternative B1**	**Alternative B2**	**Alternative C**	**Alternative D**
Socioeconomics						
Total market value of FH	Doubles in 30 years	Slight initial decrease as FHs are removed that are not upgraded to meet new standards; then an increase over 30 years	25-percent reduction in short period	Elimination of FH market value after 30 years	Major loss of market value over short period; FHs prohibited	Major loss of market value over short period; then an increase over 30 years
FH owner loss of use	No change	Reduced by number of FHs not upgraded to meet new standards	Reduced by number of FHs not upgraded to meet new standards	Greatest loss of use over 30-year period	Major loss of use in short time period	Loss of use for those NNs and FH not compliant with current permit and 26a rules
FH or NN owner costs of upgrading structure to meet standards	No change	Increase in costs	Increase in costs	Greatest increase in costs; then removing all FHs and NNs	Increase in costs for removing all unpermitted FHs and noncompliant NNs	Large increase in costs over short period for removal or upgrading FHs to meet current navigation criteria
Marina owner revenue and employment from FHs and NNs	Increased revenues	Increased revenue over 30 years	Moderate reduction in income over 30 years	Greatest reduction in income over 30 years	Largest reduction in income in shortest period	Reduction in income over short period; then an increase over 30 years

Resource	Alternative					
	No Action Alternative	Alternative A	Alternative B1	Alternative B2	Alternative C	Alternative D
			Socioeconomics (Continued)			
FH owner rental income	Supply of rentals increases and rental price stays constant or slightly decreases	Slight reduction in rental market and increase in rental price	Reduction in rental income	Gradual reduction over time to 0	Greatest loss over short period	Slight to moderate loss over short period
Renters of FHs and NNs	More options and slightly reduced rental prices	Slightly fewer options and slightly reduced rental prices	Reduced options and slightly higher rental prices	Loss of FH and NN rental options after 30 years	Greatest loss of FH rental opportunities over a short period and likely higher rental prices for remaining NNs	Moderate loss of rental options and likely higher rental prices for remaining NNs
Shoreline property owners	Reduced shoreline property values and reduced enjoyment	Reduced shoreline property values and reduced enjoyment, but impacts primarily near marinas	Slight improvement in shoreline property values and increased enjoyment	Greater improvement in shoreline property values after 30 years and greatest increase in enjoyment	Greatest positive impact on shoreline property owners within 6 months	Moderate positive impact on shoreline property owners in short period
TVA costs	Slight increase in costs for management	Greater costs for management of new standards and removing abandoned structures	Greater costs for management of new standards and removing abandoned structures	Greatest potential costs for removing abandoned structures, spread over 30 years	Increased costs for removing abandoned structures, concentrated in a short period, and increased management costs	Moderate potential cost increase for removing abandoned structures, concentrated in a short period, and increased management costs

Resource	Alternative					
	No Action Alternative	**Alternative A**	**Alternative B1**	**Alternative B2**	**Alternative C**	**Alternative D**
			Recreation			
FH and NN users	Greatest increase in number of recreation days	Large increase in number of recreation days	Decrease in number of recreation days	Number of recreation days reduced to 0 after 30 years	Large decrease in number of recreation days over a short period	Moderate or slight increase in number of recreation days after initial reduction
General public using shorelines and open water	Reduced enjoyment and access, and increased congestion	Reduced enjoyment and access, and increased congestion, primarily in marina areas	Slight improvement in access and reduced congestion, primarily in marina areas	Largest positive impact for public over 30 years	Greatest positive impact for public recognized in shortest period	Moderate positive impact for public in short period
Recreational boating and fishing	Greatest reduction in reservoir surface area, access to shoreline, and quality of recreation	Large reduction in reservoir surface area, shoreline access, and quality of recreation; impacts focused in marina areas	Moderate increase in reservoir surface area, shoreline access, and quality of recreation as unpermitted structures are removed	Moderate increase in reservoir surface area, shoreline access, and quality of recreation as unpermitted structures are removed; greater increase after 30 years	Greatest increase in reservoir surface area, shoreline access, and quality of recreation in shortest period	Neutral to slight increase in reservoir surface area, shoreline access, and quality of recreation (depending on number of FHs removed)

Resource	Alternative					
	No Action Alternative	**Alternative A**	**Alternative B1**	**Alternative B2**	**Alternative C**	**Alternative D**
			Recreation (Continued)			
Shoreline recreation access and quality of recreation	Greatest reduction in access to shoreline areas and quality of recreation	Large reduction in access and quality near marinas	Moderate increase in access and quality as unpermitted structures are removed	Moderate increase in access and quality as unpermitted structures are removed; greater increase after 30 years	Greatest increase in access and quality in shortest period	Neutral to slight increase in access and quality (depending on number of FHs removed)
			Public Safety			
Shoreline user and swimmer exposure to electric hazards	No reduction in hazards	Reduced exposure to electrical hazards with enforcement of new safety standards and removal of unpermitted structures	Reduced exposure to electrical hazards with enforcement of new safety standards and removal of unpermitted structures	Reduced exposure to electrical hazards with enforcement of new safety standards and removal of unpermitted structures; greater reduction after 30 years	Greatest reduced exposure to electrical hazards in shortest period with enforcement of new safety standards and removal of unpermitted and noncompliant structures	Reduced exposure to electrical hazards due to removal of unpermitted structures; however, hazards may persist under current regulations
Hazards associated with structural integrity	No reduction in hazards	Reduced hazards due to enforcement of new safety standards	Reduced hazards due to enforcement of new safety standards	Reduced hazards due to enforcement of new safety standards; greater reduction after 30 years	Reduced hazards due to removal of unpermitted and noncompliant structures	Reduction in hazards due to removal of unpermitted structures

Resource	Alternative					
	No Action Alternative	**Alternative A**	**Alternative B1**	**Alternative B2**	**Alternative C**	**Alternative D**
			Public Safety (Continued)			
Safety hazards from unsafe mooring practices	Increase in safety hazards associated with ropes and cables and poorly secured FHs (similar to current conditions)	Reduced hazards with enforcement of new safety standards	Reduced hazards with enforcement of new safety standards	Reduced hazards with enforcement of new safety standards	Reduced hazards with removal of unpermitted and noncompliant structures	Reduction in safety hazards associated with ropes and cables and poorly secured FHs due to removal of unpermitted structures and enforcement of current mooring regulations
Safety hazards from FHs/NNs dislodging and drifting into commercial navigation channels	No reduction in hazards (similar to current conditions)	No reduction in hazards (similar to current conditions)	Reduced hazards as unpermitted structures are removed	Reductions over time leading to elimination of hazards as all FHs and NNs are removed after 30 years	Reduced hazards as unpermitted and noncompliant structures are removed	Reduced hazards as unpermitted structures are removed
			Solid and Hazardous Wastes			
Amount of solid and hazardous waste material generated for handling and disposal	No reduction in amount (similar to current conditions)	Moderate increase in quantity generated due to demolition activities	Moderate increase in quantity generated due to demolition activities	Greatest long-term increase in quantity generated due to demolition activities	Greatest short-term increase in quantity generated due to demolition activities	Short-term increase in quantity generated due to demolition activities

Resource	Alternative					
	No Action Alternative	**Alternative A**	**Alternative B1**	**Alternative B2**	**Alternative C**	**Alternative D**
			Solid and Hazardous Wastes (Continued)			
Release of solid and hazardous wastes into the environment due to deterioration of aging structures	No reduced potential as structures continue to deteriorate over time (similar to current conditions)	Reduced potential as unpermitted structures are removed	Reduced potential as unpermitted structures are removed	Greatest long-term reduced potential as unpermitted structures are removed; greater reduction after sunset period	Greatest short-term reduced potential as unpermitted and noncompliant structures are removed	Reduced short-term potential as noncompliant FH structures are removed initially
			Visual Resources			
Scenic integrity of reservoirs	Reduced as number of FHs increases	Reduced as number of FHs increases, primarily near marinas	Slightly enhanced as unpermitted structures are removed	Slightly enhanced as unpermitted structures are removed; significant enhancement after 30 years	Enhanced in shortest period	Neutral to slightly enhanced (depending on number of FHs removed)
Scenic quality of reservoirs	Reduced as number of FHs increases	Reduced as number of FHs increases, primarily near marinas	Slightly enhanced as unpermitted structures are removed	Slightly enhanced as unpermitted structures are removed; significant enhancement after 30 years	Enhanced in shortest pericod	Neutral to slightly enhanced (depending on number of FHs removed)
Viewshed	Reduced as number of FHs increases	Reduced as number of FHs increases, primarily near marinas	Slightly enhanced as unpermitted structures are removed	Slightly enhanced as unpermitted structures are removed; significant	Enhanced in shortest period	Neutral impact or slightly enhanced (depending on number of FHs removed)

Resource	Alternative					
	No Action Alternative	Alternative A	Alternative B1	Alternative B2	Alternative C	Alternative D
				enhancement after 30 years		
Land Use						
Direct land use change associated with recreational area expansions to accommodate FHs	Increased potential	Increased potential	Slightly reduced potential	Slightly reduced potential	Reduced potential	Slightly reduced potential (depending on number of FHs removed)
Cultural Resources						
Disturbance of benthic or shoreline archaeological sites	Increased potential as number of FHs increases	Increased potential, primarily near marinas	Reduced potential with prohibition of new structures	Reduced potential with prohibition of new structures	Reduced potential with prohibition of new structures	Reduced potential
Incompatibility with historic structures	Increased potential as number of FHs increases	Increased potential, primarily near marinas	Reduced potential with prohibition of new structures	Reduced potential with prohibition of new structures	Reduced potential with prohibition of new structures	Reduced potential with historic structures initially
Water Quality						
Nutrient enrichment of reservoirs	Increased potential	Reduced potential with enforcement of new wastewater standards	Reduced potential with enforcement of new wastewater standards	Reduced potential with enforcement of new wastewater standards	Reduced potential with removal of unpermitted FHs or noncompliant NN structures	Slightly reduced potential with removal of noncompliant structures and rules enforcement

Resource	Alternative					
	No Action Alternative	**Alternative A**	**Alternative B1**	**Alternative B2**	**Alternative C**	**Alternative D**
			Water Quality (Continued)			
Recreational user exposure to human pathogens	Increased potential without enforcement of new wastewater standards	Reduced potential with enforcement of new wastewater standards	Reduced potential with enforcement of new wastewater standards	Reduced potential with enforcement of new wastewater standards	Reduced potential from removal of unpermitted or noncompliant structures	Slightly reduced potential from removal of noncompliant structures and rules enforcement
			Ecological Resources			
Terrestrial resources adjacent to shorelines	Minor adverse impacts	Minor adverse impacts	Minor beneficial impacts	Minor beneficial impacts	Minor beneficial impacts	Minor adverse impacts
Waterfowl and shorebirds	Minor to negligible adverse impacts	Minor to negligible adverse impacts	Minor to negligible beneficial impacts	Minor to negligible beneficial impacts	Minor to negligible beneficial impacts	Minor to negligible adverse impacts
Aquatic resources and aquatic ecological health in and around marinas	Minor to moderate adverse impacts on aquatic habitats	Minor to moderate adverse impacts on aquatic habitats	Minor beneficial impacts on aquatic habitats	Greatest but still minor beneficial impacts on aquatic habitats over time	Minor beneficial impacts on aquatic habitats	Minor to moderate adverse impacts on aquatic habitats
Establishment and spread of invasive terrestrial animals or plant species	Little effect	Little effect	Little effect	Little effect	Little effect	Little effect
Wetlands	Minimal impacts due to resource protection and regulations	Minimal impacts due to resource protection and regulations	Minimal impacts due to resource protection and regulations	Minimal impacts due to resource protection and regulations	Minimal impacts due to resource protection and regulations	Minimal impacts due to resource protection and regulations

Resource	Alternative					
	No Action Alternative	**Alternative A**	**Alternative B1**	**Alternative B2**	**Alternative C**	**Alternative D**
			Threatened and Endangered Species			
Threatened, endangered, or special concern species	Minor potential negative effects	Minor potential negative effects	Minor potential beneficial impacts	Minor potential beneficial impacts	Minor potential beneficial impacts	Minor potential negative effects
Critical habitat	No impacts	No impacts	No impacts	No impacts	No impacts	No impacts
			Floodplains			
Floodplains and flood risk	Minor adverse impacts on floodplains	Minor adverse impacts on floodplains	Neutral to minor beneficial impacts on floodplains	Neutral to minor beneficial impacts on floodplains	Neutral to minor beneficial impacts on floodplains	Neutral to minor adverse impacts on floodplains

This page intentionally left blank

CHAPTER 3 – AFFECTED ENVIRONMENT

3.1 Introduction to Existing Environment

Chapter 3 provides baseline information for understanding the potential environmental, socioeconomic, and recreation impacts associated with the FH/NN policy alternatives analyzed in Chapter 4, Environmental Consequences. More specifically, this chapter describes the current setting and existing conditions of natural, social, and economic resources that would be affected by the policy alternatives. The following resource issues are discussed in detail:

- Socioeconomics and Environmental Justice
- Recreation
- Public Safety
- Navigation
- Solid and Hazardous Wastes
- Visual Resources
- Cultural Resources
- Water Quality
- Ecological Resources
- Threatened and Endangered Species
- Floodplains

Chapter 3 also includes a description of the study area boundaries, an explanation on compilation of shoreline mileage data, and a discussion of existing shoreline conditions.

Soils, geology, noise, and groundwater are not addressed in detail in this EIS because few impacts are expected on these resources that would be associated with the FH management alternatives under consideration.

3.1.1 Project Area

The general project area for the policy review includes the reservoir and shoreline of the 29 reservoirs that currently have NNs or FHs, or are likely to have additional ones in the future if current trends were to continue (see Table 1.3-1, Table 3.1-1, and Figure 3.1-1). The boundary for direct effects includes the reservoirs and their shorelines, particularly in the area around existing marinas.

The analysis of indirect effects considered adjacent private lands up to one-fourth mile from the maximum shoreline contour or TVA property line (approximately equal to the average depth of a subdivision), the remainder of the reservoir area (both above and below the reservoir surface), and counties immediately adjacent to the reservoirs. However, the study area boundaries of some resources vary, especially the boundaries associated with consideration of cumulative impacts.

The project area for each resource was tailored to the potential effects of the FH/NN policy alternatives. For example, the Water Quality section addresses water quality in all of the 29 reservoirs and focuses on five reservoirs with an estimated 100 or more FHs/NNs and a high probability of increases in FHs in the future. In decreasing order of estimated numbers of FHs/NNs, these reservoirs are Norris, Fontana, Boone, South Holston, and Fort Loudoun. These reservoirs were selected because they were determined to experience the greatest impacts from the various alternatives and because they are representative of the Valley-wide reservoir types and ecoregions. For the Socioeconomic analysis, the study area included the 29 reservoirs and their 63 immediately adjacent counties (Figure 3.1-1). Potential socioeconomic impacts would most likely be experienced in the vicinity of the marinas and within the surrounding counties. Also, available socioeconomic data are often most frequently available by county.

3.1.2 Study Time Period

The temporal scope of the environmental analysis in the EIS extends at least 30 years into the future. This period was selected because it is a typical period used for planning TVA management actions and policies. However, projecting conditions after 5 to 10 years becomes increasingly speculative. The 30-year period is also the 30-year sunset period that was used in Alternative B2 – Grandfather but Sunset Existing and Prohibit New.

3.1.3 Reservoir and Shoreline Land Classification

To understand the impacts of policy alternatives, an understanding of TVA's current reservoir land planning process is important. TVA currently allocates land to seven land use allocation zones as follows:

- Zone 1 – Non-TVA Shoreland/Flowage Easement
- Zone 2 – TVA Project Operations
- Zone 3 – Sensitive Resource Management
- Zone 4 – Natural Resource Conservation
- Zone 5 – Industrial
- Zone 6 – Recreation
- Zone 7 – Shoreline Access (private water use facilities)

Detailed definitions of the seven zones are provided in Appendix B, which is from TVA's NRP (TVA 2011a).

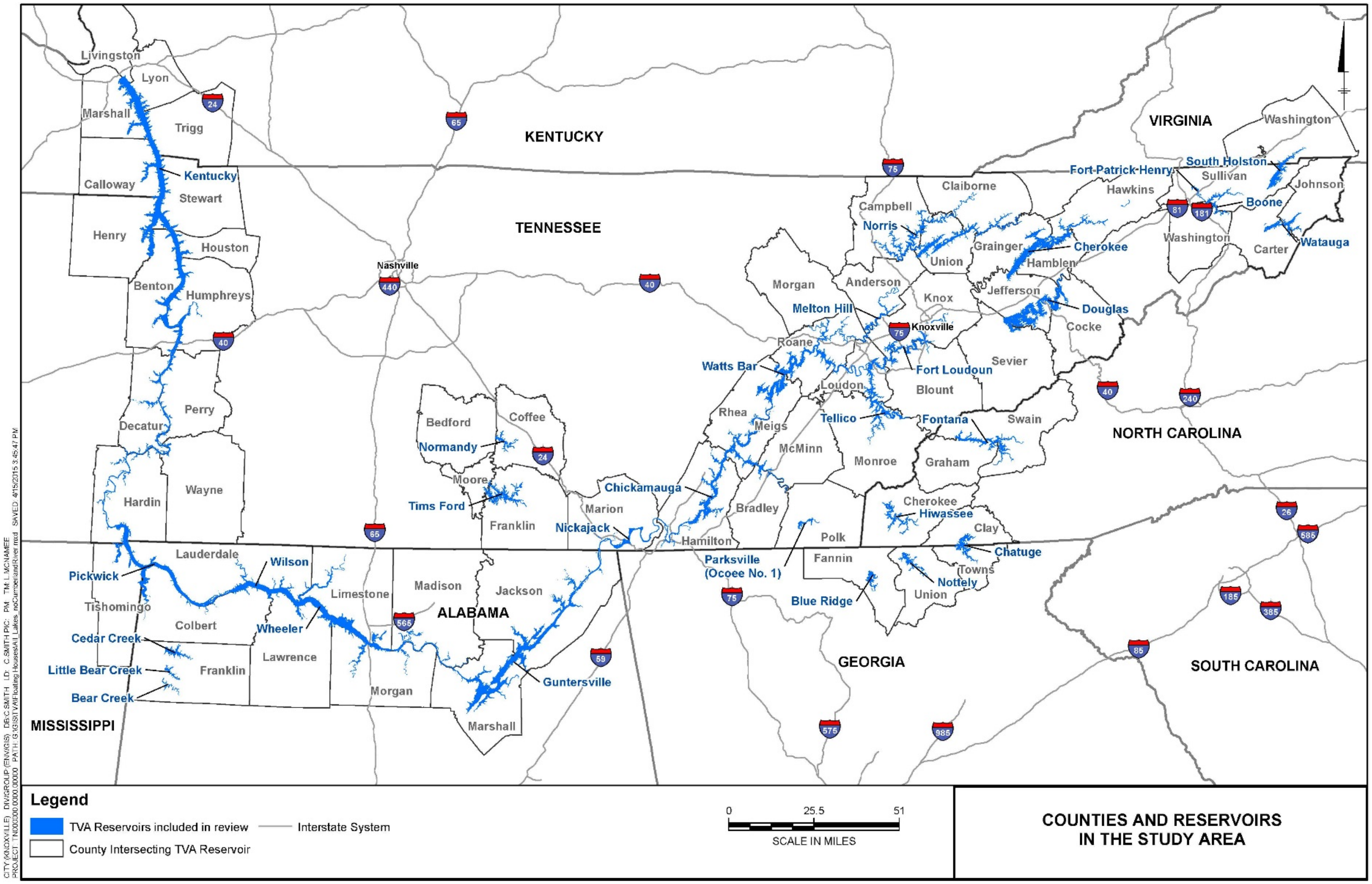


Figure 3.1-1. Counties and reservoirs in the study area

This page intentionally left blank

Table 3.1-1. Reservoir Land Owned by TVA and Its Planned Use

Reservoirs with Marinas or Potential for Marinas	Total TVA Acres of Planned Reservoir Land	Percent TVA Acreage Planned in Zone 3 (%)	Percent TVA Acreage Planned in Zone 4 (%)	Percent TVA Acreage Planned in Zone 5 (%)	Percent TVA Acreage Planned in Zone 6 (%)	Percent TVA Acreage Planned in Zone 7 (%)
Bear Creek	2,285	83.0	0.0	0.0	10.0	0.0
Blue Ridge	470	3.0	6.0	0.0	3.0	26.0
Boone	881	16.9	50.6	0.0	8.5	7.0
Cedar Creek	2,744	66.5	9.8	0.0	8.3	5.3
Chatuge	3,070	0.5	28.3	0.0	13.7	2.6
Cherokee	8,735	11.7	64.0	0.0	8.7	3.1
Chickamauga	9,864	56.9	32.1	2.5	8.5	0.0
Douglas	2,055	3.1	40.3	0.0	6.2	0.6
Fontana	927	0.0	5.0	0.0	46.9	4.4
Fort Loudoun [a]		3.0	18.0	<1.0	2.0	44.0
Fort Patrick Henry	283	7.5	40.9	0.0	15.5	10.3
Guntersville	41,190	25.4	54.9	0.8	4.6	1.9
Hiwassee	1,007	11.4	43.8	0.0	4.3	4.3
Kentucky	41,597	2.1	84.8	4.6	6.7	0.0
Little Bear	1,176	69.1	2.1	1.2	6.0	4.0
Melton Hill	2,584	49.5	24.4	0.8	8.4	5.8
Nickajack [a]		25.0	51.0	3.0	3.0	0.0
Normandy [a]		15.0	67.0	0.0	4.0	<1.0
Norris	27,993	17.3	67.8	0.0	6.6	5.4
Nottely	828	0.0	32.6	0.0	11.4	2.5

Parksville (Ocoee 1)	77	0.0	0.0	0.0	0.0	0.0
Pickwick	17,269	7.8	69.2	2.8	7.7	5.7
South Holston	2,267	0.2	45.9	5.5	19.2	0.7
Tellico	12,860	17.0	56.6	2.6	14.9	4.3
Tims Ford	3,103	10.8	67.4	1.5	0.2	6.7
Watauga	1,132	9.0	39.1	0.0	5.8	0.3
Watts Bar	16,216	23.1	23.4	2.2	9.6	14.1
Wheeler [a]		24.0	65.0	2.0	8.0	<1.0
Wilson [a]		0.0	7.0	0.0	63.0	30.0
Total	**203,849**					

Note: Acreage amounts do not include land owned by other entities.

[a] The TVA planning process has not yet been completed for these reservoirs. Land use data come from Section 7.7 of TVA's *Natural Resource Plan* (TVA 2011).

Currently, 13 LMPs covering 31 reservoirs have been completed using the seven allocation zones. For reservoirs without plans, the preliminary allocation of land to zones was obtained from the NRP as provided by TVA's Watershed Teams. These preliminary allocations were based on staff knowledge and may be revised in future land planning processes. Land use allocations for the 29 reservoirs evaluated in this EIS are summarized in Table 3.1-1.

According to TVA's SMI, Boone Reservoir has the highest density of water-use structures, with 102 per developed mile, followed by Blue Ridge (80), Chickamauga (71), and Tellico (70). Fort Loudoun supports the largest number of facilities (8,946), followed by Watts Bar (7,683), Boone (6,582), and Chickamauga (6,323). Fontana (86) and Hiwassee (211) have the fewest residential shoreline alterations.

3.2 Socioeconomics and Environmental Justice

The range of proposed policy alternatives may result in positive or negative effects on the local or regional economies as well as positive or negative effects on various socioeconomic groups. The purpose of the socioeconomics analysis is to identify the potential effects of the alternatives on the economy and socioeconomic groups, and to identify any potential measures that would be taken to avoid, minimize, or mitigate negative impacts. In addition, an environmental justice analysis was performed consistent with Executive Order (EO) 12989. The purpose of the environmental justice analysis is to determine whether there would be disproportionate negative environmental impacts on low-income households or minorities.

The analysis relies on readily available information and data to the extent possible. Sources of information and data include published TVA economic and recreational reports, data on FHs/NNs and houseboats provided by TVA, existing EISs, public agency websites, and other information available on the internet. TVA gathered additional information that was not available from readily existing sources through a survey of marina operators conducted in February 2015. TVA invited 226 marinas to take the survey. A total of 89 marinas participated, representing a response rate of 40 percent.

This section describes current socioeconomic conditions in the study area. The description of socioeconomic resources is broken into the following subsections:

- Summary of socioeconomic conditions in the counties that make up the study area
- Review of potential environmental justice concerns
- Description of the FH market and its economic impact on the study area

3.2.1 Socioeconomic Characteristics of Surrounding Counties

TVA has determined that proposed policy changes could affect reservoirs with an existing marina or with the potential to have a marina in the future. Of the TVA reservoirs, 29 could be affected by proposed policy changes. The socioeconomic impact analysis focuses on the counties surrounding these 29 reservoirs. Sixty-three counties in seven states border one or more of these reservoirs (Figure 3.1-1). These counties are considered the study area for the purposes of the socioeconomic analysis. In addition to giving an overview of the current socioeconomic conditions of the potentially affected area, a more detailed analysis was conducted on Fontana Reservoir and Norris Reservoir, as they have the largest numbers of FHs and NNs. Fontana Reservoir is located in Graham and Swain Counties in North Carolina, and Norris Reservoir is located in Anderson, Campbell, Claiborne, Grainger, and Union Counties in Tennessee. The following sections give the current baseline socioeconomic characteristics for the general study area.

3.2.1.1 Population

The population of the study area was estimated by the US Census Bureau (2013a) at almost 3.7 million people in 2013 (Table 3.2-1). The majority of the population is in Tennessee, and the most populous county in the study area is Knox County in Tennessee with an estimated population of 444,622 (see Appendix B for population estimates for all counties in the study area). The two counties surrounding

Fontana Reservoir had a combined population in 2013 of 22,794 and a combined population density of 27.79 people per square mile. This population density is much lower than for the study area as a whole, which is 133.47 people per square mile. The population of the counties around Norris Reservoir is 189,144 people, and the population density is 107.71 people per square mile.

Table 3.2-1. Population Characteristics of Counties Surrounding Potentially Affected Reservoirs

Reservoir	*State*	County	Population (2010) [a]	Population (2013) [b]	Change in Population from 2010 to 2013 [a,b] (%)	Population Density (2010) [a]	Population Density (2013) [b]
Fontana	*NC*	Graham	8,861	8,736	-1.41	30.34	29.91
		Swain	13,981	14,058	0.55	26.48	26.63
Fontana total			*22,842*	*22,794*	-0.21	*27.85*	*27.79*
Norris	*TN*	Anderson	75,129	75,542	0.55	222.83	224.05
		Campbell	40,716	40,238	-1.17	84.79	83.80
		Claiborne	32,213	31,560	-2.03	74.12	72.62
		Grainger	22,657	22,702	0.20	80.74	80.91
		Union	19,109	19,102	-0.04	85.48	85.45
Norris total			*189,824*	*189,144*	-0.36	*108.10*	*107.71*
Total, all reservoir counties			**3,627,689**	**3,685,385**	**1.59**	**131.38**	**133.47**

[a] Source: US Census Bureau 2010.
[b] Source: US Census Bureau 2013a.

Overall, the population of the study area increased 1.59 percent from 2010 to 2013; however, the populations of the counties surrounding Fontana and Norris Reservoirs both declined slightly, by 0.21 and 0.36 percent, respectively. The largest percentage increase across the study area came in Limestone County in Alabama, at 7.32 percent. The largest percentage decrease was in Lawrence County in Alabama; the population there decreased 2.19 percent.

3.2.1.2 Income and Employment

Income

Per capita income in the study area ranges from a low of $16,470 in Johnson County, Tennessee, to a high of $31,933 in Madison County, Alabama (see Appendix C for a summary of incomes for all counties in the study area). Both counties surrounding Fontana Reservoir have a lower per capita income than the state of North Carolina (The high and low median household incomes in the study area also were from Madison County, Alabama, and Johnson County, Tennessee, respectively. All of the counties surrounding Fontana and Norris Reservoirs had a lower median household income than their respective states [Table 3.2-2]). Of the five counties surrounding Norris Reservoir, only Anderson County has a higher per capita income than the state of Tennessee.

The high and low median household incomes in the study area also were from Madison County, Alabama, and Johnson County, Tennessee, respectively. All of the counties surrounding Fontana and Norris Reservoirs had a lower median household income than their respective states.

Employment

The largest employer in both counties surrounding Fontana Reservoir is the educational services, and health care and social assistance industry (Table 3.2-3). Arts, entertainment, recreation, accommodation, and food services are the second leading industry in both counties. Around Norris Reservoir, educational services, and health care and social assistance is the leading industry in Anderson, Campbell, and Claiborne Counties; and it is the second leading industry in Grainger and Union Counties. The largest industry in both Grainger and Union Counties is manufacturing.

Table 3.2-2. Summary of Income in Counties Surrounding Potentially Affected Reservoirs

Reservoir	State/County	Per Capita Income (2009–2013) [a]	Median Household Income (2009–2013) [a]	Two Largest Industries [b,c,d]
Fontana	*North Carolina [e]*	*$25,284*	*$46,334*	*1. Educ, health, and social 2. Manufacturing*
	Graham	$19,780	$33,903	1. Educ, health, and social 2. Arts, ent, rec, and accom
	Swain	$19,626	$36,094	1. Educ, health, and social 2. Arts, ent, rec, and accom
Norris	*Tennessee [e]*	*$24,409*	*$44,298*	*1. Educ, health, and social 2. Manufacturing*
	Anderson	$24,561	$43,620	1. Educ, health, and social 2. Prof, sci, mgmt, and admin
	Campbell	$16,812	$31,943	1. Educ, health, and social 2. Manufacturing
	Claiborne	$18,583	$33,229	1. Educ, health, and social 2. Manufacturing
	Grainger	$17,933	$32,364	1. Manufacturing 2. Educ, health, and social
	Union	$17,426	$34,399	1. Manufacturing 2. Educ, health, and social

[a] US Census Bureau. 2013b. 2009–2013 American Community Survey.
[b] "Educ, health, and social" = Educational services, and health care and social assistance.
[c] "Arts, ent, rec, and accom" = Arts, entertainment, and recreation, and accommodation and food services.
[d] "Prof, sci, mgmt, and admin" = Professional, scientific, and management, and administrative and waste management services.
[e] State numbers are listed only for reference and are not counted in the totals for the study area.

In October 2014, counties surrounding Norris Reservoir had a total civilian labor force of 81,510 people with an unemployment rate of 7.0 percent (Table 3.2-3). Anderson and Union Counties both had a lower unemployment rate than the state of Tennessee; and Campbell, Claiborne, and Grainger Counties all had higher unemployment rates than the state as a whole. The total civilian labor force for the counties around Fontana Reservoir was 10,627, with 875 of those people unemployed. This gives an unemployment rate of 8.2 percent for the two counties. Individually, both Graham (11.2 percent) and Swain (6.6 percent) Counties have higher rates of unemployment than the state of North Carolina as a whole, which is at 5.5 percent. Graham County also has the highest unemployment rate in the study area as a whole, while Moore County in Tennessee and Clay County in North Carolina have the lowest, at 5.0 percent. All counties surrounding reservoirs in the study area combine for a total civilian workforce of over 1.7 million people and an unemployment rate of 6.0 percent.

3.2.1.3 Housing

The affected counties had an estimated 1,705,839 total housing units in 2013 (Table 3.2-4). The two counties surrounding Fontana Reservoir had 14,632 housing units, and the five counties surrounding Norris Reservoir had 89,350. Between 2000 and 2010, the number of vacant housing units in counties around Fontana increased from 3,698 to 5,280, representing a 42.8-percent increase. The vacant housing units in counties surrounding Norris increased 36.4 percent—from 9,172 in 2000 to 12,514 in 2010. Across all counties in the study area, vacant housing units increased from 160,616 to 228,569 between 2000 and 2010, representing a 42.3-percent increase.

Table 3.2-3. Summary of Employment in the Counties Surrounding Potentially Affected Reservoirs

Reservoir	State [a]/County	Civilian Labor Force [b]	Employed [b]	Unemployed [b]	Unemployment Rate (%) [b]
Fontana	*North Carolina*	*4,680,350*	*4,422,157*	*258,193*	*5.5*
	Graham	3,789	3,364	425	11.2
	Swain	6,838	6,388	450	6.6
Fontana total		*10,627*	*9,752*	*875*	*8.2*
Norris	*Tennessee*	*3,020,443*	*2,829,933*	*190,510*	*6.3*
	Anderson	35,231	33,036	2,195	6.2
	Campbell	16,146	14,860	1,286	8.0
	Claiborne	12,296	11,306	990	8.1
	Grainger	9,318	8,613	705	7.6
	Union	8,519	8,004	515	6.0
Norris total		*81,510*	*75,819*	*5,691*	*7.0*
Total, all reservoir counties		**1,714,739**	**1,612,303**	**102,436**	**6.0**

[a] State numbers are listed only for reference and are not counted in the totals for the study area.
[b] Sources: Bureau of Labor Statistics 2014a, 2014b. Data are from October 2014 but were accessed in January 2015.

Vacation homes are captured under the housing units that are reported as vacant for seasonal, recreational, or occasional use. The study area has 74,605 housing units reported as vacant for seasonal use (Table 3.2-4). The counties around Fontana Reservoir have a total of 3,472 seasonal housing units, and the counties around Norris Reservoir have 3,542 seasonal housing units. The proportion of seasonal homes to total housing units around Norris Reservoir is similar to the proportion of seasonal homes to total housing units in the study area as a whole. Counties around Fontana Reservoir have a much higher proportion of seasonal homes to total housing units.

3.2.1.4 Government Services

The study area has a total of 920 fire departments, 229 police departments, 111 school districts, and 71 hospitals (Table 3.2-5). The 111 school districts have an estimated 541,954 students, and the 71 hospitals have an estimated 12,124 total hospital beds. Counties around Fontana Reservoir have a total of 10 fire departments, 3 police departments, 4 school districts, and 1 hospital. The counties surrounding Norris Reservoir have 53 fire departments, 17 police departments, 7 school districts, and 4 hospitals.

3.2.2 Environmental Justice

EO 12898 on Environmental Justice generally requires federal agencies to identify and address any instances where their actions may create disproportionately high and adverse health or environmental effects on minority or low-income populations. TVA is not subject to this executive order, but takes it into account as a matter of policy. Table 3.2-6 shows information on minority and low-income populations around Fontana and Norris Reservoirs.

All the counties around Fontana and Norris Reservoirs have a higher proportion of persons below the poverty level than their respective states. Across the study area, 38 of the 63 counties have poverty rates higher than their states.

Across the entire study area, only three counties have a higher proportion of minority populations than their respective states. Hamilton County in Tennessee, Madison County in Alabama, and Swain County in North Carolina all have a higher proportion of minority populations than their respective states as a whole.

Table 3.2-4. Summary of Housing in Counties Surrounding Potentially Affected Reservoirs

Reservoir	State	County	Vacant Housing Units (2000) [a]	Vacant Housing Units (2010) [b]	Vacant – for Seasonal, Recreational, or Occasional Use (2000) [a]	Vacant – for Seasonal, Recreational, or Occasional Use (2010) [b]	Housing Units (2013) [c]
Fontana	NC	Graham	1,730	2,229	1,350	1,524	5,900
		Swain	1,968	3,051	1,281	1,948	8,732
Fontana total			*3,698*	*5,280*	*2,631*	*3,472*	*14,632*
Norris	TN	Anderson	2,671	3,464	197	297	34,591
		Campbell	2,402	3,612	1,024	1,457	20,126
		Claiborne	1,463	2,006	252	362	14,876
		Grainger	1,462	1,865	598	792	10,760
		Union	1,174	1,567	458	634	8,997
Norris total			*9,172*	*12,514*	*2,529*	*3,542*	*89,350*
Total, all reservoir counties			**160,616**	**228,569**	**45,853**	**74,605**	**1,705,839**

[a] Source: US Census Bureau 2000.
[b] Source: US Census Bureau 2010.
[c] Source: US Census Bureau 2013b.

Table 3.2-5. Summary of Government Services in Counties Surrounding Potentially Affected Reservoirs

County	Fire Departments[a]	Police Departments[b]	School Districts[c]	Students[c]	Hospitals[d]	Hospital Beds [d]
Fontana Reservoir – North Carolina						
Graham	5	1	1	1,222	0	0
Swain	5	2	3	2,238	1	20
Fontana total	*10*	*3*	*4*	*3,460*	*1*	*20*
Norris Reservoir – Tennessee						
Anderson	13	5	3	12,598	1	210
Campbell	14	5	1	5,972	2	218
Claiborne	14	3	1	4,784	1	176
Grainger	6	2	1	3,658	0	0
Union	6	2	1	4,464	0	0
Norris total	*53*	*17*	*7*	*31,476*	*4*	*604*
Grand total	**920**	**229**	**111**	**541,954**	**71**	**12,124**

[a] Source: US Fire Administration 2015.
[b] Source: USA Cops 2015.
[c] Source: National Center for Education Statistics 2015.
[d] Source: American Hospital Directory 2015.

Table 3.2-6. Potential Environmental Justice Communities in Counties Surrounding Potentially Affected Reservoirs

State/ County	White Alone, not Hispanic [a]	Black or African American [a]	American Indian [a]	Asian [a]	Native Hawaiian/ Pacific Islander [a]	Two or More Races [a]	Hispanic or Latino [a]	Persons below Poverty Level (%) [b]
				Fontana Reservoir				
North Carolina	***71.7***	***22.0***	***1.6***	***2.6***	***0.1***	***2***	***8.9***	***17.5***
Graham	90.3	0.4	7.0	0.4	0.1	1.9	2.7	21.1
Swain	65.9	1.1	27.9	0.6	Z	4.4	4.4	27.2
				Norris Reservoir				
Tennessee	***79.1***	***17.0***	***0.4***	***1.6***	***0.1***	***1.7***	***4.9***	***17.6***
Anderson	92.2	4.2	0.4	1.2	Z	1.9	2.4	18.2
Campbell	97.7	0.5	0.3	0.3	0.1	1.1	1.3	23.8
Claiborne	96.8	1.1	0.3	0.6	Z	1.2	1.0	22.9
Grainger	97.9	0.7	0.3	0.2	0.1	1.0	2.7	20.4
Union	97.9	0.2	0.4	0.2	0.1	1.2	1.4	23.6

[a] Source: US Census Bureau 2013a.
[b] Source: US Census Bureau 2013b.

Qualla Boundary

The Qualla Boundary is land located in western North Carolina held in a trust for the Eastern Band of Cherokee Indians. The largest portion of the trust lies in eastern Swain County and northern Jackson County east of Fontana Reservoir. Noncontiguous portions of the land trust are also located in Graham County within the study area. Both Swain and Graham Counties have a much higher proportion of their population that is American Indian than the overall proportion in the state of North Carolina. Additionally, Swain and Graham Counties have the highest proportion of American Indians out of all the counties in the study area. In Swain County, 27.9 percent of the population is American Indian; and in Graham County, the American Indian population is 7.0 percent—compared to 1.9 percent in the state of North Carolina.

3.2.3 Indicators of Positive Socioeconomic Impacts of Floating Houses

FHs/NNs positively affect the local economy of the study area in a variety of ways. Currently, approximately 1,836 FHs/NNs are estimated across 16 reservoirs (Table 3.2-7). They provide positive impacts by providing an additional source of revenue for marina operators and other businesses, and create an opportunity for recreation. This section attempts to quantify the current impacts of FHs/NNs on the study area, using the following indicators:

- The market value of the existing FH/NN inventory
- The value of the FH/NN rental market
- Levels of marina revenue and employment that are attributable to FHs/NNs

Each of the indicators is discussed below. In Section 4.2, changes in these indicators are used to illustrate the potential impacts of the management alternatives.

3.2.3.1 Market Value of Existing Floating Houses and Nonnavigable Houseboats

A combination of data sources, including county tax appraisals and online searches of various real estate sites, was used to estimate the average and total market value of the current FHs/NNs. For the three reservoirs with existing data on FH/NN values (Fontana, Kentucky, and Norris), an average was calculated for each reservoir. For reservoirs with no data on home prices, an average was substituted based on the available data from the three reservoirs. The average home price for each reservoir was multiplied by the estimated number of FHs/NNs per reservoir to yield the total market value. The results are listed by reservoir in Table 3.2-8. Across all reservoirs in the study area, the total estimated value is approximately $100 million.

3.2.3.2 Floating House and Nonnavigable Houseboat Rental Market Value

The value of the FH/NN rental market is estimated as the total revenue generated from renting FHs/NNs. Data were obtained from online searches of FH/NN rental costs, visitor surveys from TVA reservoirs conducted by the University of Tennessee, and other data available online. To calculate total annual rental revenue, estimates were needed for the average rental rate for a night's stay and the average number of nights a rental is occupied, giving the average revenue per rental unit. That number was then multiplied by the estimated number of rental units to obtain total revenue.

Rental rates on 4 of the 29 reservoirs (Boone, Fontana, Nickajack, and Norris) were found through an online search. For each of the four reservoirs, an average rental price by month was calculated, adjusting for seasonal rates as they were listed. An average by month of the rates for the four reservoirs was then applied to the remaining 25 reservoirs for which data were not available. These numbers were used for the average nightly rental rate by month and by reservoir.

The market values of individual FHs/NNs are expected to vary with the age, condition, and location of the structures. The values used herein likely overstate the average and total market values. First, online listings are asking prices, which likely overstate the true market value. Second, older or less valuable homes are likely underrepresented in the online listings. Third, applying the average from the 3 reservoirs with data to 26 reservoirs without data could lead to an overstatement of market value if the homes are more valuable on average at reservoirs where information is available. Public comments received during scoping suggest that this may be the case; several commenters noted that FHs/NNs on other reservoirs are not as nice as those on Norris and Fontana.

To calculate the average number of occupied nights, the reported visitation rates by month (collected in surveys by the University of Tennessee at 14 of TVA's reservoirs) were used (Schexnayder et al. 2009a, 2009b; Stephens, Griffin et al. 2007; Stephens, Didier et al. 2006a-f). Survey respondents listed their estimated number of trips for each month for the 14 reservoirs, and the average number of trips for each month was used to calculate the remaining reservoirs. To estimate the occupancy rate, full occupancy was assumed during the month with the highest reported number of trips. This is a conservative assumption. Occupancy rates were adjusted for the remaining months by dividing the reported trips for that month by the number of trips in the peak visitation month. The number of occupied nights was calculated by multiplying the number of days in each month by the occupancy rate.

Finally, multiplying the average number of occupied nights by the average nightly rental rate gives the revenue per rental unit. Based on information from online searches and the marina survey, it was estimated that approximately 5 percent of the FHs/NNs are available for rent. Therefore, total rental revenue was calculated by multiplying the revenue per rental unit by 5 percent of the number of FHs. The total estimated value of the FH/NN rental market in the study area is approximately $5.5 million (Table 3.2-9).

Table 3.2-7. Floating Houses/Nonnavigable Houseboats and Marinas in Potentially Affected Reservoirs

Reservoir	Estimated Current Number of Floating Houses and Nonnavigable Houseboats	Number of Marinas	Existing Marina Footprint (acres)
Bear Creek	0	0	0.0
Blue Ridge	12	1	23.7
Boone	133	7	51.6
Cedar Creek	0	0	0.0
Chatuge	0	4	39.2
Cherokee	2	11	130.2
Chickamauga	20	14	172.1
Douglas	0	10	69.0
Fontana	357	6	997.1
Fort Loudoun	100	10	101.8
Fort Patrick Henry	6	1	5.4
Guntersville	12	19	464.3
Hiwassee	30	4	45.2
Kentucky	55	61	658.1
Little Bear Creek	0	0	0.0
Melton Hill	0	1	2.0
Nickajack	30	3	45.5
Normandy	0	0	0.0
Norris	921	24	644.4
Nottely	0	1	4.1
Parksville	0	1	13.5
Pickwick	2	7	112.0
South Holston	117	6	144.9
Tellico	0	4	67.3
Tims Ford	0	1	23.7
Watauga	37	7	109.8
Watts Bar	2	13	148.6
Wheeler	0	5	70.6
Wilson	0	5	14.6
Total	**1,836**	**226**	**4,159**

Table 3.2-8. Estimated Current Values for Floating Houses/Nonnavigable Houseboats in the Study Area

Reservoir [a]	Estimated Current Number of Floating Houses and Nonnavigable Houseboats	Estimated Current Average Value for Floating House/ Nonnavigable Houseboats	Total Estimated Current Value
Fontana	357	$22,005	$7,855,785
Kentucky	55	$85,000	$4,675,000
Norris	921	$64,800	$59,680,800
Other	503	$57,268	$28,805,972
Total	1,836	$55,020	$101,017,557

[a] Reservoir-specific data are presented for reservoirs with available data.

Table 3.2-9. Estimated Current Rental Market Revenue for Floating Houses and Nonnavigable Houseboats

Reservoir [a]	Estimated Current Number of Floating Houses/ Nonnavigable Houseboats for Rent	Estimated Average Annual Revenue per Floating House/ Nonnavigable Houseboat	Estimated Total Annual Revenue from Rental Market for Floating Houses/ Nonnavigable Houseboats
Boone	7	$27,075	$189,523
Fontana	18	$52,156	$938,807
Nickajack	2	$21,465	$42,931
Norris	46	$74,132	$3,410,088
Other	21	$42,613	$894,863
Total	**94**	**$217,441**	**$5,476,212**

[a] Reservoir-specific data are presented for reservoirs with data.

3.2.3.3 Marina Employment and Revenue

Many of the FHs/NNs and related activities are centered on marinas. In total, the study area has 226 marinas across the 29 reservoirs. This section estimates the amount of revenue and employment potentially generated by FHs/NNs.

Marinas offer a variety of services to FH/NN users, including the following:

- Spaces for mooring of FHs/NNs
- Renting out FHs/NNs that are owned by the marina
- Renting out FHs/NNs that are not owned by the marina through a rental program
- Selling groceries and other supplies to FH/NN users

The current proportion of revenue to marinas coming from FHs/NNs was estimated using information collected during the marina survey. Of the 89 marinas that responded to the survey, 84 provided information on the percentage of annual revenue that is derived from FHs/NNs. The average percentages of total gross annual revenue that came from mooring fees for FHs was 13.3 percent, the average percentage from renting out FHs/NNs was 4.8 percent, and the average percentage from selling groceries or other goods to FH/NN users was 9.8 percent. Based on these responses, approximately 28 percent of annual revenues for marinas is derived from FHs/NNs. It was assumed that this percentage is representative of all marinas in the study area with FHs/NNs.

Information on marina employment and revenue was obtained from the Bureau of Labor Statistics (2013) and the US Census Bureau's 2012 Economic Census (2012). Table 3.2-10 summarizes the averages for the study area. On average, marinas have an annual revenue of $880,000 per year and pay approximately $208,000 per year in wages to nine employees.

Table 3.2-10. Estimated Current Average Annual Marina Revenue, Employment, and Wages by State

State	Estimated Current Average Annual Revenue per Marina	Estimated Current Average Annual Employment per Marina	Estimated Current Average Annual Wages per Marina
Alabama	$886,561	7.3	$208,572
Georgia	$1,015,025	8.7	$238,795
Kentucky	$1,126,616	13.2	$265,048
Mississippi	$886,150	9.8	$208,476
North Carolina	$698,881	6.1	$164,419
Tennessee	$678,829	8.0	$159,701
Virginia	NA	NA	NA
Overall Average	**$882,010**	**8.9**	**$207,502**

NA = Data not available
Sources: US Census Bureau 2012; Bureau of Labor Statistics 2013.

Based on the results of the marina survey discussed above, approximately 28 percent of total marina revenue is attributable to FHs/NNs. Assuming that employment and wages are proportional to revenue, this percentage was applied to employment and wages as well. Multiplying the overall average values from Table 3.2-10 by 28 percent results in the following estimates:

- FHs/NNs generate approximately $250,000 of annual revenue per marina
- FHs/NNs generate approximately 2.5 employees per marina
- FHs/NNs generate approximately $58,000 of wages per marina

TVA had reservoir-specific information on the number of marinas with FHs/NNs at 9 of the 29 reservoirs in the study area. The number of marinas with FHs/NNs at the other 20 reservoirs was estimated based on the results of the marina survey. Approximately 21 percent of the marinas that responded to the survey indicated that FHs or NNs were present at the marina. This percentage was applied to the number of marinas at the remaining 20 reservoirs in order to estimate the number of marinas with FHs/NNs at those reservoirs. The per-marina revenue, employment, and wage figures discussed above then were applied (results are in Table 3.2-11). Across the 29 reservoirs included in the study area, it was estimated that FHs/NNs generate approximately $16 million in marina revenue and approximately $4 million in wages to 164 marina employees.

Table 3.2-11. Estimated Current Marina Revenue, Employment, and Wages from Floating Houses and Nonnavigable Houseboats

Reservoir [a]	Number of Marinas with Floating Houses	Estimated Current Annual Marina Revenue Generated from Floating Houses and Nonnavigable Houseboats	Estimated Current Marina Employees Supporting Floating Houses and Nonnavigable Houseboats	Estimated Current Annual Marina Wages Generated from Floating Houses and Nonnavigable Houseboats
Boone	5	$1,234,814	12.4	$290,502
Chickamauga	1	$246,963	2.5	$58,100
Fontana	6	$1,481,777	14.9	$348,603
Fort Patrick Henry	1	$246,963	2.5	$58,100
Kentucky	2	$493,926	5.0	$116,201
Nickajack	1	$246,963	2.5	$58,100
Norris	22	$5,433,183	54.5	$1,278,210
South Holston	5	$1,234,814	12.4	$290,502
Watauga	3	$740,889	7.4	$174,301
Other	19	$4,692,295	47.1	$1,103,909
All Reservoirs	**65**	**$16,052,587**	**161.0**	**$3,776,531**

[a] Reservoir-specific data are presented for reservoirs with data.

It should be noted that this estimate was derived from a combination of several different data sources and therefore is fairly uncertain. However, it provides a reasonable estimate, given the available information, of the potential economic contribution of FHs/NNs in the study area.

3.2.3.4 Floating House and Nonnavigable Houseboat Recreation Use Statistics

FH/NN use also affects recreation in the study area. The total visitation to the study area due to FHs/NNs is estimated in Section 3.3, Recreation, of this EIS. Table 3.2-12 summarizes the results presented in that section.

3.2.4 Indicators of Negative Socioeconomic Impacts of Floating Houses and Nonnavigable Houseboats

This section attempts to quantify the potential current negative socioeconomic impacts of FHs/NNs on shoreline property owners, recreators, and the general public. As discussed further in Section 4.2, these groups are, in general, negatively affected by FHs/NNs. Based on public comments received during the scoping process, the negative effects of FHs/NNs are typically more severe for those that are not associated with marinas or are in poor condition. Two indicators therefore were used to represent the extent of these potential negative effects:

- Number of FHs/NNs
- Number of FHs/NNs not associated with marinas

Table 3.2-13 presents the estimated current numbers of FHs/NNs and estimated numbers of FHs/NNs that are not associated with marinas. The numbers are based on TVA's 2011 FH inventory, which is the best currently available information of which TVA is aware. It is possible that these estimates are understated for some reservoirs, particularly for the reservoirs indicating that all FHs/NNs are associated with marinas. In Section 4.2, the potential changes shown in the table are used as indicators of the changes in the number of shoreline property owners potentially affected by FHs/NNs. TVA believes that this proxy is reasonable for these purposes, given the available information.

Table 3.2-12. Estimated Current Visitation to Floating Houses and Nonnavigable Houseboats

Reservoir	Estimated Current Number of Floating Houses/ Nonnavigable Houseboats	Total Estimated Current User Days
Bear Creek	0	0
Blue Ridge	12	1,800
Boone	133	19,964
Cedar Creek	0	0
Chatuge	0	0
Cherokee	2	293
Chickamauga	20	3,002
Douglas	0	0
Fontana	357	53,563
Fort Loudoun	100	14,954
Fort Patrick Henry	6	901
Guntersville	12	1,801
Hiwassee	30	4,501
Kentucky	55	8,328
Little Bear	0	0
Melton Hill	0	0
Nickajack	30	4,534
Normandy	0	0
Norris	921	136,791
Nottely	0	0
Parksville	0	0
Pickwick	2	300
South Holston	117	17,563
Tellico	0	0
Tims Ford	0	0
Watauga	37	5,554
Watts Bar	2	300
Wheeler	0	0
Wilson	0	0
Total	**1,836**	**274,150**

Table 3.2-13. Estimated Current Number of Floating Houses Not Associated with Marinas

Reservoir	Estimated Current Number of Floating Houses/Nonnavigable Houseboats	Estimated Current Number of Floating Houses/ Nonnavigable Houseboats Not Associated with Marinas
Bear Creek	0	0
Blue Ridge	12	12
Boone	133	52
Cedar Creek	0	0
Chatuge	0	0
Cherokee	2	0
Chickamauga	20	0
Douglas	0	0
Fontana	357	0
Fort Loudoun	100	25
Fort Patrick Henry	6	5
Guntersville	12	12
Hiwassee	30	0
Kentucky	55	10
Little Bear	0	0
Melton Hill	0	0
Nickajack	30	0
Normandy	0	0
Norris	921	0
Nottely	0	0
Parksville	0	0
Pickwick	2	1
South Holston	117	6
Tellico	0	0
Tims Ford	0	0
Watauga	37	14
Watts Bar	2	1
Wheeler	0	0
Wilson	0	0
Total	**1,836**	**138**

3.3 Recreation

Providing accessible natural resources and recreational opportunities for the people of the Tennessee Valley is a key component of the TVA stewardship mission. TVA reservoirs and the land surrounding them provide a host of recreational activities, drawing millions of visitors each year. The reservoirs and surrounding areas provide a vast number of recreational opportunities such as camping, hiking, fishing, swimming, and boating.

TVA manages 49 reservoirs. Of these reservoirs, 29 are the focus of the current policy review. The remaining 20 reservoirs do not have any existing or proposed future marinas and currently do not have any known FHs/NNs. In the remaining 29 TVA reservoirs, TVA manages almost 637,000 acres of reservoir area and over 10,700 miles of reservoir shoreline.

Recreation User Groups

- Surface water recreational use
  - FH/NN Users
- Shoreline recreational use
  - Developed Recreation
  - Undeveloped Recreation

The 29 reservoirs under review provide opportunities for several different types of recreational activities. In 2006 and 2007, TVA sponsored a recreational survey by the University of Tennessee at 14 of their reservoirs. The activities reported most often by survey respondents are shown in Table 3.3-1. This table shows the activities selected by respondents as the primary reason for being at the reservoir. Many people participate in multiple activities while they are visiting the reservoirs. These activities were categorized into shoreline-based recreation or surface water-based recreation.

Table 3.3-1. Primary Recreational Activities at TVA Reservoirs

Activity	Percent of Total Users (%)	Recreation Type
Fishing from a boat	30.8	Surface water-based
Pleasure boating	28.4	Surface water-based
Swimming/beach use	13.6	Shoreline-based
Fishing from the shore or bank	3.8	Shoreline based
Riding a personal watercraft	3.5	Surface water-based
Water-skiing/tubing/other towing	5.8	Surface water-based
Hiking/walking/jogging	2.5	Shoreline-based
Camping	5.3	Shoreline-based
Bicycling	1.5	Shoreline-based
Canoeing or kayaking	1.6	Surface water-based
Sightseeing	1.1	Shoreline-based
Hunting	0.7	Shoreline-based
Sailing	0.3	Surface water-based
Picnicking	0.3	Shoreline-based
Viewing wildlife	0.2	Shoreline-based
Other	0.7	NA

NA = Data not available

Sources: Data are presented in nine reports: Schexnayder et al. 2009a, 2009b; Stephens, Griffin et al. 2007; Stephens, Didier et al. 2006a–f.

This review analyzes the potential impacts on two user groups: people that participate in recreational activities along the shorelines of TVA reservoirs (shoreline-based) and people that participate in recreational activities on the surface waters of TVA reservoirs (water-based). Within the surface water recreation group, people that use FHs for recreation on TVA reservoirs are specifically evaluated. This subset of users will be the most directly affected by any policy changes. The users were grouped this way because the impacts across users and the potential for encounters with FHs while participating in the activities within the specific groupings will be similar.

3.3.1 Surface Water Recreation

Surface water-based recreational activities primarily involve some form of watercraft, mainly boats. Numerous developed facilities on the 29 affected TVA reservoirs cater to these activities and provide access to roughly 637,000 surface acres of water. According to data provided by TVA on recreational facilities, 697 facilities have boat launching ramps, 226 have marinas, 129 have boat rentals, and 44 have canoe put-ins. Once on the water, recreational activities include:

- Fishing
- Pleasure boating
- Riding personal watercraft
- Water skiing, tubing, or other towing
- Canoeing or kayaking
- Sailing

Surface water recreation was estimated using data from the 2006–2007 surveys of 14 reservoirs mentioned in Section 3.2.3.1. The reservoirs in the study included Blue Ridge, Chatuge, Cherokee, Douglas, Fontana, Fort Loudoun, Hiwassee, Kentucky, Melton Hill, Nickajack, Norris, Nottely, Parksville, and Wheeler. The surveys provided an estimate of visitors during the study period, using counts of people as they left various developed recreational sites around the reservoirs. To estimate visitation at the remaining 15 reservoirs, where no survey information was available, the estimates at the 14 reservoirs were used to calculate an average number of visitors per shoreline mile. In addition to the counts of people leaving, the visitors were asked for information about their recreation. Among other questions, they were asked to estimate their average number of trips to the reservoir for each month of the year. Using these averages for each month and the averages for the study period enabled extrapolating an estimate of trips by month to each of the 29 reservoirs in the study area. Survey respondents were asked what was their primary reason for visiting the reservoir. The percentage breakdown of their responses was multiplied to estimate recreation by activity, giving an estimate of just over 3.9 million user days per year participating in water-based recreation across the 29 reservoirs (Table 3.3-2).

<u>Floating House and Nonnavigable Houseboat Users</u>

FH/NN users are within the group of people that participate in recreation on the surface waters of the 29 potentially affected reservoirs. Based on data provided by TVA recreation specialists, 1,836 FHs/NNs on 16 reservoirs are currently estimated (Table 3.3-3).

To estimate visitation to FHs/NNs, first, the number of structures that were available for rent, either by a marina or by an individual owner, was estimated. This estimate was set at 5 percent, based on the relatively low number of rentals found through online searches and based on a survey of marina owners on TVA reservoirs. For FHs/NNs that are available for rent, an occupancy rate was then estimated. For each reservoir, survey responses for the overall estimated trips per month were used to establish a range of use over the course of a year. A full occupancy was assumed during each reservoir's estimated peak use month. Peak-use months were June or July for all reservoirs. From the peak-use month, occupancy was scaled back to the same proportion as the reported overall reservoir visitation. Across all reservoirs, the occupancy rates range from a low of 27.92 percent in February to a high of 98.85 percent in June (Table 3.3-4).

Table 3.3-2. Estimates of Surface Water Recreation User Days by Activity and Reservoir

Reservoir	Fishing (Boat)	Pleasure Boating	Riding a Personal Watercraft	Waterskiing/ Tubing/ Other Towing	Canoeing or Kayaking	Sailing	Total
Bear Creek	8,126	7,101	911	1,404	411	84	18,038
Blue Ridge	3,936	8,308	555	2,173	483	0	15,456
Boone	20,152	17,611	2,260	3,482	1,019	209	44,733
Cedar Creek	12,924	11,294	1,449	2,233	653	134	28,688
Chatuge	7,036	14,850	993	3,885	863	0	27,627
Cherokee	88,009	58,006	13,601	4,200	1,800	3,400	169,017
Chickamauga	123,453	107,884	13,846	21,333	6,239	1,278	274,033
Douglas	64,608	17,110	11,635	2,875	0	0	96,228
Fontana	28,616	25,007	3,209	4,945	1,446	296	63,520
Fort Loudoun	82,975	77,212	12,216	14,290	0	691	187,384
Fort Patrick Henry	4,102	3,584	460	709	207	42	9,105
Guntersville	148,713	129,958	16,679	25,698	7,516	1,539	330,104
Hiwassee	10,251	21,633	1,446	5,660	1,258	0	40,248
Kentucky	495,293	329,842	33,939	25,454	13,788	11,666	909,982
Little Bear Creek	6,950	6,073	779	1,201	351	72	15,426
Melton Hill	26,725	13,985	3,002	1,318	4,247	879	50,156
Nickajack	81,406	17,268	2,995	4,934	0	0	106,603
Normandy	11,160	9,752	1,252	1,928	564	115	24,772
Norris	145,873	167,675	13,081	24,973	2,775	0	354,377
Nottely	6,297	13,290	889	3,477	773	0	24,725
Parksville	2,676	5,647	378	1,477	328	0	10,506
Pickwick	74,883	65,439	8,398	12,940	3,785	775	166,220
South Holston	27,953	24,428	3,135	4,830	1,413	289	62,049
Tellico	55,071	48,126	6,176	9,516	2,783	570	122,243
Tims Ford	41,837	36,561	4,692	7,230	2,115	433	92,867
Watauga	16,716	14,608	1,875	2,889	845	173	37,106
Watts Bar	113,934	99,565	12,778	19,688	5,758	1,179	252,903
Wheeler	224,696	76,375	12,176	17,157	12,729	0	343,132
Wilson	23,527	20,560	2,639	4,065	1,189	243	52,223
Total	**1,957,899**	**1,448,753**	**187,445**	**235,966**	**75,338**	**24,069**	**3,929,470**

Table 3.3-3. Estimated Current Number of Floating Houses and Nonnavigable Houseboats by Potentially Affected Reservoir

Reservoir	Estimated Current Number of Floating Houses/ Nonnavigable Houseboats
Blue Ridge	12
Boone	133
Cherokee	2
Chickamauga	20
Fontana	357
Fort Loudoun	100
Fort Patrick Henry	6
Guntersville	12
Hiwassee	30
Kentucky	55
Nickajack	30
Norris	921
Pickwick	2
South Holston	117
Watauga	37
Watts Bar	2
Total	**1,836**

For FHs/NNs that are not available for rent, an estimated occupancy rate of 14.3 percent was assigned. This percentage equates to occupying a FH/NN roughly 2 days out of every 14, or visiting every other weekend.

The total user days for rental FHs/NNs was calculated by multiplying the total number of FHs/NNs at each reservoir by the percentage that are available for rent to obtain the number of available FH rentals. The number of available rentals was multiplied by the total days of each month and the estimated occupancy rate. The average household size of all the counties across the study area was calculated at 2.46, using the county data from the US Census Bureau (2013b); this number was used as the group size to calculate the estimated user days.

To find user days for FHs/NNs that are not available for rent, the total number of FHs/NNs was multiplied by the percentage that are not available for rent and by the total days in the month and the average household size of 2.46. The estimate of total user days for all FHs/NNs was then calculated by adding the totals of user days for the FHs/NNs that are available for rent and the FHs/NNs that are not available for rent.

Using an estimate that 5 percent of FHs/NNs are available for rent gives just under 275,000 total user days based on 1,836 FHs/NNs. Although this recreational activity was not specifically identified, these users should already be captured in the estimate of total surface water-based recreation provided above and were not added to the total recreation estimate.

Table 3.3-4. Estimated Current Average Rental Occupancy Rates for All Reservoirs in the Study Area

Month	Estimated Current Average Occupancy Rate (%)
January	28.00
February	27.92
March	48.05
April	69.69
May	88.08
June	98.85
July	98.70
August	90.42
September	73.97
October	55.66
November	37.36
December	30.01
Average rental occupancy	**62.23**

3.3.2 Shoreline Recreation

TVA manages approximately 293,000 acres of land, much of which is available for recreation. This acreage includes approximately 10,700 miles of reservoir shoreline around the 29 reservoirs within the study area, which provides ample opportunity for shoreline-based recreation. People who use the shorelines of TVA reservoirs may do so at developed areas with modern facilities, such as campgrounds with electrical outlets, bathrooms, and showers or even resorts with reservoir views (developed recreation). Alternatively, they may take advantage of undeveloped natural areas through activities such as hiking or hunting (undeveloped recreation).

3.3.2.1 Developed Recreation

Developed facilities around the TVA reservoirs provide a diverse opportunity for shoreline-based recreation. Developed sites at the 29 potentially affected reservoirs include 254 managed campsites, 357 picnic facilities, 136 beaches, 131 facilities offering lodging, 169 developed trails, 172 fishing berms or piers, and 56 visitor centers. Developed recreational activities along the shoreline of these reservoirs include:

- Swimming at a managed beach
- Fishing from a pier or dock
- Camping at a managed campground
- Hiking, walking, or jogging along a maintained trail or path
- Picnicking

The survey data discussed in Section 3.2.1 were used to estimate shoreline-based visitation for developed recreation. Using the same methods that were used to estimate water-based visitation, 1.3 million user days were estimated (Table 3.3-5).

Table 3.3-5. Developed Shoreline Recreation Estimates by Activity and Reservoir

Reservoir	Swimming/ Beach Use	Fishing (Shore)	Hiking/ Walking/ Jogging	Camping	Bicycling	Other	Total
Bear Creek	3,235	1,035	665	1,258	407	776	7,375
Blue Ridge	5,917	0	193	2,318	0	266	8,694
Boone	8,022	2,566	1,649	3,119	1,009	1,926	18,290
Cedar Creek	5,145	1,645	1,058	2,000	647	1,235	11,730
Chatuge	10,576	0	345	4,144	0	475	15,540
Cherokee	14,802	7,601	2,200	3,800	0	3,800	32,203
Chickamauga	49,143	15,718	10,102	19,105	6,180	11,796	112,044
Douglas	14,646	2,738	15,604	6,707	0	821	40,517
Fontana	11,391	3,643	2,342	4,428	1,433	2,734	25,972
Fort Loudoun	16,595	9,450	4,379	1,844	3,227	5,762	41,257
Fort Patrick Henry	1,633	522	336	635	205	392	3,723
Guntersville	59,199	18,934	12,169	23,014	7,445	14,209	134,969
Hiwassee	15,407	0	503	6,037	0	692	22,640
Kentucky	21,212	42,423	24,393	38,181	0	20,151	146,361
Little Bear Creek	2,766	885	569	1,075	348	664	6,307
Melton Hill	1,245	7,615	4,027	366	2,270	7,542	23,064
Nickajack	7,577	21,144	12,158	1,938	24,668	2,114	69,600
Normandy	4,442	1,421	913	1,727	559	1,066	10,128
Norris	18,631	15,459	1,982	3,171	0	3,171	42,414
Nottely	9,465	0	309	3,709	0	425	13,908
Parksville	4,022	0	131	1,576	0	181	5,910
Pickwick	29,809	9,534	6,128	11,588	3,749	7,155	67,962
South Holston	11,128	3,559	2,287	4,326	1,399	2,671	25,370
Tellico	21,922	7,011	4,506	8,522	2,757	5,262	49,981
Tims Ford	16,654	5,327	3,423	6,474	2,094	3,997	37,971
Watauga	6,654	2,128	1,368	2,587	837	1,597	15,171
Watts Bar	45,354	14,506	9,323	17,632	5,704	10,886	103,404
Wheeler	27,119	70,287	2,214	14,943	12,729	83,016	210,307
Wilson	9,365	2,995	1,925	3,641	1,178	2,248	21,352
Total	**453,076**	**268,145**	**127,203**	**199,866**	**78,843**	**197,030**	**1,324,164**

3.3.2.2 Undeveloped Recreation

Of the total 293,000 acres of land managed by TVA, 229,000 acres are undeveloped lands available for dispersed recreation. An additional 508,000 acres of land surrounding the reservoirs once held by TVA have since been transferred or sold. Most of this land was transferred to other state and federal agencies for public use. Assuming that the same proportion of undeveloped land that exists on TVA-managed lands exists on these 508,000 acres; an additional 397,000 acres of land are available for undeveloped recreation around all TVA reservoirs. Activities on these lands include:

- Hunting
- Camping
- Hiking
- Bird watching
- Mountain biking

The surveys used to estimate visitation described above were conducted at developed sites, enabling estimates for both developed shoreline visitation and water-based visitation at those facilities. These estimates could not be used for the dispersed recreation occurring in undeveloped areas.

To estimate undeveloped recreation visitation, an estimate of 20 dispersed/undeveloped recreation trips per land acre was used. This number was used in 2011 to estimate the economic benefits of the NRP (TVA 2011d). The estimate was calculated using data from actual visitation on USACE-managed lands and data on the proportion of people participating in dispersed recreational activities in the TVA region. Approximately 240,000 acres of TVA-managed land surround the 29 potentially affected reservoirs in this study. Approximately 188,000 acres of this land was estimated as undeveloped, using the same ratio of developed land to undeveloped land as exists across all TVA lands. Of the 508,000 total other acres around TVA reservoirs, 417,000 acres was estimated to be around the 29 reservoirs. Again, using the ratio of undeveloped land to developed land results in a total of 326,000 acres of non-TVA land available for undeveloped recreation, which gives a total of roughly 514,000 acres of undeveloped land. Multiplying this number by 20 user days per acre gives approximately 10.3 million user days for undeveloped recreation.

3.3.3 Total Visitation

As discussed above, TVA used interview and survey data collected at 14 reservoirs to estimate the number of surface water user days and developed shoreline user days. Under the surface water recreation user group, 3.9 million user days across the study area were estimated. In the shoreline user group, 1.3 million user days of developed recreation were estimated. Data from the NRP were used to estimate approximately 20 user days per acre of undeveloped area for a total of 10.3 million user days of undeveloped recreation in areas surrounding the 29 potentially affected reservoirs. In total, TVA estimates that there are 15.5 million recreational user days on and around the 29 potentially affected reservoirs. Additionally, of the 3.9 million user days associated with surface water-based recreation, 275,000 user days are estimated to be associated with FHs/NNs.

These estimates are consistent with TVA’s ROS (TVA 2004), which estimated roughly 21.8 million user days across 35 reservoirs, or approximately 623,000 user days per reservoir. This analysis estimates approximately 535,000 user days per reservoir for the 29 reservoirs.

3.4 Public Safety

This section describes the affected environment associated with public safety for the 29 reservoirs where FHs/NNs are present or with potential to be constructed. Existing public safety issues include improper mooring and anchoring practices that create recreational boating hazards, lack of structural integrity, fire hazards, and unsafe electrical systems.

Some FHs/NNs are improperly moored and anchored, such that mooring/anchoring lines run for several hundred feet slightly below the water surface and are tied to trees (Figures 3.4-1 and 3.4-2), rather than the structures being moored in a slip with a dock and land-based utilities. Such practices create recreational boating hazards.

Figure 3.4-1. Unsafe mooring practice

Figure 3.4-2. Unsafe mooring practice

Currently, a number of FHs/NNs at the TVA reservoirs lack structural integrity. Some have been abandoned, creating obvious safety and pollution concerns. These structures can be dangerous to boaters and swimmers because they may come apart, sink, and their moorings become untied. Abandoned and derelict structures may also be attractive for children, adolescents, persons conducting illegal activities, and others.

FHs/NNs with propane and charcoal grills onboard may pose fire hazards to those onboard and FHs/NNs secured nearby. Firefighters cannot readily service FHs/NNs.

Currently, a number of FHs/NNs at the TVA reservoirs have unsafe electrical systems (Figures 3.4-3, 3.4-4, and 3.4-5). Most post-1978 FH structures have been approved by the marina owner/utility for safety. However, many structures do not comply with newer federal or state electrical codes, such as the 2008 National Electric Code, NFPA 303-2006, Fire Protection Standard for Marinas and Boatyards or with

Tennessee's 2014 Noah Dean and Nate Act (Tennessee Code Annotated 68-102-201-602 et seq.) relative to marine and boat dock safety, such as requiring ground fault circuit interrupters (GFCIs) that protect against fatal shocks by shutting down electricity before it can arc into the water.

Figure 3.4-3. Electrical system

Figure 3.4-4. Electrical system

Figure 3.4-5. Unsafe electrical system

Currently, TVA demolishes abandoned structures on a case-by-case basis, primarily in the event that structures pose a hazard to navigation. During TVA demolition activities, public access to demolition areas are restricted by creation of a safety zone around equipment and structures to limit the potential for injury.

3.5 Navigation

Under the TVA Act, TVA is directed to manage the Tennessee River and its tributaries to promote navigation and control floods. The Tennessee River has 800 miles of commercially navigable waterways. These waterways include the 652-mile-long main navigation channel that extends from Knoxville, Tennessee to the Ohio River at Paducah, Kentucky. Commercial navigation also extends into three major tributaries—the Clinch River, Little Tennessee River, and Hiwassee River.

TVA completed the main navigation channel in 1945 with a series of 10 dams and navigation locks. The main channel is maintained to provide a year-round minimum depth of 11 feet, which is sufficient for 9-foot draft vessels with 2 feet of overdepth. The minimum width of the navigation channel is 300 feet.

3.5.1 Commercial Navigation

The Tennessee River supports a substantial amount of commercial navigation annually. As shown in Table 3.5-1, commercial traffic using the locks on the Tennessee River far outnumbers the noncommercial vessels. Approximately 187 commercial waterfront terminals that are distributed along the Tennessee River waterway support this commercial traffic. These commercial waterfront terminals are the import/export centers for economic activity along the Tennessee River.

The main navigation channel passes through 9 of the 29 reservoirs analyzed in this EIS. Specifically, the channel does not pass through Norris or Fontana Reservoirs, which together account for approximately 70 percent of the current number of FHs/NNs present on TVA reservoirs. Nevertheless, the 9 reservoirs through which the main navigation channel passes account for over 200 of these structures (Table 3.5-2).

Table 3.5-1. Summary of 2008 Vessel Traffic for the Tennessee River Lock System

Lock [a]	Number of Vessels Passing through the Lock [b]		
	Commercial	Other (Including Recreation)	Total
Kentucky	36,067	356	36,423
Pickwick Main	16,878	882	17,760
Pickwick Auxiliary	6,757	219	6,976
Wilson Main	10,310	1,492	11,802
Wilson Auxiliary	0	1	1
Wheeler Main	9,750	1,185	10,935
Wheeler Auxiliary	1,294	95	1,389
Guntersville Main	5,685	1,409	7,094
Guntersville Auxiliary	1	19	20
Nickajack	2,710	1,357	4,070
Chickamauga	2,444	4,358	6,802
Watts Bar	1,056	1,875	2,931
Fort Loudoun	764	1,572	2,336
Total	**93,716**	**14,823**	**108,539**

[a] Melton Hill Lock is not included as it is not on the primary navigation channel.
[b] A vessel could be counted multiple times as it travels from lock to lock.
Source: TVA 2012.

Table 3.5-2. Estimated Current Number of Floating Houses and Nonnavigable Houseboats on Reservoirs That Contain the Tennessee River's Main Navigation Channel

Reservoir	Estimated Current Number of Floating Houses and Nonnavigable Houseboats	Number of Existing Marinas	Number of Marinas Adjacent to Main Navigation Channel [a]
Fort Loudoun	100	10	1
Watts Bar	2	13	0
Chickamauga	20	14	1
Nickajack	30	3	2
Guntersville	12	19	7
Wheeler	0	5	1
Wilson	0	5	0
Pickwick	2	7	0
Kentucky	55	61	2
Total	**221**	**137**	**14**

[a] Marinas located on the mainstem river and located less than 0.5 mile from the channel line.

Most of the existing marinas on the nine reservoirs are in coves, embayments, and branches of the Tennessee River (Google Earth 2015; TVA 2015b; USACE 2003). Marinas in these locations are outside the main navigation channel. Moreover, many are located at least 0.5 mile from the channel line (the middle of the navigation channel). Consequently, only 10 percent of the existing marinas are located adjacent to the main navigation channel (Table 3.5-2).

3.5.2 Navigational Safety

The safety of all vessels in and around the main commercial channel is essential. TVA provides designated shoreline areas along the channel to promote safety. Commercial traffic can tie off in these areas during fog and other inclement weather, equipment malfunctions, and emergencies. In situations where safety harbors and landings are not readily available, barge tows commonly push up against the bank.

TVA maintains 160 safety harbors and landings along the mainstem reservoirs and two tributary reservoirs (Melton Hill and Tellico). The average distance between harbors and landings is 4.7 miles (TVA 2012). Together, these safety harbors and landings minimize the risk of damage to property.

On the Tennessee River system, the US Coast Guard (USCG) is responsible for installing and maintaining navigation aids that mark the commercial navigation channel. Buoys mark the limits of the channel where it passes through shallow areas or dredged cuts below locks. On open stretches of the waterway where buoys are not used, navigation lights and day beacons guide vessels from point to point.

The overall number of FHs and NNs has been increasing since the 1970s. Although NNs have been on the reservoirs for over 50 years, they have not affected commercial traffic using the main navigation channel. No incidents or accidents involving FHs/NNs and commercial traffic on the Tennessee River have been recorded (Salik pers. comm.).

3.5.3 Current Navigation Regulations

One of the primary objectives of TVA regulations implementing Section 26a of the TVA Act is to promote navigation by managing potential obstructions on the Tennessee River system. This includes restricting placement of structures within the limits of harbors and landings, restricting any object that would block visibility of navigation aids, and prohibiting “no-wake” zones outside approved marina harbor limits adjacent to the commercial navigation channel. These regulations apply to all existing FHs/NNs and marinas. TVA conducts inspections to identify noncompliant structures or facilities per these regulations.

3.6 Solid and Hazardous Wastes

This section describes the affected environment associated with solid and hazardous wastes at the 29 reservoirs where FHs/NNs are present or likely to be constructed. Under the Federal Resource Conservation and Recovery Act (RCRA) regulations, household waste (including full and empty aerosol cans) are excluded from RCRA Subtitle C regulations. The term "household waste" refers to garbage, trash, and other waste from single and multiple residences and other residential units such as hotels, motels, bunkhouses, ranger stations, campgrounds, and day-use recreation areas. In order for household hazardous waste to be excluded from regulations, it must meet two criteria: (1) the waste must be generated by individuals on the premises of a temporary or permanent residence; and (2) the waste must be composed primarily of materials found in the waste generated by consumers in their homes. The household exclusion applies to all household hazardous wastes, including electronics, appliances, medicinal drugs and ointments, waste oil, antifreeze, pesticides, paint, paint thinners, batteries, lamps, thermostats, spent filters from filtering water, aerosol cans, and cleaning fluids/solvents.

Owners of FHs/NNs are responsible for removal of wastes. Solid waste generated during the use of an individual structure is estimated at approximately 1.2 to 1.8 pounds per day (Nemerow et al. 2009). This limited amount of waste would be disposed of in marina waste receptacles or taken offsite by owners to appropriate dumpsters. Marinas are responsible for the proper removal and disposal of waste for structures moored in their marina. Currently, not all NNs and FHs comply with all waste management regulations, especially those pertaining to sewage disposal. Septic system wastes are described in Section 3.11, Water Quality.

The owners or marinas are responsible for demolition of derelict/noncompliant structures, including disposal of demolition wastes. Demolition wastes are generally disposed of as construction and demolition waste (C&D waste) in permitted landfills as “special waste” using roll-off dumpsters as the appropriate containers. Over time, there is a potential for quantities of solid and hazardous wastes on TVA reservoirs to increase as NNs and FHs deteriorate with age.

TVA periodically assesses the conditions of abandoned structures (Figures 3.6-1 and 3.6-2) as they deteriorate and determines whether demolition is needed—which occurs primarily when the structure represents a navigation hazard. On average, TVA removes approximately five or six abandoned structures per year.

Figure 3.6-1. Abandoned structure

Figure 3.6-2. Derelict structure

Typical solid wastes generated during removal/demolition activities include a mixture of conventional inert building materials consisting of roofing shingles, glass, wood, brick, block, concrete, drywall, paper, metals, fiberglass, ceiling tiles, and plastic/vinyl. Relatively small quantities of the following wastes may also be generated:

- Cleaning solvents
- Aerosol cans
- Bleach
- Pesticides/herbicides

- Lightbulbs
- Batteries
- Thermostats
- Air conditioners (window units)
- Asbestos-containing materials (ACMs)
- Lead-based paint
- Fire extinguishers
- Latex and oil-based paints
- Varnishes and stains
- Propane cylinders
- Polychlorinated biphenyls (PCBs) (light fixtures)
- Fuels, oil, or chemicals (stored in buildings)
- Mercury

Structures built prior to 1980 typically contain ACM and lead-based paint. Based on preliminary estimates, ACM and lead-based paint may be present in approximately 40 to 60 percent of the NNs; most of the unpermitted FHs do not contain ACM and lead because they were constructed in the 1990s to present.

Prior to demolition of abandoned structures, demolition contractors typically conduct a category-by-category characterization of buildings and structures that could be demolished. During these characterizations, all hazardous materials or other on-site materials that require special handling are identified—including ACM, lead-based paint, PCBs, and mercury—and removed prior to demolition.

Oil and fuel storage areas associated with private residences classified as FHs/NNs are not subject to Spill Prevention Control and Countermeasure (SPCC) plans if the aggregate storage capacity is less than 1,320 gallons of aboveground storage, less than 42,000 gallons of underground storage, and non-transportation related.

For any marine facility with oil and fuel storage capacity greater than 1,320 gallons of aboveground storage, greater than 42,000 gallons of underground storage, and transportation related an SPCC plan is required, along with best management practices (BMPs) specified for their marine facility. The SPCC plan and BMP plan would address installation of secondary containment structures and double-walled fuel containment. In the event of inadvertent spills of fuels, oils, or hazardous materials, effects from localized spills are addressed effectively through implementation of the demolition contractor's SPCC plans and compliance with federal and state requirements. All FHs/NNs within marina harbor limits also need to comply with marina-specific guidance and procedures. Standard SPCC plans include procedures for training personnel in spill prevention and control techniques and requirements; maintaining appropriate spill control equipment in areas where refueling may occur; implementing safe driving practices; ensuring the proper transport of hazardous materials in compliance with federal, state, and local regulations; and complying with pertinent regulations to minimize the potential for an accidental release.

Most owners of structures to be removed (i.e., derelict or abandoned) would attempt to sell/retain the larger, more expensive components, such as electrical and mooring cables. Electrical wires and poles serving the demolished structures are de-energized and may be left in place for future service. Any transformers serving the removed FHs/NNs would be the responsibility of the local electrical utility. When removing the transformer or electrical equipment, the local electrical utility typically tests for PCBs. In general, electrical equipment that cannot be effectively tested, light ballasts, and small capacitors are disposed of by the local electrical utility according to regulations applying to PCB waste.

When TVA removes or demolishes abandoned FHs/NNs, it typically hires licensed contractors experienced with demolition activities. Contractors are required to comply with all applicable environmental and safety regulations, including proper handling and disposal of any waste.

Demolition wastes are typically transported by truck and disposed of in off-site permitted landfills. The landfills and truck haul routes for final disposal of nonrecyclable materials generated at TVA reservoirs with 50 or more NNs and FHs are listed in Table 3.6-1.

Table 3.6-1. Landfills to Reservoirs with 50 or More Floating Houses and Nonnavigable Houseboats

Reservoir	Landfill Name	Landfill Closure Year	Landfill Location	Average Distance from Reservoir	Potential Routes
Boone	Eco Safe Landfill	2035 [a]	Blountville, Tennessee	25 miles	TN-394, I-26E, I-81
South Holston	Eco Safe Landfill	2035 [a]	Blountville, Tennessee	15 to 50 miles (depending on marina)	I-81, TN-394, TN-34/US-421
Norris	Chestnut Ridge Landfill	2078	Heiskell, Tennessee	40 to 60 miles (depending on marina)	I-75, TN-33, TN-170
Fort Loudoun	Chestnut Ridge Landfill	2078	Heiskell, Tennessee	50 to 70 miles (depending on marina)	I-40, I-75, TN-72, US-321
	Alcoa/Maryville City Landfill	2072	Friendship, Tennessee	80 to 100 miles (depending on marina)	US-129, TN-334, NC-28
Fontana	Chestnut Ridge Landfill	2078	Heiskell, Tennessee	60 to 70 miles (depending on marina)	I-75, US-441, I-40, NC-28
	White Oak Landfill	2058	Waynesville, North Carolina	119 to 200 miles (depending on marina)	US-74/US-23, US-276

[a] Estimated
Source: USEPA 2014.

3.7 Visual Resources

TVA lands and areas of jurisdiction include power plants, dams, reservoirs, and tracts of land adjacent to the reservoirs that range in size from tenths of an acre to several hundred acres. Because the scenic features of the landscape are not limited by land boundaries, the attractive landscape character extends across TVA lands and other public and private lands alike. The natural elements together with the communities and other cultural development often provide a scenic, rural countryside.

Land uses adjacent to the reservoirs include residential development, public parks, commercial development, and sporadic industrial facilities. The reservoirs offer abundant water-based recreation opportunities along with a variety of scenery. Most embayments are broadly open at the mouth, and some wind over a mile to their headwaters.

Among the scenic resources of each of the reservoirs, the waterbody itself is the most distinct and outstanding aesthetic feature. The horizontal surface provides visual balance and contrast to the islands and wooded hillsides. The reservoirs weave around ridges and bends, changing views periodically seen from the water. The waterbody also links the other landscape features together. Views across the water are satisfying and peaceful to most observers.

Other important scenic features include the secluded coves and steep, wooded ridges that occur around the reservoirs. The isolated coves with wooded shoreline provide relatively private locations for dispersed recreation activities. Significant elevation changes along some stretches of shoreline provide a dramatic contrast to the surrounding reservoir and gently sloping countryside, particularly when they are viewed from background distances. Most shorelines upstream of the dams appear natural. Slopes and ridgelines seen from the reservoirs are generally heavily vegetated with mature hardwood and evergreen trees, and provide positive visual contrast to the reservoirs. There is usually little development in the foreground distances.

Islands are another significant feature that provide scenic accents and visual reference points throughout the reservoirs; they also serve as visual buffers for less desirable views. They provide a pleasing foreground frame for the distant shoreline or background.

As noted in the ROS (TVA 2004), lower winter pool levels often result in the exposure of tributary reservoir bottoms and flats, in contrast to when the higher pool levels meet the vegetated shoreline. This visual change in reservoir character is created in shallower portions of the reservoir and becomes most evident in the headwater and embayment areas. Headwater areas often revert to characteristics of the original river environment, including wide, barren shorelines and discolored rock bluffs along the former river channel. Exposure of reservoir bottom areas is common to tributary and, to a much lesser extent, mainstem reservoirs.

The visual effect for mainstem reservoirs from lower winter pool levels can range from the occurrence of sandbars and small islands to extensive flat areas that are dry with exposed ground. Many of these large, exposed flat areas are associated with wildlife management areas or other areas that exhibit wetland characteristics. Consequently, their appearance tends to blend in an acceptable degree with the natural surrounding landscape. In other cases, the flats are a notable part of residential viewsheds, where the change in landscape character is not as acceptable and is interpreted as creating a lower level of scenic integrity.

Each reservoir exhibits its own combination and degree of visual effects with respect to its operating plan. Its existing character and level of scenic attractiveness is maintained throughout the year. The same can be said for reservoirs classified as run-of-river projects. Reservoirs with similar landscape characteristics display a combination of effects related to both shoreline rings and exposed reservoir bottoms. These combinations create lower levels of scenic integrity.[5]

Exposed shorelines or reservoir bottoms alone do not create the lowest level of scenic integrity, but rather exposure of other visible elements from lower water levels. Woody debris, trash, riprap, underwater structures such as tires used for fish habitat, and floating structures sitting on the bottom add unattractive visual contrast to the area viewed.

It is also important to note that, for some reservoirs, flood conditions create shoreline conditions that do not appear natural. For example, vegetated areas, normally above water, are covered; shoreline structures float higher than their moorings; and parking lots or other recreational facilities are submerged in water.

[5] "Scenic integrity" measures scenic value according to the degree of visual unity and wholeness of the landscape. It is one of the characteristics used by TVA and other agencies to assess the visual quality of land under its management.

Various combinations of development and land use patterns that are present in the viewed landscapes along the shorelines contribute to the overall visual character of the project area. These can range from the more urban and industrial developments often associated with the mainstem reservoirs to residential developments that are common to both mainstem and tributary reservoirs. Urban and industrial developments generally create a lower level of scenic integrity. Residential areas and water-related facilities that include docks, boathouses, stairways, and shoreline protection structures are becoming more common. The presence of these facilities in the landscape reduces scenic integrity.

TVA's dam structures contrast visually with the lands that border them. The structures appear predominately industrial near the dams and switchyards. Most buildings are broadly horizontal and can be seen in the foreground. Transmission structures, including towers and lines, and fossil and nuclear plant structures generally can be seen up to middleground distances, depending on topography and viewer position. The most significant focal point in the landscape is generally the smokestacks and cooling towers, which can be up to 800 feet in height. Farther away, closer to the borders on all sides, the landscape becomes natural appearing with slight human alterations. Residents and motorists along local roads have views up to middleground distances of the dam, depending on seasonal variations of vegetation and atmospheric conditions.

The presence of marinas also contributes to the scenic integrity of the reservoirs. The docks, support buildings, and boats contrast with natural features of the reservoirs. Views of the marinas from the reservoir are typically in the foreground from the marina or the marina entrance but may also occur in the middleground and background from areas along the shoreline. The location, size, and configuration of the marina greatly influence how these facilities affect the scenic integrity of the overall reservoir. Many of the marinas, such as the Blue Springs Marina on Norris Reservoir and the Perryville Marina on Kentucky Reservoir are located in coves that limit views of the FHs/NNs and other marina features to a small portion of the reservoir and the recreators using the marina facilities. Other marinas, such as the Waterside Marina on Norris Reservoir and Alarka Dock on Fontana Reservoir are situated in larger harbors, with docks and other marina facilities spread out along the shoreline. The facilities are visible from a larger portion of the reservoir and the shoreline, and affect the scenic integrity of a larger portion of the reservoir.

Important factors that influence the scenic attractiveness are the presence of existing natural or scenic resources and the number of marinas. Table 3.7-1 shows the number of marinas at each reservoir and the percentage of land area classified as "natural area" within 0.25 mile of the reservoir shoreline. The natural area classification includes the following land types:

- National forest and national parks
- State, municipal, and county parks
- State game lands
- Scenic trails and observation areas
- Wildlife management areas, wildlife refuges, nature preserves, and habitat protection areas
- Important ecological features such as caves, springs, bluffs, and specific high-quality habitats
- Conservation easements
- TVA habitat protection areas
- Historic areas and important archaeological sites

Table 3.7-1. Reservoirs Ranked by Percent of Acreage in Natural Area

Reservoirs with Marinas or Potential for Marinas	Estimated Current Number of Floating Houses and Nonnavigable Houseboats	Number of Marinas	Land Area within 0.25 Mile of Shoreline (acres)	Natural Area within 0.25 Mile of Shoreline (acres)	Natural Area within 0.25 Mile of Shoreline (%)
Hiwassee	30	4	18,022	18,022	100
Nottely	0	1	10,580	10,580	100
Watauga	37	7	12,238	12,238	100
Parksville (Ocoee 1)	0	1	4,878	4,858	100
Fontana	357	6	25,879	25,060	97
Chatuge	0	4	11,397	8,817	77
Bear Creek	0	0	6,090	4,268	70
South Holston	117	6	14,281	9,274	65
Cedar Creek	0	0	6,410	3,912	61
Tellico	0	4	35,168	17,602	50
Normandy [a]	0	0	8,529	4,193	49
Nickajack [a]	30	3	21,744	10,457	48
Wheeler [a]	0	5	89,148	41,378	46
Blue Ridge	12	1	13,767	6,235	45
Little Bear	0	0	5,031	2,226	44
Norris	921	24	89,353	34,116	38
Melton Hill	0	1	19,456	7,295	37
Kentucky	55	61	165,914	61,833	37
Tims Ford	0	1	24,570	7,917	32
Guntersville	12	19	84,601	25,363	30
Pickwick	2	7	46,384	11,578	25
Cherokee	2	11	44,120	9,509	22
Fort Patrick Henry	6	1	3,392	728	21
Watts Bar	2	13	69,695	14,839	21
Chickamauga	20	14	69,320	11,749	17
Boone	133	7	8,435	955	11
Fort Loudoun [a]	100	10	36,068	3,739	10
Douglas	0	10	36,956	1,454	4
Wilson[a]	0	5	17,578	449	3

[a] The TVA planning process has not yet been completed for these reservoirs. Land use data comes from Section 7.7 of TVA's *Natural Resource Plan* (TVA 2011a).

The opportunities for recreation and the scenic quality of the waterbodies and adjacent lands attract a high number of recreators with sensitivity to the visual environment to many of the reservoirs. One of the most visited areas is Fontana Reservoir. Bordered by the Great Smoky Mountains National Park (GSMNP) and the Nantahala National Forest, the reservoir attracts boaters, hikers, climbers, and campers. The GSMNP is the most visited national park in the United States, with numerous recreational opportunities.[6] Fontana Dam, the tallest concrete dam east of the Rockies, is of interest to recreators and engineering enthusiasts. The dam provides a view of the reservoir to the east and is a crossing point for the Appalachian Trail. Many of the hikers observe the reservoir when using the Trail and the support facilities in Fontana Village. Other views of the reservoir facilities are available from trails and viewpoints on the surrounding ridges and mountain peaks of GSMNP and the Nantahala National Forest, which is situated south of Fontana Reservoir. Although the topography of the reservoir limits some views of the marinas, the 6 marinas and 357 FHs currently located on the reservoir would be visible from some locations in the GSMNP and the Nantahala Forest.

3.8 Land Use

The proposed alternatives would affect those reservoirs with existing marinas or those with the potential for marinas in the near future. Currently, 29 reservoirs are expected to be affected by the alternatives. Approximately half of these reservoirs already contain FHs/NNs. TVA manages much of the shoreline surrounding these reservoirs because it owns the land (the land is in TVA's custody and control), but it manages all of the shoreline under Section 26a of the TVA Act. TVA owns approximately 293,000 acres of the land surrounding the reservoirs. Land use and land cover on TVA reservoir lands, and on a 0.25-mile surrounding area of influence, was quantified in 2008–2009. The state of most of these lands is natural habitat, with 81 percent forested. Approximately 24 percent is pasture or cropland, 7 percent developed with open space, 4 percent developed, and 2 percent barren. TVA's designated uses for these lands reflect their ecological condition.

As discussed in Section 1.6.2, TVA has developed categories that divide its reservoir lands into seven land use zones; these zones provide guidance regarding the types of development or activities that are permitted on TVA lands (Appendix B). The zone most likely to be affected by the alternatives would be Zone 6 lands, defined as land designated for developed recreation. Table 3.1-1 provides the total land area at each potentially affected reservoir and the area of Zone 6 lands within each reservoir.

Of TVA's 293,000 acres of reservoir land, 182,300 acres have been designated for Natural Resource Conservation, 50,000 acres for Sensitive Resource Management, 21,200 acres for Recreation (developed and informal), 14,000 acres for Shoreline Access (residential-related waterfront facilities like docks), and 4,200 for Industrial. An additional 21,000 acres provide the land base for TVA project operations like its dam reservations and power plant sites.

In addition to the land use cover types already discussed, TVA lands may contain land that is designated as prime farmland. The US Department of Agriculture defines prime farmland as "land that has the best combination of physical and chemical characteristics for producing food, fee, forage, fiber, and oilseed crops and that is available for these uses" (USDA NRCS 1993). These lands could be cultivated land, pastureland, or other land that is not urban land, built-up land, or water areas.

Land at several of the affected TVA reservoirs is labeled as farmland of statewide importance. These lands are determined by the appropriate state agency and represent land that is of statewide importance for the production of food, feed, fiber, forage, and oil seed crops (USDA NRCS 1993).

A total of 22,000 acres of prime farmland surround the 29 potentially affected reservoirs. Table 3.8-1 provides the acreage of prime and important farmland for each of these reservoirs.

[6] Great Smoky Mountains National Park. Website http://www.nps.gov/grsm/index.htm. Accessed April 14, 2015.

Table 3.8-1. Prime Farmland within TVA Reservoir Lands

Reservoir	Prime Farmland (acres)	Farmland of Statewide Importance (acres)	Farmland of Local Importance (acres)
Bear Creek	NA	NA	NA
Blue Ridge	11	0	0
Boone	59	0	0
Cedar Creek	NA	NA	NA
Chatuge	132	0	0
Cherokee	254	0	0
Chickamauga	NA	NA	NA
Douglas	245	0	0
Fontana	0	0	0
Fort Loudoun	NA	NA	NA
Fort Patrick Henry	50	0	0
Guntersville	2,499	0	0
Hiwassee	106	0	0
Kentucky	8,297	276	0
Little Bear	NA	NA	NA
Melton Hill	NA	NA	NA
Nickajack	952	0	0
Norris	434	0	0
Normandy	NA	NA	NA
Nottely	0	0	0
Parksville (Ocoee 1)	NA	NA	NA
Pickwick	NA	NA	NA
South Holston	292	45	0
Tellico	2,102	0	0
Tims Ford	518	0	0
Watauga	12	0	0
Watts Bar	2,871	0	0
Wheeler	2,994	0	0
Wilson	NA	NA	NA

NA = Data not available

Source: TVA 2011b.

3.9 Cultural Resources

Areas with known important cultural resources are classified by TVA as Zone 3, which includes areas of significant or potentially significant archaeological sites, as well as properties listed in the National Register of Historic Places (NRHP). The NRP EIS (TVA 2011b) presents the amount of reservoir area and shoreline area that has been surveyed for cultural resources. Although a substantial amount of these areas has been surveyed previously, cultural resource surveys were not comprehensive in scope or were conducted prior to the passage of the National Historic Preservation Act (NHPA), the primary law determining the role of federal agencies in the event of a federal undertaking.

Section 106 of the NHPA indicates that agencies must take into account the effects of any given federal undertaking on historic properties. This process generally involves four steps: (1) initiate the process, which includes informing state historic preservation offices and federally recognized tribes of the proposed action; (2) identify historic properties; (3) assess potential effects; and (4) resolve potential adverse effects. The Area of Potential Effects (APE) is 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." (36 CFR Part 800.16[d]) The APE for archaeological resources is considered to be any area affected by ground-disturbing activities associated with the proposed undertaking. The APE for architectural resources consists of the 0.805-kilometer (0.5-mile) area surrounding any new FH or any new aboveground construction associated with this undertaking, as well as any areas where the project would alter existing topography or vegetation in view of a historic resource. Individual areas will need to be addressed in compliance with the provisions and stipulations of the NHPA of 1966, as amended (16 United States Code [USC] Section 470), and the Archaeological and Historic Preservation Act of 1974 (16 USC 479). Other laws applicable to the treatment of cultural resources as a result of federal undertakings include the Archaeological and Historic Preservation Act (16 USC 469–469c), the Archaeological Resources Protection Act (16 USC 470aa–470mm), and the Native American Graves Protection and Repatriation Act (25 USC 3001–3013).

Historic properties, as defined by the NHPA, include archaeological sites, both prehistoric and historic, and architectural resources, such as buildings, structures, objects, sites, and districts. The process of identifying historic properties includes the identification of both known historic properties listed in the NRHP and those eligible for listing in the NRHP, per the amendment to the NHPA (16 USC 470). NHPA Section 110 provides for the responsibilities of the federal government with respect to historic properties and ensures that historic preservation efforts are integrated into existing federal programs. The section below provides an overview of known resources and potential consequences based on the proposed alternatives.

The Tennessee River Valley has a rich cultural occupation that extends for over 15,000 years. Early TVA archaeologists such as William Webb and T.M.N. Lewis (University of Tennessee) were instrumental in defining the cultural sequence of the region’s precontact occupants. Since its inception in the 1930s, an estimated 11,500 archaeological sites have been identified on TVA lands. Within the specific study area, a total of 11,368 sites have been identified and recorded. Of these, approximately 40 percent (n=4,155) are inundated and located below the terrestrial shoreline (Table 3.9-1). The remaining sites, 7,213 in number, have been identified above the summer pool and are considered terrestrial sites. While the number of sites identified is considerable, it is estimated that less than 25 percent of these sites have been evaluated for NRHP eligibility (TVA 2011b).

As a result, the raw number of identified sites may be a misleading metric if the original survey methodology is unknown. For example, T.M.N Lewis, the original director of the University of Tennessee Archaeology program, estimated that he surveyed roughly 75 percent of the Watts Bar reservoir area by December 1940. He was successful in recording hundreds of sites, all of which were identifiable by artifact scatters on the surface or conspicuous features across the landscape (e.g., mound sites, cemeteries). Lewis concluded that “the prehistory of the Watts Bar Basin was so similar to that of the Chickamauga Basin that excavation of three or four sites would be sufficient and would avoid unnecessary duplication of effort” (Lyon 1996:165). His survey efforts, although standard for the time, lacked subsurface data from a systematic sample of the area. Instead, hampered by dam construction and flooding schedules, he focused on high-profile sites likely to yield the highest number of artifacts. As a result, knowledge of cultural sequence for many of the reservoirs is incomplete, despite potential survey coverage, and is largely biased toward higher-profile sites.

Table 3.9-1. Approximate Number of Identified Archaeological Sites and Percentage of TVA Lands Systematically Surveyed within Potentially Affected Reservoirs

Reservoir	Land Systematically Surveyed (%)	Number of Inundated Sites	Number of Sites above Normal Summer Pool	Total Number of Sites Recorded [a]
Bear Creek	75	152	454	606
Blue Ridge	51	111	7	118
Boone	0	36	20	56
Chatuge	40	185	158	343
Cherokee	16	599	164	763
Chickamauga	8	103	455	558
Clear Creek	0	0	0	0
Douglas	Unknown	103	12	115
Fontana	Unknown	146	11	157
Fort Loudoun	0	65	31	96
Fort Patrick Henry	Unknown	35	37	72
Guntersville	<1	219	776	995
Hiwassee	40	248	16	264
Kentucky	1	500	1,335	1,835
Little Bear	NA	NA	NA	NA
Melton Hill	44	14	104	118
Nickajack	15	38	72	110
Normandy	Unknown	0	43	43
Norris	Unknown	314	738	1,052
Nottely	12	168	56	224
Parksville (Ocoee #1)	10	20	1	21
Pickwick	29	222	596	818
South Holston	54	17	87	104
Tellico	7	285	368	653
Tims Ford	36	39	78	117
Watauga	Unknown	106	37	143
Watts Bar	41	151	477	628
Wheeler	8	254	1,077	1,331
Wilson	0	0	0	0
Total	**21% (average)**	**4,130**	**7,210**	**11,340**

[a] Data available from http://www.tva.com/environment/reports/nrp/pdf/finals/nrp_feis_chapter_4.pdf 2011 table.

The percentage of shoreline surveyed varies greatly between each reservoir, between 75 percent surveyed on Bear Creek and 0 percent or unknown for roughly one-third of the reservoirs (n=12). Many of the reservoirs that list an unknown amount of systematic survey but a large number of sites (e.g., Norris) or a high ratio of inundated sites to those above pool (e.g., Cherokee) were likely surveyed during the early years of the TVA. Others with higher percentages of recorded systematic survey were likely surveyed more recently in association with federal actions. Based on available data, roughly 40 large-scale surveys have been conducted on TVA lands within the past 30 years, which largely accounts for the percentage of systematic surveyed shoreline data provided in Table 3.9-1.

In addition to archaeological sites, 4,725 historic structures have been recorded on TVA-managed lands in the study area; of these, 204 are considered either eligible or potentially eligible for NRHP listing (Table 3.9-2). To date, 94 historic structures or districts in the study area are currently listed in the NRHP. In general, by their nature historic structures are more visible on the landscape and easier to incorporate into the planning process.

Table 3.9-2. Numbers of Historic Structures Surveyed within Potentially Affected Reservoirs

Reservoir and Location	Recorded Historic Structures	NRHP-Eligible or Potentially Eligible Historic Structures	NRHP-Listed Historic Structures/Districts
Mainstem Reservoirs			
Kentucky, KT/TN	438	1	12
Pickwick, AL/MS/TN	151	2	1
Wilson, AL	21	1	4
Wheeler, AL	546	1	7
Guntersville, AL/TN	1,223	64	6
Nickajack, TN	50	1	0
Chickamauga, TN	138	1	10
Watts Bar, TN	91	1	10
Fort Loudoun, TN	139	1	2
Total Mainstem	***2,797***	***73***	***52***
Tributary Reservoirs			
Norris, TN	421	2	0
Melton Hill, TN	19	1	5
Douglas, TN	413	47	4
South Holston, TN/VA	184	17	1
Boone, TN	89	4	5
Fort Patrick Henry, TN	73	1	0
Cherokee, TN	362	12	8
Watauga, TN	67	1	0
Fontana, NC	28	1	3
Tellico, TN	269	6	3
Chatuge, NC	25	4	2
Nottely, GA	23	5	2
Hiwassee, NC	25	1	2
Blue Ridge, GA	38	1	-

Reservoir and Location	Recorded Historic Structures	NRHP-Eligible or Potentially Eligible Historic Structures	NRHP-Listed Historic Structures/Districts
Parksville (Ocoee #1), TN	1	2	-
Tims Ford, TN	158	3	1
Normandy, TN	93	1	4
Bear Creek, AL	2	2	1
Little Bear Creek, AL	14	1	1
Cedar Creek, AL	45	21	0
Total Tributary	***1,928***	***131***	***42***
Total Reservoirs	**4,725**	**204**	**94**

Source: TVA 2011b.

3.10 Water Quality

This section addresses only surface water quality. TVA does not anticipate that Floating Houses Policy alternatives will significantly influence groundwater resources except perhaps around marinas that add septic facilities. The potential impacts on groundwater from the addition of these facilities would be evaluated during an individual project permitting process.

The water quality in TVA's reservoir system is affected by many factors, including the physical characteristics of each reservoir, especially flow and residence time. "Residence time" characterizes the amount of time that is available for physical, chemical, and biological processes to occur within a reservoir. For example, a residence time of 300 days would suggest a reservoir with sufficient time for thermal stratification, algal growth, reduced dissolved oxygen (DO), and a variety of related biological and chemical processes to show an effect. In contrast, a residence time of 10 days would suggest substantial water movement and little time for these processes to make a substantial change in water quality.

The physical characteristics of selected TVA reservoirs, including mean annual flow and residence time, are listed in Table 3.10-1. Residence times for six of the nine mainstem reservoirs are 10 days or less, and residence times for all of the selected mainstem reservoirs are less than 20 days. The residence times are short for a few small tributary reservoirs; however, many of the tributary reservoirs have residence times of over 100 days. The long retention times of the tributary reservoirs make them more sensitive to nutrients and organic pollution (Baker 2003).

As discussed more fully in Section 3.11, Ecological Resources, TVA monitors the health of its reservoirs as part of the Reservoir Vital Signs Monitoring Program (VSMP). Five key indicators (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 (TVA 2014). Section 3.11 describes the ecological health of the five reservoirs (Boone, Fort Loudoun, South Holston, Norris, and Fontana) that currently have 100 or more FHs/NNs and a high probability of increases. Table 3.11-8 lists the average reservoir ecological health scores of the other 24 potentially affected reservoirs for the period from 1994 to 2014. In addition to flow and residence time, reservoir water quality can be affected by localized discharges (e.g., from municipal or industrial sewer systems) and by non-point discharges (e.g., agriculture and urbanization).

Current trends in population growth, increases in watershed impervious surface area, and increased water-based recreation would tend to increase adverse impacts on surface water quality unless these increases in pollutant sources are offset by improved wastewater management and treatment.

Table 3.10-1. Physical Characteristics of Selected TVA Reservoirs

Reservoir	River Basin	Drainage Area (sq km)	Mean Annual Flow (m^3/s)	Full Pool Area (ha)	Full Pool Volume (106 m^3)	Mean Depth (m) [a]	Residence Time (days)[a]
Mainstem Reservoirs							
Fort Loudoun	Tennessee	24,730	452	5,909	448	7.6	10
Watts Bar	Tennessee	44,830	770	15,783	1,246	7.9	17
Chickamauga	Tennessee	53,850	950	14,326	775	5.4	8
Nickajack	Tennessee	56,640	982	4,197	297	7.1	3
Guntersville	Tennessee	63,330	1,136	27,479	1,256	4.6	12
Wheeler	Tennessee	76,640	1,376	27,143	1,295	4.8	9
Wilson	Tennessee	79,640	1,417	6,273	782	12.5	6
Pickwick	Tennessee	85,000	1,515	17,443	1,140	6.5	8
Kentucky	Tennessee	104,120	1,764	64,873	3,502	5.4	19
Tributary Reservoirs							
Watauga	Watauga	1,210	19	2,602	702	27.0	325
Wilbur	Watauga	1,220	20	29	1	3.0	0
South Holston	Holston	1,820	26	3,068	811	26.4	262
Boone	Holston	4,770	68	1,744	233	13.4	30
Fort Patrick Henry	Holston	4,930	71	353	33	9.4	5
Cherokee	Holston	8,880	124	12,262	1,827	14.9	92
Douglas	French Broad	11,760	189	12,303	1,737	14.1	49
Fontana	Little Tennessee	4,070	107	4,306	1,752	40.7	124
Tellico	Little Tennessee	6,800	0	6,678	511	7.7	31
Norris	Clinch	7,540	114	13,841	2,517	18.2	169
Melton Hill	Clinch	8,660	139	2,303	148	6.4	11
Blue Ridge	Toccoa/Ocoee	600	16	1,331	238	17.9	117
Ocoee #1	Toccoa/Ocoee	1,540	37	765	105	13.7	28
Ocoee #2	Toccoa/Ocoee	1,330	34	0	0	0.0	0
Ocoee #3	Toccoa/Ocoee	1,270	31	194	4	1.8	1
Nottely	Hiwassee	550	11	1,692	210	12.4	134
Chatuge	Hiwassee	490	12	2,853	288	10.1	199

Reservoir	River Basin	Drainage Area (sq km)	Mean Annual Flow (m^3/s)	Full Pool Area (ha)	Full Pool Volume (106 m^3)	Mean Depth (m) [a]	Residence Time (days)[a]
Hiwassee	Hiwassee	2,510	53	2,465	521	21.1	67
Apalachia	Hiwassee	2,640	58	445	71	16.0	13
Normandy	Duck	510	9	1,307	144	11.0	141
Tims Ford	Elk	1,370	26	4,836	654	13.5	240
Upper Bear Creek	Bear Creek	280	6	749	46	6.2	75
Bear Creek	Bear Creek	600	12	279	12	4.2	9
Little Bear Creek	Bear Creek	160	3	631	56	8.9	158
Cedar Creek	Bear Creek	460	9	1,700	116	6.8	113

ha = hectare
m = meter
m^3 = cubic meter
m^3s = cubic meters per second
sq km = square kilometer

[a] Mean depth and residence time are based on average, rather than full pool area and volume.
Source: TVA data.

As expected from the higher flows and shorter residence times, the ecological health for all of the mainstem reservoirs was rated as fair or good. The lowest score was for Fort Loudoun Reservoir, which is affected by urban runoff and point source discharges from the greater Knoxville metropolitan area.

The ecological health for most of the tributary reservoirs was rated as fair or poor. Of the tributary reservoirs, only Watauga and Blue Ridge Reservoir received a good rating. South Holston, Fort Patrick Henry, Douglas, Fontana, Norris, Melton Hill, Chatuge, and Hiwassee Reservoirs received fair ratings; while Boone, Cherokee, Tellico, Nottely, and Tims Ford Reservoirs received poor ratings.

Although TVA routinely monitors water quality at select locations within its reservoirs, TVA does not have a program to monitor water quality at or in the vicinity of marinas and has very little water quality data associated with marina activities or FHs/NNs. Even at locations for which data are available (such as at Powell River Mile 30 on Norris Reservoir, where data have been collected as part of the Vital Signs Monitoring Program [VSMP] since the 1990s), TVA cannot attribute data trends to the marina activities because data are not matched with upstream reference data. Many marina discharges to surface waters, especially from FHs/NNs, are known to be intermittent and of short duration. Unless a monitoring team is at the site of one of these discharges when it occurs, any samples collected at the site are unlikely to be representative of the discharge. Changes in weather or lake levels can result in local changes in flow patterns, which also make collecting data on these discharges and their impacts on surface water very difficult, time-consuming, and expensive. However, it is well established in scientific research that sewage and its constituents adversely affect water quality and freshwater aquatic life. Because water quality monitoring data necessary to conduct a quantitative analysis of the potential impacts of discharges on surface waters are not available, a qualitative analysis of the potential impacts of discharges to surface waters from FHs/NNs is provided as a proxy.

State environmental regulatory agencies designate the streams and other waterbodies in their state for various uses, such as recreation, drinking water supplies, or fish and aquatic life. If a particular stream segment does not meet the criteria for its designated uses, the state's water quality regulatory agency lists that stream segment as impaired in the state's Section 303(d) list. Table 3.10-2 lists the TVA reservoirs under consideration with a high or moderate probability of increases in the numbers of FH and any impairments listed in their respective state's Section 303(d) water quality impairment listings.

Table 3.10-2. Summary Listing of Reservoirs and Their Section 303(d)-Listed Impairments

Reservoir	Section 303(d) Impairment Criteria in Reservoir	Sources of Impairment in Reservoir	Wastewater-Related Impairments in Streams Entering Reservoir	Sources of Impairment in Streams
Blue Ridge	None		FC	Non-point
Boone	PCB, Chlordane	Sediment	EC, Nutrients	Ag., MS4
Chatuge	None		FC	Non-point
Cherokee	Mercury	Atm	EC, Nutrients	Ag, MS4, Muni.
Chickamauga	Mercury	Atm	EC, Nutrients	Ag, MS4, Muni.
Douglas	pH	Atm	EC	Septic, Muni, MS4
Fontana	FC	Ag, Septic	FC	Ag, Septic
Fort Loudoun	PCB, Mercury	Sediment, Atm	EC, Nutrients	Ag, MS4, Muni
Fort Patrick Henry	None		EC	Ag, MS4
Guntersville	Metals	Atm	Nutrients, Org	Ag
Hiwassee	Mercury, EC	Atm, Industry, unknown	EC, Nutrients	Ag, MS4
Kentucky	None		EC, Nutrients, low DO	Ag, Muni
Melton Hill	PCB, Chlordane	Sediment	EC, Nutrients	MS4, Muni, Ag
Nickajack	PCB, Dioxins	Sediment	EC, Nutrients	MS4, Muni
Norris	Mercury	Atm	EC, Nutrients	Ag, MS4, Muni
Nottely	FC	Non-point	FC	Non-point
Pickwick	Nutrients	Ag	Org, Nutrients	Ag, Septic
South Holston	Mercury	Atm, Industry	EC, Nutrients	Ag, MS4
Tellico	PCB, Mercury		EC, Nutrients	Ag, Muni
Tims Ford	Thermal, low DO	Upstream dams	EC, Nutrients	Ag, Muni
Watauga	Mercury	Atm	EC, Nutrients	Ag, Muni, MS4
Watts Bar	PCB, Chlordane, Mercury	Sediment	EC, Nutrients	Ag, Muni
Wheeler	Nutrients, PFOS	Ag, Industry	Nutrients	Ag, Muni
Wilson	Nutrients, Org	Ag	Nutrients, Org	Urban Runoff

Ag – agriculture usually pasture grazing; Atm – atmospheric deposition; DO – dissolved oxygen; EC – E. coliform; FC – fecal coliform; MS4 – discharges from MS4 (municipal separate storm sewer system) areas; Muni – municipal point sources or collection system failure; Org – organic enrichment; PCB – polychlorinated biphenyl; Septic – failed septic tank-adsorption field systems

The aspect of FHs/NNs that is most likely to affect surface water quality is direct discharge of untreated wastewater to the surface water around these structures. Potential effects on water quality parameters include increased pathogens, nutrient enrichment, and decreased DO. Consequently, the following water quality discussion focuses on impairments for DO, pathogens (E. coliform [EC] and fecal coliform [FC]), and nutrients listed in the state's Section 303(d) list. These parameters can be affected by other sources in addition to residential wastewaters. For example, nutrient levels, such as nitrogen or phosphorus, can become elevated because of stormwater runoff from agricultural areas or from urban areas.

Sewage characteristics can vary depending on the water source, the number of household occupants, their age and health, and the products used in the household (such as soaps, shampoos, and detergents). While black water typically contains more concentrated wastes that are high in biological oxygen demand (BOD), bacteria, and potential pathogens, grey water also may contain elevated BOD and pathogens. "Pathogens" are disease-causing organisms such as bacteria, viruses, or protozoa. Grey water can also contain pharmaceutical and personal care products. They include prescription and over-the counter drugs, diagnostic agents, dietary supplements, fragrances, soaps, conditioners, sunscreens, cosmetics, caffeine, and nicotine. Over the past decade, water quality surveys have indicated that numerous areas of the United States, including Tennessee, have pharmaceuticals and steroid hormones in their waterways. Additional studies have linked the exposure of fish and amphibians to natural and synthetic steroids to harmful effects such as reproductive and endocrine disruption (estrogen and/or androgen). (TDEC 2012.)

Polluted stormwater runoff from urban areas is commonly transported through municipal separate storm sewer systems (MS4s), from which it is often discharged untreated into local waterbodies. To prevent harmful pollutants from being washed or dumped into an MS4,[7] operators must obtain a National Pollutant Discharge Elimination System (NPDES) permit and develop a stormwater management program.

Table 3.10-2 identifies the listed impairments for the study area. Most of the reservoirs in the TVA system shown as impaired in Table 3.10-2 are listed for parameters that are not related to domestic wastewater. Several are impaired because of mercury from atmospheric deposition or for PCBs, dioxins, chlordane, or metals from legacy industrial discharges. Pickwick, Wheeler, and Wilson Reservoirs are listed as impaired because of nutrients from agriculture. The large volumes and high flows in most of the TVA reservoirs help them to meet their designated use criteria even though many of their tributary streams are impaired. Those flows help natural processes break down the constituents in domestic wastewater that are more biodegradable than the persistent chemicals and toxic metals that cause impairments in most reservoirs.

Even those reservoirs impaired because of criteria associated with domestic wastewater, such as FC, often have more than one source contributing to that impaired condition. For example, part of Fontana Reservoir is listed for FC bacteria probably from agricultural runoff and individual on-site wastewater failures. Hiwassee Reservoir is listed for EC bacteria, but the listing states that the source is unknown. Nottely Reservoir is listed for FC from non-point sources, which probably include a combination of agricultural runoff and residential sources. These three reservoirs are all tributary reservoirs with lower flows than the mainstem reservoirs.

Most FHs/NNs are currently located in or near marinas within a reservoir, not within a tributary stream. However, all of the reservoirs have one or more tributary streams with segments impaired for criteria that could be related to domestic wastewater. Many of these impaired stream segments are too far from a reservoir or too small to be relevant to the water quality near FHs/NNs. Some of the larger tributary streams do flow into reservoir embayments that currently have marinas near the stream mouth or nearby.

---

[7] An MS4 is a conveyance or system of conveyances that is:

- Owned by a state, city, town, village, or other public entity that discharges to waters of the United States
- Designed or used to collect or convey stormwater (including storm drains, pipes, and ditches)
- Not a combined sewer
- Not part of a Publicly Owned Treatment Works (sewage treatment plant)

(http://water.epa.gov/polwaste/npdes/stormwater/Municipal-Separate-Storm-Sewer-System-MS4-Main-Page.cfm)

Those tributary streams, their Section 303(d) impairments, their probable impairment sources, and the reservoir into which they discharge are listed in Table 3.10-3; also listed are some additional tributary streams that seemed likely sites for possible future FHs.

Table 3.10-3. Sampling of Tributary Streams Listed for Coliform or Nutrients

Reservoir into Which Stream Discharges	Tributary Stream	Section 303(d) Impairment Criteria	Source of Impairment
Boone	Gammon Creek	Nitrate +Nitrite, EC	MS4, pasture grazing
Boone	Reedy Creek	Nitrates, EC	MS4
Boone	Cash Hollow Creek	EC	MS4
Boone	Knob Creek	Nitrate +Nitrite, EC	MS4, pasture grazing
Boone	Carroll Creek	Nitrate + Nitrite, EC	MS4, pasture grazing
Boone	Boones Creek	Nitrate + Nitrite, EC	MS4, pasture grazing
Boone	Beaver Creek	Nitrate + Nitrite, EC	MS4, pasture grazing
Cherokee	Turkey Creek	EC	Collection system failure, MS4
Chickamauga	Wolftever Creek	EC	MS4
Fort Loudoun	First Creek	Nitrate + Nitrite, EC	Collection system failure, MS4
Fort Loudoun	Second Creek	Nitrate + Nitrite, EC	Collection system failure, MS4
Fort Loudoun	Turkey Creek	EC	MS4
Fort Loudoun	Fourth Creek	EC	MS4
Kentucky	West Sandy Embayment	Nutrients, DO	Septics, pasture grazing
	Big Sandy River	EC, Nutrients	Pasture grazing
Norris	Big Creek	Nitrate + Nitrite,	Municipal point source
Tellico	Bat Creek	EC, Nutrients	Municipal point source, collection system failure

DO – dissolved oxygen; EC – E. coliform; MS4 – discharges from MS4 (municipal separate storm sewer system) areas

TVA lists certain TVA reservoirs as No Discharge reservoirs in relation to MSDs on boats (http://www.tva.gov/river/26apermits/guidelines/discharges.html).[8] No Discharge zones are areas of water that require greater environmental protection and where even the discharge of treated sewage could be harmful. The USCG developed MSD guidelines to regulate wastewater discharges from boats and ships. Because houseboats were originally designed to be boats, the MSD guidelines also apply to wastewater discharges from houseboats. If a houseboat is turned into a nonnavigable facility, the occupants have sometimes continued to use the MSD on No Discharge reservoirs instead of upgrading to residential plumbing and sewage treatment systems.

Table 3.10-4 identifies 13 reservoirs with potential future increases in the number of FHs. In descending order by current number of FHs/NNs, they are Norris, Fontana, Boone, South Holston, Fort Loudon, Kentucky, Watauga, Nickajack, Chickamauga, Guntersville, Pickwick, Watts Bar, and Wheeler Reservoir. They are listed in Table 3.10-4 with their reservoir type and usual ecological health rating.

[8] A marine sanistation device (MSD) is “any equipment for installation on board a vessel which is designed to receive, retain, treat, or discharge sewage, and any process to treat such sewage” (33 USC 1322[a]1).

Table 3.10-4. Regulation of MSD Discharges on Reservoirs with a High Potential for Increasing Numbers of Floating Houses

Reservoir	Estimated Current Number of Floating Houses and Nonnavigable Houseboats	Reservoir Type	Ecological Health Rating	MSD Discharge Allowed?
Norris	921	Tributary	Fair	No
Fontana	357	Tributary	Fair	No
Boone	133	Tributary	Poor	No
South Holston	117	Tributary	Fair	Yes
Fort Loudoun	100	Mainstem	Fair	Yes
Kentucky	55	Mainstem	Good	Yes
Watauga	37	Tributary	Good	No
Nickajack	30	Mainstem	Good	Yes
Chickamauga	20	Mainstem	Good	Yes
Guntersville	12	Mainstem	Good	Yes
Pickwick	2	Mainstem	Fair	Yes
Watts Bar	2	Mainstem	Fair	Yes
Wheeler	0	Mainstem	Fair	Yes

MSD = marine sanitation device

The following surface water quality review focuses on those reservoirs with an estimated 100 or more FHs/NNs and with a high probability of increases in those numbers; these reservoirs were determined to have the greatest potential to be affected by the various alternatives. In decreasing order of estimated numbers of existing FHs/NNs, these five reservoirs are Norris (921), Fontana (357), Boone, (133), South Holston (117), and Fort Loudoun (100). These five reservoirs are also representative of the Valley-wide reservoir types and ecoregions. Norris, Boone, and South Holston are tributary reservoirs from the Ridge and Valley Ecoregion. Fontana is a tributary reservoir from the Blue Ridge Ecoregion. Fort Loudoun is a run-of-the-river or mainstem reservoir. Detailed descriptions of these five reservoirs, including information from the VSMP and other water quality sources, are provided later. Pollutants that may or are known to cause any of the five target reservoirs to not meet their designated uses are noted in the discussion of the reservoirs.

Of the five reservoirs addressed in this review, TVA lists Norris, Fontana, and Boone as No Discharge reservoirs (http://www.tva.gov/river/26apermits/guidelines/discharges.html). Discharges from Type I and Type II MSDs on boats are allowed on South Holston and Fort Loudoun Reservoirs because they are not listed as No Discharge reservoirs.

In attempts to meet navigable houseboat criteria under current TVA regulations, some FH owners have put outboard motors on porches and applied for vessel numbers that they applied to their FH. However, the Tennessee Department of Environment and Conservation (TDEC) has stated that those structures designed and built as residences, not designed as vessels, should not be allowed to discharge wastewater unless they are a permitted facility and the discharge meets the terms of that permit. Thus, even though vessels are allowed MSD discharges on South Holston and Fort Loudoun Reservoirs, Tennessee regulations on sewage do not allow discharge from FHs unless they are permitted and in compliance with their permits.

3.10.1 Norris Dam and Reservoir

The Clinch River flows southwestward for 300 miles from its headwaters in Virginia through the hills of northeastern Tennessee before emptying into the Tennessee River near Kingston. Norris Dam is located at just over 79 miles upstream from the mouth of the Clinch River, immediately downstream from the river's confluence with Cove Creek, which joins the river from the northwest. The reservoir includes parts of Anderson, Campbell, Union, Claiborne, and Grainger Counties. Norris Reservoir spans a 73-mile stretch of the Clinch from the dam to River Ridge at the Claiborne-Grainger county line. The reservoir also covers the lower 56 miles of the Powell River, which empties into the Clinch 10 miles upstream from Norris Dam. The dam's tailwaters are part of Melton Hill Reservoir, which stretches for 56 miles along the Clinch from Norris to Melton Hill Dam.

Norris Dam is a multipurpose dam located on the Clinch River in Anderson and Campbell Counties in Tennessee. The dam is 265 feet high and stretches 1,860 feet across the Clinch River. Norris has 809 miles of shoreline and 33,840 acres of water surface. It is the largest reservoir on a tributary of the Tennessee River. In a year with normal rainfall, the water level in Norris Reservoir varies about 29 feet from summer to winter in order to provide seasonal flood storage. The reservoir has a flood-storage capacity of 1,113,000 acre-feet.

TDEC classifies Norris Reservoir for domestic water supply, industrial water supply, fish and aquatic life, recreation, livestock watering and wildlife, and irrigation. As listed in Table 3.10-2, the Clinch River portion of Norris Reservoir in Campbell, Anderson, Union, Claiborne, and Grainger Counties is listed on the State of Tennessee’s Section 303(d) list as impaired (i.e., for not supporting its designated uses) due to mercury in contaminated sediments (TDEC 2014). The Tennessee Wildlife Resources Agency (TWRA) has issued a precautionary advisory for largemouth bass, striped bass, smallmouth bass, and sauger. The Powell River Embayment is not included in this advisory. (TDEC 2012.) However, as discussed earlier, mercury is not a pollutant expected to be discharged from FHs/NNs. More relevant is that Big Creek is listed for nitrate and nitrite from a municipal point source. Big Creek flows into Ollis Creek, which flows into Norris Reservoir. There are two marinas near where Ollis Creek flows into Norris Reservoir, both with FHs or NNs.

3.10.2 Fontana Dam and Reservoir

The Little Tennessee River flows for 135 miles from its source in the mountains of northern Georgia to its mouth along the Tennessee River opposite Lenoir City, Tennessee. Fontana Dam is located 61 miles above the mouth of the Little Tennessee, in a remote area where the westward-flowing river bends briefly to the south. The Great Smoky Mountains rise to the north and the Yellow Creek Mountains (mostly protected by the Nantahala National Forest) rise to the south. Fontana is the uppermost of five dams on the Little Tennessee River, with Cheoah Dam 10 miles downstream, followed by Calderwood, Chilhowee, and Tellico Dams.

Fontana Dam is a multipurpose dam on the Little Tennessee River in Swain and Graham Counties in North Carolina. The dam is 480 feet high and stretches 2,365 feet across the Little Tennessee River. Fontana Reservoir provides 238 miles of shoreline and 10,230 acres of water surface for recreational activities. In a year with normal rainfall, the water level in Fontana Reservoir varies about 56 feet from summer to winter in order to provide seasonal flood storage. Fontana has a flood-storage capacity of 514,000 acre-feet.

Along with a 29-mile stretch of the Little Tennessee, Fontana Reservoir also extends across the lower 11 miles of the Tuckasegee River (which flows southward from Cherokee and Bryson City) and the lower 5 miles or so of the Nantahala River, extending into the Nantahala Gorge. Several rapid-flowing mountain streams empty into Fontana's northern shore. The most notable of these streams, Eagle and Hazel Creeks, form substantial embayments just upstream from the dam.

The North Carolina Department of Environment and Natural Resources classifies Fontana Reservoir for primary recreation-fresh water, aquatic life, and secondary recreation-fresh water (NCDENR 2014a).

Some portions are also classified as water supply-highly developed, outstanding resource waters, trout waters, or critical areas. The Tuckasegee River Arm of Fontana Reservoir from Lemmons Creek to Peachtree Creek in Swain County is listed on the State of North Carolina's Section 303(d) list as impaired because of fecal coliform. Water quality issues of concern in this subbasin include impacts from developments on steep slopes, agricultural runoff, stream bank erosion, limited riparian buffers, and individual on-site wastewater failures. (NCDENR 2014b.)

3.10.3 Boone Dam and Reservoir

Boone Dam is located 19 miles above the South Fork Holston River's confluence with the North Fork Holston River (which forms the Holston River proper). The Watauga River joins the South Fork Holston almost immediately upstream from the dam, creating a V-shaped reservoir that extends for 17 miles up the South Fork Holston (to Bluff City) and for 15 miles up the Watauga. Boone Dam is 31 miles downstream from South Holston Dam and 10 miles upstream from Fort Patrick Henry Dam.

Boone Dam is a multipurpose dam on the South Fork Holston River on the border between Sullivan and Washington Counties in Tennessee. The dam impounds the 4,500-acre Boone Reservoir, and its tailwaters are part of Fort Patrick Henry Reservoir. The dam is 160 feet high and stretches 1,697 feet across the South Fork Holston River. In a year with normal rainfall, the water level in Boone Reservoir varies about 25 feet from summer to winter in order to provide seasonal flood storage. The reservoir has a flood-storage capacity of 75,800 acre-feet.

TDEC classifies the South Fork Holston and Watauga Rivers in Boone Reservoir for domestic water supply, industrial water supply, fish and aquatic life, recreation, livestock watering and wildlife, and irrigation. Boone Reservoir in Washington and Sullivan Counties is listed on the State of Tennessee's Section 303(d) list as impaired due to PCBs and chlordane in contaminated sediments. All of Boone Reservoir in Sullivan and Washington Counties (4,400 acres) has fish consumption advisories due to PCBs and chlordane levels found in carp and catfish. Pesticides are more likely to bioaccumulate in these fish species since they tend to accumulate more in fattier fish. At such levels, children, pregnant women, and nursing mothers should not consume the fish species named; and others should limit consumption of the species to one meal per month. (TDEC 2012.) However, as discussed earlier, PCBs and chlordane are not pollutants expected to be discharged from FHs. More relevant is that seven tributary streams discharging into Boone Reservoir are listed for nitrate + nitrite and/or EC, as shown in Table 3.10-3. Four of these streams currently have a marina located at their mouth where FHs could be added.

3.10.4 South Holston Dam and Reservoir

South Holston Dam is located 50 miles above the South Fork Holston River's confluence with the North Fork Holston River (which forms the Holston River proper). The dam impounds the South Holston Reservoir of 7,550 acres, which extends about 24 miles northeastward across the Tennessee-Virginia stateline. The dam site is situated in an area where the river descends out of the Appalachian Mountains and enters the upper Holston Valley. The Cherokee National Forest surrounds the dam and the Tennessee half of its reservoir, and the Jefferson National Forest surrounds the Virginia half of the reservoir. The reservoir includes parts of Sullivan County in Tennessee and Washington County in Virginia.

South Holston Dam is a multipurpose dam on the South Fork Holston River in Sullivan County, Tennessee. The earth-and-rockfill dam is 285 feet high and reaches 1,600 feet across the South Fork Holston River. South Holston Reservoir has 168 miles of shoreline and a flood-storage capacity of 252,800 acre-feet. In a year with normal rainfall, the water level in South Holston Reservoir varies about 25 feet from summer to winter in order to provide seasonal flood storage.

TDEC classifies the South Fork Holston Reservoir for domestic water supply, industrial water supply, fish and aquatic life, recreation, livestock watering and wildlife, and irrigation. South Holston Reservoir in Sullivan County is listed on the State of Tennessee's Section 303(d) list as impaired due to mercury from atmospheric deposition. The portion of South Holston Reservoir within Tennessee (7,206 acres) in

Sullivan County has a precautionary advisory for largemouth bass because of mercury from atmospheric deposition. (TDEC 2012.) However, as discussed earlier, mercury is not a pollutant expected to be discharged from FHs. More relevant is that several tributary streams discharging into South Holston Reservoir are listed for EC and nutrients from agriculture and MS4 sources. For example, Painter Spring Branch is listed for EC from pasture grazing from South Holston to the state line.

3.10.5 Fort Loudoun Dam and Reservoir
Fort Loudoun Dam (located at TN River Mile 602.5) is a multipurpose main river dam located on the Tennessee River, which provides a navigable waterway from the mouth of the river at Paducah, Kentucky, to the source of the river above Knoxville, Tennessee—some 652 river miles apart. The dam is 122 feet high and stretches 4,190 feet across the Tennessee River. Fort Loudoun Reservoir is fed by releases from TVA's Douglas and Cherokee Lakes in addition to the inflow from a significant local drainage area, which includes portions of the Great Smoky Mountains. Tellico Reservoir on the Little Tennessee River, which is connected to Fort Loudoun Lake via a canal, also contributes inflow to Fort Loudoun Reservoir. Fort Loudoun Reservoir has 379 miles of shoreline and 14,600 acres of water surface. It has a flood-storage capacity of 111,000 acre-feet. To maintain the water depth required for navigation, Fort Loudoun Reservoir is kept at a minimum winter elevation of 807 feet. The typical summer operating elevation is between 812 and 813 feet.

TDEC classifies Fort Loudoun Reservoir for fish and aquatic life, irrigation, livestock watering and wildlife, recreation, and public water supply. Fort Loudoun Reservoir is listed on the State of Tennessee's Section 303(d) list as impaired. All of Fort Loudoun Reservoir (14,600 acres) located in Loudon and Blount Counties is listed for PCBs from contaminated sediment. The Upper Portion is also listed for mercury from atmospheric deposition and contaminated sediment. Additionally, a fish consumption advisory for Fort Loudoun Reservoir is in place due to mercury and PCB contamination, addressing consumption of catfish, largemouth bass over 2 pounds, and largemouth bass from the Little River Embayment. Due to mercury, a precautionary advisory is also in effect for any sized largemouth bass from Highway 129 to the confluence of Holston and French Broad Rivers (534 acres). However, as discussed earlier, PCBs and mercury are not pollutants expected to be discharged from FHs. More relevant is that four tributary streams discharging into Fort Loudoun are listed for nitrate + nitrite and/or EC as listed in Table 3.10-3. The sources are collection system failures and/or MS4 runoff. In addition, the State of Tennessee has issued a bacteriological advisory for the Sinking Creek Embayment of Fort Loudoun Reservoir (1.5 miles from the head of the embayment to the cave) because of impacts from Knoxville urban runoff. (TDEC 2012).

3.11 Ecological Resources
Ecological resources most relevant to the potential impacts of changes in TVA's Floating Houses Policy include terrestrial ecology (vegetation, wildlife, waterfowl, and shorebirds), aquatic resources and ecological health (fish communities, shoreline aquatic habitat, and mussels), and wetlands. Invasive species are also addressed in this section. TVA has published extensive descriptions of these resources in various NEPA documents and reports, including the EISs for the SMI (TVA 1998), ROS (TVA 2004), and NRP (TVA 2011b), in addition to resource-specific reports. These documents are publically available and can be accessed on TVA's website. This section presents only a summary of the available information as it is relevant to the potential impacts of changes in TVA's Floating Houses Policy.

3.11.1 Vegetation, Wildlife, Waterfowl, and Shorebirds
The terrestrial ecology of the Tennessee River Valley is unique in its diversity. Braun (1950) recognized four forest regions in the Valley: oak-chestnut, mixed mesophytic, western mesophytic, and oak-pine. Approximately 60 species of reptiles, 70 species of amphibians, 180 species of breeding birds, and 60 species of mammals occur in these forested regions and other habitats throughout the Valley. The area of the Tennessee River system within 0.25 mile of reservoir shorelines was the focus area for this section because this zone supports several plant and animal communities that depend on, or are otherwise associated with, littoral reservoir and shoreline conditions.

Several habitat types in the Valley, including riparian forests, exposed flats, vernal pools, wetlands, and river islands, are essential to wildlife for foraging, migration, and reproduction. Migrating and resident waterfowl, shorebirds, gulls, and wading birds use these habitats year round. Riparian forests, primarily bottomland hardwoods, have been ranked among the highest priority of areas that provide optimal habitat for wildlife such as Neotropical songbirds (Hunter et al. 1993). Shallow water with emergent vegetation, overhanging banks, exposed sandbars, and rotting wood along the shoreline provide vital nesting and basking habitat for non-game animals such as turtles and snakes. Semi-aquatic mammals, such as muskrat (*Ondatra zibethicus*), beaver (*Castor canadensis*), and river otter (*Lontra canadensis*), also use these habitats for foraging and shelter.

Southern Appalachian forests support some of the richest diversity of birds in North America (Simons et al. 1998). Several animal species associated with upland habitats rely on lowlands for food, refuge, reproduction habitat, and migration routes. Features important to birds and other wildlife that occur in upland habitats include bluffs, caves, and other rock-dominated areas.

Vegetative communities of the Valley can be grouped into two broad categories: lowland and upland. Lowland communities are associated with creeks, streams, rivers, and reservoirs and are most likely to be influenced by changes in reservoir operations. Upland communities include all other communities lacking an aboveground hydrologic connection to a waterbody. These areas are typically situated at or above maximum summer pool levels.

Many plant communities, such as bottomland hardwood forest, scrub/shrub wetlands, and flats (also called mudflats), are widespread in the Valley. Changes in the elevation, duration, and timing of flooding of lowland communities may affect their distribution and species composition. Upland communities may be affected by loss of shoreline from erosion, conversion of land to residential development, and changes in groundwater levels. Wildlife dependent on flats, wetlands, or other lowland community types include a variety of migratory waterfowl, wading birds, shorebirds, songbirds, and other non-game animals—including reptiles, amphibians, and small mammals.

Bottomland hardwood forests occur in floodplains as well as along terraces, natural levees, and back-lying sloughs associated with reservoirs. Representative tree species found in these forests include such species as bald cypress (*Taxodium distichum*), black gum (*Nyssa sylvatica*), black willow (*Salix nigra*), box elder (*Acer negundo*), cottonwood (*Populus deltoides*), and green ash (*Fraxinus pennsylvanica*), among others. Five globally imperiled floodplain forest communities are known from the study area. More detailed information on lowland plant communities can be found in the ROS EIS (http://www.tva.gov/environment/reports/ros_eis/).

Scrub/shrub and herbaceous communities also occur in floodplains, terraces, and other saturated to temporarily-flooded riparian habitats. Representative shrub species found in these forests include such species as black willow, box elder, buttonbush (*Cephalanthus occidentalis*), and green ash. A detailed list of tree and shrub species commonly occurring in these habitats are listed in the ROS EIS. Three globally imperiled riparian plant communities occur in the study area; a globally imperiled herbaceous community (the floodplain pool) potentially occurs in the Blue Ridge Physiographic Region (TVA 2004).

Reservoir flats occur in the drawdown zone between maximum summer and minimum winter pool elevations. These habitats tend to be dominated by plant species capable of completing their life cycle between the start of each annual winter drawdown and frost (Webb et al. 1988; Amundsen 1994). Representative plant species found on TVA reservoir flats include such species as Amazon sprangletop (*Leptochloa panicoides*), blunt spike rush (*Eleocharis obtuse*), Bosc's mille grains (*Oldenlandia boscii*), clustered mille grains (*O. uniflora*), and grassleaf mudplantain (*Heteranthera dubia*)—some of which are essentially restricted to the TVA reservoir flats. No globally imperiled plant communities are known to be associated with reservoir flats in the study area.

The primary stopover habitat provided by TVA's reservoir system is an extensive array of mudflats. These habitats are available at the onset of fall reservoir drawdown through the following April. Mudflats provide a diverse array of microhabitats including a vegetated zone used primarily by waterfowl and to a limited extent, shorebirds. Mud and shallow water zones create a mixture of microhabitats used by shorebirds; many of which have very specialized foraging strategies. These strategies allow shorebird species to feed in close proximity without competing for resources. Mudflat habitats provide critical foraging and resting sites for shorebirds, especially sandpipers (small, long-distance migrants), as they migrate through the interior United States.

During annual reservoir drawdowns, thousands of acres of mudflats are exposed, providing habitat for migrating shorebirds and waterfowl (TVA 2004; Smith 2006; Laux 2008; Wirwa 2009). As mudflats are exposed, a complex community of invertebrates develops in moist soils along the receding reservoir edge, creating an important source of food for shorebirds and waterfowl (Skagen and Knopf 1994; Laux 2008; Wirwa 2009). As the drawdown continues, plant communities develop on upper portions of mudflats, providing an important source of food and cover for waterfowl during fall and winter months.

Mudflat communities are first colonized by least spike-rush (*Eleocharis acicularis*) a major component in some mudflat area that are drier (Henry 2012). This vegetation develops into a thick "carpet." The species propagates by rhizomes and/or seeds, and is adapted to the fluctuating water levels experienced on the mudflats. Seeds and stems of least spike-rush are important food for waterfowl and mammals. Least spike-rush provides habitat for amphibians and fish (when flooded) and helps to stabilize mudflat surfaces. Intermediate sites were dominated by lowland toothcup (*Rotala ramosior*), scarlet ammannia (*Ammannia coccinea*), three- lobed beggarticks (*Bidens tripartita*), chufa flatsedge *(Cyperus esculentus*), teal lovegrass (*Eragrostis hypnoides*), and marsh seedbox (*Ludwigia palustris*). On the driest sites, common water-willow (*Justicia americana),* marsh aster (*Symphyotrichum lanceolatum)*, and alligator-weed (*Alternanthera philoxeroides*) form such dense stands that very little sunlight reaches the sediment surface (Henry 2012).

TVA's reservoir system continues to provide a diversity of habitat for shorebirds and waterfowl. In a recent 5-year study, more than 129,000 shorebirds, representing 37 species, were observed in and around the reservoirs and tailwaters of the Tennessee River Valley (Henry 2012). This level of diversity exceeds those reported from other interior regions in the United States. The majority of shorebirds were observed on Kentucky, Wheeler, Douglas and Chickamauga Reservoirs. Kentucky and Douglas Reservoirs provide the highest quality habitats. Chickamauga and Wheeler Reservoirs provide benefits for birds overwintering in the region; however, several historical shorebird aggregation sites on these reservoirs are no longer available due to prior changes in reservoir operations (Henry 2012).

Shorebirds typically begin migrating through the Tennessee River Valley in late July. Exposure of mudflats during August is important for several shorebird species of concern. As feeding during migration is critical to shorebird survival, conservation of habitats is a priority management objective (Brown et al. 2001). Waterfowl resources are diverse in the Valley. Peak waterfowl abundance occurs during November; several daily surveys exceeded 5,000 birds on nine mudflats (Wirwa 2009). Whereas most reservoirs provide habitat for either early or late migrants, only Kentucky and Douglas Reservoirs provide important habitats throughout fall migration. Timing and rate of drawdown of TVA reservoirs significantly influence suitability of habitat for waterbirds by affecting mudflat exposure, vegetation establishment, seed production, and invertebrate availability (Wirwa 2009).

Most upland plant communities within 0.25 mile of reservoir shorelines are hardwood forest communities. Reservoir levels sufficiently influence adjacent groundwater to affect some upland plant communities near reservoirs. Evergreen forests occupy relatively small areas within 0.25 mile of the reservoirs in the system, and a substantial amount of this forestland type has been converted. Glades and barrens are upland habitats that have been, in some cases, flooded or encroached on by reservoirs. Two globally imperiled wetland plant communities associated with glades are known to occur in the study area, and a third could occur in the study area (TVA 2004). Seepage areas associated with rock shelters or bluffs also support uncommon plant communities. Three globally imperiled wetland plant communities are known to occur in association with such habitats in portions of the study area. For more detailed information on the upland plant communities see the ROS (TVA 2004).

3.11.2 Aquatic Resources and Ecological Health

Aquatic resources occurring in the TVA region are important from local, national, and global perspectives. Tennessee has approximately 319 fish species, including native and introduced species, and 129 freshwater mussels. The Tennessee-Cumberland Rivers have the highest number of endemic fish, mussel, and crayfish species in North America (Schiling and Williams 2002). This is the most diverse temperate freshwater ecosystem in the world. In reservoirs, largemouth bass (*Micropterus salmoides*), crappie (*Poxomis spp.*), and striped bass (*Morone saxatalis*) are highly sought game species. Trout provide popular tailwater fisheries below tributary cold-water discharge dams; sauger (*Sander canadensis*), white bass (*Morone chrysops*), striped bass, and catfish (*Ictaluridae*) fisheries occur below tributary and mainstream warm-water discharge dams.

The nine mainstem reservoirs on the Tennessee River differ from tributary reservoirs primarily in that they are typically more shallow, have higher flows, and thus retain the water in the reservoir for a shorter period. They generally do not become as strongly stratified as tributary reservoirs. Although DO in the lower reservoir levels is often reduced, it is seldom depleted. Because winter drawdowns on mainstem reservoirs are much less severe than on tributaries, bottom habitats generally remain wetted all year. This benefits benthic organisms but promotes the growth of aquatic plants in the extensive shallow overbank areas of some reservoirs. Tennessee River mainstem reservoirs generally support healthy fish communities, ranging from about 50 to 90 species per reservoir. Good to excellent sport fisheries exist, primarily for black bass, crappie, sauger, white and striped bass, sunfish, and catfish. The primary commercial species are channel and blue catfish and buffalo.

TVA conducts regular ecological monitoring of reservoirs and tailwater fauna using indices based on all of these biological components. TVA monitors the health of its reservoirs, as part of the VSMP. TVA initiated this program in 1990. Reservoirs throughout the Tennessee Valley have been monitored for physical and chemical characteristics of waters, 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 (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 (TVA 2014).

The overall health ratings of TVA reservoirs are based on five ecological indicators:

- Dissolved oxygen. A good rating means enough oxygen is dissolved in the water to support a healthy population of fish and other aquatic life. Oxygen is as important to aquatic life as it is to life on land.

- Chlorophyll. Chlorophyll is a measure of the amount of algae in the water. A good rating means that algal growth is within the expected range. If algae levels are too low, the reservoir’s food web can be affected. If levels are too high, water treatment costs may increase, and oxygen supplies in the bottom layer of water may be depleted by decaying algae. Algal growth depends primarily on the amounts of nitrogen, phosphorus, and other nutrients in the water.

- Fish. A good rating means a large number and variety of healthy fish.

- Bottom life. A good rating means that a variety of animals live on the reservoir bottom (worms, insects, and snails, for example).

- Sediment. A good rating means that the reservoir bottom is free of pesticides and PCBs, and that metals concentrations are within expected background levels.

When monitoring ecological conditions at each reservoir, TVA takes samples from up to four locations, depending on the reservoir's size. These sites are classified as:

- Forebay. The deep, still water near a dam.
- Mid-reservoir. The middle part of a reservoir, where a transition occurs from a river-like environment to a reservoir-like environment.
- Embayment. A very large slough or cove. (TVA monitors only four embayments: Hiwassee River on Chickamauga Reservoir, Big Sandy River on Kentucky, Bear Creek on Pickwick, and Elk River on Wheeler.)
- Inflow. The river-like area at the extreme upper end of a reservoir.

Table 3.11-1 identifies 13 reservoirs with an estimated high probability of future increases in the number of FHs. In descending order by current number of FHs/NNs, they are Norris, Fontana, Boone, South Holston, Fort Loudoun, Kentucky, Watauga, Nickajack, Chickamauga, Guntersville, Pickwick, Watts Bar, and Wheeler Reservoirs. They are listed in Table 3.11-1 with their reservoir type and usual ecological health rating.

Table 3.11-1. Reservoirs with a High Potential for Increasing Numbers of Floating Houses, Reservoir Type, Ecological Health, and Whether MSD Discharges are Allowed

Reservoir	Estimated Current Number of Floating Houses and Nonnavigable Houseboats	Reservoir Type	Ecological Health Rating [a]	MSD Discharge Allowed?
Norris	921	Tributary	Fair	No
Fontana	357	Tributary	Fair	No
Boone	133	Tributary	Poor	No
South Holston	117	Tributary	Fair	Yes
Fort Loudoun	100	Mainstem	Fair	Yes
Kentucky	55	Mainstem	Good	Yes
Watauga	37	Tributary	Fair	No
Nickajack	30	Mainstem	Good	Yes
Chickamauga	20	Mainstem	Good	Yes
Guntersville	12	Mainstem	Good	Yes
Pickwick	2	Mainstem	Good	Yes
Watts Bar	2	Mainstem	Fair	Yes
Wheeler	0	Mainstem	Fair	Yes

MSD = marine sanitation device

[a] Based on reservoir data from 1994 to 2014.

Five reservoirs have an estimated 100 or more FHs/NNs, and a high expectation of future increases in FHs: Norris, Fontana, Boone, South Holston, and Fort Loudoun (Table 3.11-1). Four of these five reservoirs are tributary reservoirs (Norris, Fontana, Boone, and South Holston). Tributary reservoirs are characterized by long retention times and substantial winter drawdowns. Fort Loudoun is a run-of-the-river (mainstem) reservoir and is characterized by short retention times and little drawdown. The long retention times of the tributary reservoirs make them much more sensitive to nutrients and organic pollution (Baker 2003). The usual ecological health ratings for the five reservoirs with 100 or more FHs/NNs are all fair, except for Boone, which had a poor rating.

The estimates for current numbers of FHs/NNs on the other eight reservoirs with a high probability of increasing numbers of FHs are much smaller than on the high five reservoirs, ranging from 55 on Kentucky Reservoir down to none on Pickwick, Watts Bar, and Wheeler. These eight reservoirs have ecological health ratings of fair to good. Of these eight reservoirs, only Watauga is a tributary reservoir (Blue Ridge Ecoregion) (Baker 2003) and is listed as a No Discharge reservoir. The other seven reservoirs are run-of-the-river or mainstem reservoirs (Baker 2003). The shorter retention time in the mainstem reservoirs probably contributes to their fair to good ecological health ratings. Discharges from Type I and Type II MSDs on boats are allowed on these seven mainstem reservoirs.

Table 3.11-2 identifies an additional 11 reservoirs with an estimated moderate probability of future increases in the number of FHs. Most of these reservoirs do not currently have any FHs/NNs; however, Blue Ridge Reservoir has 12, Fort Patrick Henry Reservoir has 6, and Hiwassee Reservoir has 30. Of the 11 reservoirs with moderate probability for future increases in FHs, 8 are tributary reservoirs and 3 are run-of-the-river or mainstem reservoirs. All three mainstem reservoirs have fair ecological health ratings, which is again probably partially due to their shorter retention times. Blue Ridge and Chatuge Reservoirs had good and fair ecological health ratings, respectively, but the other eight tributary reservoirs all had poor ecological health ratings. The poor ratings may be attributed to the longer retention times. Discharges from Type I and Type II MSDs on boats are allowed on the three mainstem reservoirs (Melton Hill, Tellico, and Wilson).

Table 3.11-2. Additional Reservoirs with a Moderate Potential for Increasing Numbers of Floating Houses, Reservoir Type, and Ecological Health Rating

Reservoir	Estimated Current Number of Floating Houses and Nonnavigable Houseboats	Reservoir Type	Ecological Health Rating[a]
Blue Ridge	12	Tributary	Good
Chatuge	0	Tributary	Fair
Cherokee	2	Tributary	Poor
Douglas	0	Tributary	Poor
Fort Patrick Henry	6	Tributary	Poor
Hiwassee	30	Tributary	Fair
Melton Hill	0	Main stem	Fair
Nottely	0	Tributary	Poor
Tellico	0	Main Stem	Fair
Tims Ford	0	Tributary	Poor
Wilson	0	Main Stem	Fair

[a] Based on reservoir data from 1994 to 2014.

Other causes for poor ratings could be trends in watershed development or weather patterns, which influence streamflow. The VSMP has determined that changes in overall reservoir health ratings from year to year are often attributable to weather, particularly the amount of rain received in a reservoir's watershed.

As noted in Section 3.10, those reservoirs with an estimated 100 or more FHs/NNs with a high probability of increases in those numbers have the greatest potential to be affected by the various alternatives.

3.11.2.1 Norris Dam and Reservoir

TVA monitors three locations on Norris Reservoir—the deep, still water near the dam, called the "forebay," and two locations in the middle part of the reservoir—usually on a 2-year cycle. The ecological health of Norris Reservoir rated fair in 2011, as it has since 1994.

Table 3.11-3 shows the ratings for individual ecological health indicators at Norris Reservoir in 2011. These ratings are briefly explained in the paragraphs that follow.

Table 3.11-3. Ecological Health Indicators at Norris Reservoir (2011)

Monitoring Location	Dissolved Oxygen	Chlorophyll	Fish	Bottom Life	Sediment
Forebay	Poor	Good	Fair	Fair	Fair
Mid-reservoir, Clinch	Poor	Good	Good	Fair	Fair
Mid-reservoir, Powell	Poor	Good	Good	Good	Fair

Dissolved oxygen: The most significant ecological health issue on Norris is low DO concentrations. Dissolved oxygen rates poor at all three monitoring locations because the lower half of the water column contains little oxygen (less than 2 milligrams per liter [mg/L]) during the summer. This issue is mostly the result of the reservoir's basic characteristics. Norris is a deep tributary storage reservoir with a long summer retention time; it can take more than 200 days for water to move through the reservoir. As the summer sun heats the surface of the reservoir, a warmer layer of water forms on top of a cooler layer. The layers do not mix, so the bottom layer becomes devoid of oxygen as decaying plants and other materials that settle to the bottom use up the oxygen. TVA has installed equipment to add oxygen to the water as it is flows through Norris Dam.

Chlorophyll: In most years, chlorophyll rates good at all three monitoring locations..

Fish: The fish community received good ratings at both mid-reservoir monitoring locations and a "high fair" rating at the forebay. Monitoring typically shows good species diversity and balanced population characteristics at the mid-reservoir locations. The forebay has rated fair each year monitored due largely to the collection of fewer fish species than expected.

Bottom life: Bottom life rates good at the Powell mid-reservoir location and fair at the forebay and Clinch mid-reservoir locations. Bottom life typically rates poor or fair at the forebay and fair or at the lower end of the good range at the mid-reservoir sites.

Sediment: Sediment quality rates fair at all three monitoring locations. Low PCB levels were detected in the sediment samples at each location, and arsenic concentrations were above suggested background levels at the forebay and Powell mid-reservoir locations. The forebay sediments typically have elevated arsenic and lead concentrations. Lows levels of chlordane, a pesticide previously used to control termites and crop pests, have been detected in the sediments at each site in some previous years.

3.11.2.2 Fontana Dam and Reservoir

TVA monitors three locations on Fontana Reservoir—the deep, still forebay near the dam and two locations in the middle part of the reservoir—usually on a 2-year cycle. Since 1994, Fontana Reservoir has on average received fair to good ratings. Fontana Reservoir rated fair in 2010, a similar rating to previous years in which the full complement of indicators was measured. Bottom life usually rates poor on Fontana.

Table 3.11-4 shows the ratings for individual ecological health indicators at Fontana Reservoir in 2010. These ratings are briefly explained in the paragraphs that follow.

Table 3.11-4. Ecological Health Indicators at Fontana Reservoir (2010)

Monitoring Location	Dissolved Oxygen	Chrlorophyll	Fish	Bottom Life	Sediment
Forebay	Good	Good	Good	Poor	Good
Mid-reservoir: Little Tennessee River arm	Fair	Good	Good	Poor	Fair
Mid-reservoir: Tuskasegee River arm	Poor	Fair	Good	Poor	Good

Dissolved oxygen: Dissolved oxygen rated good at the forebay and fair at the Little Tennessee mid-reservoir location because a small area along the reservoir bottom contained low DO concentrations (< 2 mg/L) in late summer. A greater area of water with low DO was present at the Tuckasegee location and resulted in a poor rating. In previous years, DO has rated good or fair at the forebay and Little Tennessee mid-reservoir locations and fair or poor at the Tuckasegee location. However, the area with low DO was substantially smaller at the Tuckasegee location in 2004 than in other years, resulting in the only good rating for DO at this location. Fontana is a deeper reservoir than Norris, and the low DO values in Fontana are likely caused by the depth as well as the long summer retention time. TVA has installed equipment to add oxygen to the water as it is flows through Fontana Dam.

Chlorophyll: Chlorophyll rated good at the forebay and Little Tennessee mid-reservoir monitoring locations and fair at the Tuckasegee location. Chlorophyll has rated good at the forebay in all years monitored. Chlorophyll ratings have fluctuated between good, fair, and poor at the Little Tennessee mid-reservoir location, with no specific trend over time. At the Tuckasegee mid-reservoir location, chlorophyll received good ratings during the early 1990s but has fluctuated between fair and poor ratings since 1995.

Fish: The fish community rated good at all monitoring locations. The fish community has rated fair or good at these locations in previous years.

Bottom life: Bottom life rated poor at all monitoring locations. Bottom life has rated poor or at the low end of the fair range at these locations in past years because relatively few organisms, primarily those capable of tolerating poor conditions, have been collected from the reservoir bottom.

Sediment: Sediment quality rated good at the forebay and Tuckasegee mid-reservoir locations because no PCBs or pesticides were detected and all metal concentrations were within the expected range. Copper exceeded expected background levels at the Little Tennessee mid-reservoir location, resulting in a fair rating. In 2008, chromium exceeded suggested background concentrations at this location, but neither copper nor chromium has been above background levels in other monitoring years. Historically, sediment ratings have fluctuated between good and fair at all locations depending on whether chlordane was detected. The pesticide chlordane was last detected in the reservoir sediments in 2002 and only at the Tuckasegee monitoring location.

3.11.2.3 Boone Dam and Reservoir

TVA monitors three locations on Boone Reservoir—the deep, still water forebay near the dam and two mid-reservoir locations—usually on a 2-year cycle.

Table 3.11-5 shows the ratings for individual ecological health indicators at Boone Reservoir in 2011. These ratings are briefly explained in the paragraphs that follow.

Table 3.11-5. Ecological Health Indicators at Boone Reservoir (2011)

Monitoring Location	Dissolved Oxygen	Chlorophyll	Fish	Bottom Life	Sediment
Forebay	Poor	Poor	Fair	Fair	Fair
Mid-reservoir (South Holston)	Poor	Poor	Fair	Fair	Fair
Mid-reservoir (Watauga River)	Good	Poor	Fair	Fair	Fair

Dissolved oxygen: Dissolved oxygen rated poor at the forebay and South Fork Holston River mid-reservoir monitoring locations and good at the Watauga River mid-reservoir location. Dissolved oxygen concentrations have varied considerably from year to year and from site to site. Weather conditions and the related changes in reservoir flows are the major factor in these differences. TVA has installed equipment to add oxygen to the water as it is flows through Boone Dam. Because deeper water is more prone to stratification with accompanying lower DO during the summer months, the current lower water levels that TVA is maintaining as it investigates the Boone Dam leakage could result in higher DO levels during summer.

Chlorophyll: Chlorophyll concentrations were elevated at all monitoring locations, rating poor. High chlorophyll concentrations are a common problem on Boone Reservoir, typically rating poor or at the low end of the fair range. If TVA maintains lower than normal water levels, the reduction in the retention time in Boone Reservoir may reduce chlorophyll concentrations.

Fish: As in previous years, the fish community rated fair at all three monitoring locations. TVA did not collect as many species as expected and found relatively few intolerant species (species known to require good water quality conditions). As stated above, lower water levels may increase summer DO, which could improve the fish community.

Bottom life: Bottom life rated fair at all monitoring locations. Most of the animals collected were species able to tolerate poor water quality conditions. For all locations, bottom life typically rates poor or at the low end of the fair range. As stated above, lower water levels may increase summer DO, which could improve the bottom life.

Sediment: Sediment quality rated fair at all monitoring locations. PCBs were detected at all sites. The arsenic concentration was slightly above suggested background levels in the forebay, and the chromium concentration was slightly elevated at the South Holston River mid-reservoir site. Problems with metals and organic contaminants have persisted over the years. Chlordane and PCBs have been present in the sediments at all monitoring locations, and elevated copper and sometimes zinc levels have been present at the Watauga River mid-reservoir site. These metals (arsenic, chromium, copper, and zinc) naturally occur in soils but can also originate from many sources. Their concentrations in sediments deposited in the reservoir are generally near—slightly above or below—suggested background concentrations.

Because deeper water is more prone to stratification with accompanying lower DO during the summer months, the lower water levels that TVA is currently maintaining as it investigates the Boone Dam leakage may improve ecological health.

3.11.2.4 South Holston Dam and Reservoir

The overall ecological condition in South Holston Reservoir rated fair in 2012. Historically, ecological health ratings have fluctuated within the poor and low-to-mid-fair range. In all years monitored, low ratings for two indicators—DO and bottom life—consistently reduced the reservoir's overall health score. In 2012 and other years in which South Holston rated fair, several indicators scored at the upper end of their historical ranges.

TVA monitors two locations on South Holston Reservoir—the forebay near the dam and the middle part of the reservoir. Monitoring is usually conducted on a 2-year cycle.

Table 3.11-6 shows the ratings for individual ecological health indicators at South Holston Reservoir in 2012. These ratings are briefly explained in the paragraphs that follow.

Table 3.11-6. Ecological Health Indicators at South Holston Reservoir (2012)

Monitoring Location	Dissolved Oxygen	Chlorophyll	Fish	Bottom Life	Sediment
Forebay	Poor	Good	Fair	Fair	Good
Mid-reservoir	Poor	Fair	Fair	Poor	Good

Dissolved oxygen: As in previous years, DO rated poor at both monitoring locations. Both locations experienced low DO concentrations (<2 mg/L) in the lower half of the water column during summer. TVA has installed equipment to add oxygen to the water as it is flows through South Holston Dam.

Chlorophyll: Chlorophyll rated good at the forebay but fair at the mid-reservoir because concentrations were slightly elevated. Chlorophyll has rated good at the forebay in all years except 1994, when it rated at the upper end of the fair range. Chlorophyll ratings have varied between good, fair, and poor at the mid-reservoir location.

Fish: The fish community rated at the upper end of the fair range at both monitoring locations. Species diversity and catch rates were slightly lower than expected. Over time, the fish assemblage has consistently rated good or a “high fair” at both locations.

Bottom life: Ratings for bottom life were “low fair” at the forebay and poor at the mid-reservoir. Bottom life at the forebay was slightly more abundant, but at both locations, the species collected were those able to tolerate poor conditions. Bottom life typically rates poor at the mid-reservoir and poor or at the low end of the fair range at the forebay.

Sediment: Sediment quality rated good at both monitoring locations. No PCBs or pesticides were detected, and all metal concentrations were within the expected range. Historically, sediment ratings have fluctuated between good and fair at both locations dependent on whether chlordane was detected. The pesticide chlordane was last detected in the sediments of South Holston Reservoir in 2002. Sediment quality also rated fair at the forebay in 2008 because the arsenic concentration was slightly above expected background levels.

3.11.2.5 Fort Loudoun Dam and Reservoir

TVA monitors three locations on Fort Loudoun Reservoir—the forebay of the dam; the middle part of the reservoir; and the river-like area at the extreme upper end of a reservoir, called the "inflow." Fort Loudoun Reservoir was monitored annually from 1994 through 2007. During this period, the reservoir has on average received poor ratings. In 2008, TVA began monitoring Fort Loudoun every other year. (Most TVA reservoirs are monitored every other year.)

The ecological health condition of Fort Loudoun Reservoir rated fair in 2011. Conditions were similar to most previous years. Low ratings for three indicators—chlorophyll, bottom life, and sediment quality—typically reduce the reservoir’s overall health score. In addition, DO has rated poor in some years.

Table 3.11-7 shows the ratings for individual ecological health indicators at Fort Loudoun Reservoir in 2011 (however, several indicators at the inflow location were not measured at the time). These ratings are briefly explained in the paragraphs that follow.

Table 3.11-7. Ecological Health Indicators at Fort Loudoun Reservoir (2011)

Monitoring Location	Dissolved Oxygen	Chlorophyll	Fish	Bottom Life	Sediment
Forebay	Fair	Poor	Fair	Poor	Fair
Mid-reservoir	Good	Poor	Fair	Fair	Fair
Inflow	ND	ND	Fair	Poor	ND

ND = No data

Dissolved oxygen: Dissolved oxygen rated fair at the forebay and good at the mid-reservoir monitoring location. This indicator usually rates good at the mid-reservoir location, but ratings have varied between good, fair, and poor at the forebay, generally in response to reservoir flow conditions. TVA has installed aeration equipment to add oxygen to the deep water above Fort Loudoun Dam and to improve conditions immediately downstream.

Chlorophyll: Average summer chlorophyll concentrations were high at both monitoring locations, resulting in poor ratings. High chlorophyll concentrations are a consistent issue on Fort Loudoun, rating poor at both sites in most previous years.

Fish: The fish assemblage rated “high fair” at all three monitoring locations. The variety of fish collected at each location was good, but catch rates were slightly lower than desired and composition was dominated by a few species such as gizzard shad, bluegill, and largemouth bass. The fish community typically scores good or at the upper end of the fair range at the forebay and mid-reservoir, while scores at the inflow have generally fluctuated within the fair range.

Bottom life: Similar to previous years, bottom life rated poor at the forebay and inflow monitoring locations and fair at the mid-reservoir location. Relatively few organisms are usually collected from the forebay and inflow locations, and those collected are primarily species capable of tolerating poor conditions. Bottom life at the mid-reservoir location typically rates fair due to greater diversity, which includes a better representation of intolerant species such as mayflies.

Sediment: Sediment quality rated fair at both the forebay and mid-reservoir monitoring locations because PCBs were detected. Sediment quality typically rates fair at both locations due to chlordane, PCBs, and/or zinc exceeding suggested limits.

In addition to the 5 reservoirs described in detail above, Table 3.11-8 lists the average reservoir ecological health scores of the 24 potentially affected reservoirs for the period from 1994 to 2014.

Reservoir aquatic communities were primarily characterized using the Reservoir Fish Assemblage Index and the reservoir benthic community index of TVA. Both indices are components of the VSMP.

The VSMP rates environmental conditions in reservoirs using a fish and benthic Index of Biological Integrity (IBI) (Dycus and Meinert 1991). TVA also monitors sport fish populations using the Sport Fishing Index (SFI), which incorporates the status of population quantity and quality along with available angler catch information. Within a reservoir, the SFI scores are used to monitor positive or negative trends in population status, relative to fishing experience (Hickman 2000).

TVA also has implemented a variety of programs to improve conditions for aquatic resources. TVA implemented the Reservoir Releases Improvement (RRI) Program to improve water quality and aquatic habitat in tributary tailwaters by providing minimum flows and increasing DO concentration (see Section 4.4, Water Quality). TVA’s commitment to established minimum flows and minimum DO concentrations in tailwaters would not be changed among project alternatives. Another TVA activity attempts to stabilize reservoir levels for a 2-week period when water temperatures reach 65 °F at a depth of 5 feet. Stabilizing reservoir levels aids fish spawning success. This fish spawning operation minimizes water level fluctuations during the peak spawning period to avoid more than a 1-foot-per-week change (either lowering or rising) in pool levels. This program will be adjusted beginning in spring 2004 to stabilize levels at 60 °F in order to better include crappie, smallmouth bass, and early largemouth and spotted bass spawning. TVA also operates certain hydropower operations in a manner that provides important flow levels for spring spawning grounds of certain fishes. For example, prescribed spring flows are provided downstream of Watts Bar Reservoir to enhance sauger spawning.

Table 3.11-8. Average Ecological Health Ratings of Potentially Affected Reservoirs (1994–2014)

Reservoir	Average Rating Score	Average Ecological Health Rating[a]
Tims Ford	51	Poor
Bear Creek	52	Poor
Cherokee	53	Poor
Nottely	53	Poor
Normandy	54	Poor
Tellico	56	Poor
Douglas	57	Poor
Chatuge	59	Poor
Wilson	61	Fair
Fort Patrick Henry	62	Fair
Watts Bar	62	Fair
Little Bear Creek	63	Fair
Cedar Creek	65	Fair
Hiwassee	65	Fair
Wheeler	66	Fair
Melton Hill	66	Fair
(Parksville) Ocoee No. 1	68	Fair
Pickwick	72	Good
Watauga	73	Good
Kentucky	73	Good
Guntersville	78	Good
Chickamauga	80	Good
Blue Ridge	84	Good
Nickajack	86	Good

[a] Ratings below 60 are considered Poor; ratings between 60 and 69 are considered Fair; and ratings above 70 are considered Good.

3.11.3 Freshwater Mussels

Of the approximate 500 species that compose the entire freshwater mussel fauna of the world, over 130 species have been found in Tennessee. The Tennessee River system is home to approximately 100 species of freshwater mussels, many of which are endemic to the watershed. Most of the current diversity is concentrated in the upper Tennessee Basin, with 85 mussel species (http://www.tva.gov/rrsc/readingroom/biodiversityrec.htm). Of the species that are native to Tennessee, 11 are presumed extinct, and 38 others are federally listed as threatened or endangered by USFWS.

Much of the formerly prime mussel habitat, especially in the Tennessee and Cumberland River basins, was lost after the construction of dams; and many mussel populations have been reduced or extirpated due to fragmentation of riverine habitats. Remaining mussel species and populations are highly dependent on the physical habitat, water quality, and flow conditions; and most species prefer or require flowing water with clean substrates and good water quality to survive and reproduce. In general, mussel diversity and abundance is greatest in the remaining free-flow sections of river, followed by flowing warm-water tailwaters. Mussel habitat is reduced in reservoirs, as most sensitive mussel species are riverine-dependent and do not tolerate standing water and sedimentation with the exceptions of some mussel species adapted to these conditions.

Compared to pre-impoundment conditions, the status of freshwater mussel populations in the mainstem Tennessee River and its reservoirs is greatly reduced in terms of diversity and abundance (TVA 2004). The status of individual populations varies by species. Previously mentioned water quality impairments and loss of necessary fish hosts (needed to complete the life cycle) have also contributed to the decline of mussel populations (TVA 2004). In tributary reservoirs, mussel communities are strongly affected by seasonal thermal stratification and resulting low DO concentration, and by large water level fluctuations. The potential occurrence of mussels in marina areas is rather limited for the reasons stated above, and where the two do occur together, the mussel species would likely be a more tolerant species adapted to a wide range of aquatic habitats.

3.11.4 Invasive Species

Changes in the reservoir operations policy may affect population abundance and spread of invasive terrestrial and aquatic animals and terrestrial plants. Changes in land use can influence the abundance and spread of both invasive terrestrial animals and plants. Changes in water quality, elevation, and flow can influence the abundance and spread of invasive aquatic animal species.

The invasive terrestrial and aquatic animals and terrestrial plants with the potential to occur in the Valley were determined based on discussions with TVA staff; the list of priority invasive species identified by TVA; and other federal and state invasive species lists—including state invasive plant lists from Exotic Pest Plant Councils for Tennessee, Kentucky, and North Carolina. Only terrestrial plant species within the Valley categorized as “severe threat” on any available state invasive plant lists were evaluated. The invasive aquatic animals considered in this document are being tracked as invasive nuisances in the Valley. Invasive aqauatic plants are present in some reservoirs and represent a nuisance, for example hydrilla (*Hydrilla verticillata)* in Guntersville reservoir. Other aquatic plant species that may be in TVA reservoirs include parrot feather (*Myriophyllum aquaticum)*, Brazilian elodea (*Egeria densa)*, and water hyacinth (*Eichhornia crassipes)*.

3.11.4.1 Invasive Terrestrial Animals and Plants

Seven invasive terrestrial animal species that pose a serious threat to terrestrial communities in the TVA reservoir system would be potentially affected by the alternatives. They include the Asian tiger mosquito (*Aedes albopictus*), known as a potential transmitter of various diseases of humans and domestic animals; nutria (*Myocastor coypus*), a large semi-aquatic rodent; and birds—including the European starling (*Sturnus vulgaris),* house sparrow *(Passer domesticus),* rock dove *(Columba livia),* house finch *(Caropodacus mexicanus*), and Eurasian collared dove (*Streptopelia decaocto*)—that compete with native birds for food and nesting resources.

Of the 19 invasive terrestrial plants identified as priority species for TVA, the most problematic species are common privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), Japanese knotweed (*Polygonum cuspidatum*), and Nepal grass (*Microstegium vimineum*) (TVA 2004). These plants compete with native species, and their abundance has been linked to the decline of several native plant species. Areas that contain protected plants or uncommon community types are of particular concern.

3.11.4.2 Invasive Aquatic Animals

Seven invasive aquatic animal species pose a serious threat to aquatic communities in the TVA reservoir system: common carp (*Cyprinus carpio*), grass carp (*Ctenopharyndogon idella*), alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), rusty crayfish (*Orconectes rusticus*), Asiatic clam (*Corbicula fluminea*), and zebra mussel (*Dreissena polymorpha*). The Asiatic clam and zebra mussel are the most problematic of these species in the Tennessee River system, because these two species adhere to raw water intake systems at power plants and city water supplies.

By far, the invasive aquatic species of greatest concern is the zebra mussel. Zebra mussels were first found about 25 years ago found in the Tennessee River just upstream from Kentucky Dam, and the spread of zebra mussels has continued. In places where large numbers of zebra mussels occur, lakefront property owners have been plagued by encrusted dock pilings and ladders, as well as sharp, foul-smelling shells littering beaches and shorelines. Boaters have experienced problems with increased drag and poor motor performance—the result of a buildup of mussels on hulls and internal engine parts. Intake pipes at water treatment and power plants have become clogged. Zebra mussels can form living blankets on the river and reservoir bottom, killing native mussels and reducing food supplies for young fish and other aquatic life.

3.11.4.3 Regulatory Programs and TVA Management Activities for Invasive Species

EO 13112—Invasive Species requires federal agencies to (1) prevent the introduction of invasive species; (2) detect and respond rapidly to control populations of such species in a cost-effective and environmentally sound manner; (3) monitor invasive species populations accurately and reliably; and (4) provide for restoration of native species and habitat conditions in ecosystems that have been invaded. Consistent with this order, this EIS has considered the effects of the Floating Houses Policy alternatives on invasive species.

TVA conducts a variety of ongoing management activities to control invasive terrestrial plants and aquatic animals. Through its Natural Areas Management Program, TVA has actively managed invasive terrestrial plants on lands known to contain rare plants or uncommon plant communities. Historically, invasive terrestrial plants were controlled mainly by hand removal, with limited herbicide application. Hand removal is still used, but herbicides are used to a greater extent now because more is known about this approach and more effective herbicides are available. Fire suppression occasionally is used, although recent forest fires have limited this option.

For invasive aquatic animals, TVA conducts an active program to monitor the populations of Asiatic clams and zebra mussels at power projects. When required, TVA uses chemical and warm-water treatments to control Asiatic clams and zebra mussels at generating facilities. TVA has considerable ongoing management of invasive aquatic plants in Gunterville Reservoir. TVA does not conduct management activities associated with the other invasive aquatic species.

3.11.5 Wetlands

Wetlands are highly productive and biologically diverse ecosystems that provide multiple public benefits such as flood control, reservoir shoreline stabilization, improved water quality, and habitat for fish and wildlife resources. "Wetlands" are defined as those areas inundated by surface or ground water with a frequency sufficient to support a prevalence of vegetation or aquatic life that requires saturated or seasonably saturated soil conditions for growth and reproduction (TVA 1980). The presence of wetlands across the TVA region varies greatly. Wetland areas are typically located along shorelines of reservoirs, streams, and rivers, and along bottomland transitional areas. Many wetland areas resulted from the creation of the TVA reservoirs and have become transitional areas separating the terrestrial ecosystem from the aquatic ecosystem.

Potentially affected wetlands occur on flats between summer and winter pool elevations, on islands, along reservoir shorelines, in dewatering areas, in floodplains, on river terraces, along connecting rivers and streams, around springs and seeps, in natural depressions, in areas dammed by beaver, in and around constructed reservoirs and ponds (diked and/or excavated), and in additional areas that are isolated from other surface waters. In general, vegetated wetlands occur with greater frequency and size along the mainstem reservoirs and tailwaters than along the tributary reservoirs and tailwaters. This is due in part to the larger sized watersheds of mainstem reservoirs resulting in a greater volume of water; greater predictability of the annual hydrologic regime; shoreline and drawdown zone topography (wider and flatter floodplains, riparian zones, and drawdown zones and large areas of shallow water); and larger areas of relatively still, shallow-water areas. Wetlands tend to be smaller and do not occur as frequently on tributary reservoirs because of the relatively steep drawdown zones, the rolling to steep topography of adjacent lands, shoreline disturbance caused by wave action, and the lower predictability and shorter duration of summer pool levels.

Table 3.11-9 shows the total wetland acreage for reservoirs in the study area, the wetland acreage of thos reservoirs within 0.25 mile of a marina, and the percentage of total wetland acreage that wetlands within 0.25 mile of a marina represents.

The potentially affected wetland types include the following:

- Aquatic beds—submersed areas supporting aquatic vegetation.
- Seasonally exposed flats—areas of non-persistently vegetated and non-vegetated mudflats, as well as flats of other natural and artificial substrate types such as mixtures of sand, silt, cobble, and gravel.
- Emergent wetlands—areas of low-growing marshes and wet meadows.
- Scrub/shrub wetlands—areas with shrubs and or saplings.
- Forested wetlands—swamp and bottomland areas with hardwood and other wetland tree species.
- Ponds—areas of constructed ponds, beaver ponds, and other naturally occurring ponds and seasonal pools.

Descriptions and lists of the commonly occurring vegetation species in these wetlands can be found in TVA (2012). Almost half (47 percent) of the wetlands associated with the TVA reservoir system are classified as forested wetlands, approximately 20 percent are aquatic beds and flats, approximately 16 percent are ponds, approximately 8 percent are emergent wetlands, and approximately 9 percent are scrub/shrub (TVA 2012). When aquatic beds are exposed, they function as flats; likewise, while flats are submersed, they sometimes develop aquatic bed vegetation.

3.11.5.1 Wetlands Analysis Zones and Acreage Calculations

A combination of field verification and geographic information system (GIS) analysis of National Wetlands Inventory (NWI) digital data for TVA reservoirs was used to determine wetland types. Wetland types were then classified into three different zones. Wetland acreages were stratified by the following zones:

- Zone 1 – area from winter pool to normal summer pool elevation
- Zone 2 – area from normal summer pool elevation to maximum shoreline contour
- Zone 3 – area from maximum shoreline contour to 0.25-mile inland

Table 3.11-9. Wetland Acreage by Reservoir and Shoreline Wetland Areas within 0.25 Mile of Existing Marinas

Reservoirs with Marinas or Potential for Marinas	Number of Existing Marinas (private and commercial)	Total Wetland Acreage [a]	Wetland Acreage within 0.25 Mile of a Marina	Wetland Acreage within 0.25 Mile of a Marina as a Percentage of Total Wetland Acreage (%)
Kentucky	61	43,592	274.2	0.6
Wilson [b]	5	3,906	29.7	0.8
Norris	24	506	23.0	4.5
Guntersville	19	15,606	15.8	0.1
Chatuge	4	668	12.2	1.8
Pickwick	7	5,279	8.8	0.2
Cherokee	11	3,223	7.4	0.2
Fort Loudoun [b]	10	498	3.5	0.7
Tellico	4	680	2.9	0.4
Chickamauga	14	6,940	2.6	0.0
South Holston	6	59	2.3	3.9
Fontana	6	63	2.2	3.5
Watauga	7	784	2.0	0.3
Blue Ridge	1	8	1.1	13.8
Melton Hill	1	390	1.0	0.3
Boone	7	56	0.9	1.6
Douglas	10	4,750	0.7	0.0
Nottely	1	4,551	0.5	0.0
Hiwassee	4	166	0.3	0.2
Nickajack [b]	3	3,405	0.0	0.0
Tims Ford	1	730	0.0	0.0
Fort Patrick Henry	1	45	0.0	0.0
Wheeler [b]	5	20,160	0.0	0.0
Watts Bar	13	1,051	0.0	0.0
Parksville (Ocoee 1)	1	122	0.0	0.0
Little Bear	0	348	0.0	0.0
Cedar Creek	0	1,793	0.0	0.0
Bear Creek	0	271	0.0	0.0
Normandy	0	237	No marinas	0.0

[a] Total acreage represents five types of wetlands: combined aquatic beds and flats; emergent; ponds; forested; and scrub/shrub.
[b] Data from Section 7.7 of the *Natural Resource Plan* (TVA 2011a).

As shown in Table 3.11-9, several wetland areas are within or immediately adjacent to existing marinas. These wetland areas represent valuable habitat for aquatic species as well as terrestrial wildlife. Forested wetlands have been the most heavily disturbed on private land throughout the TVA region over the last 50 years. The presence of wetlands on or adjacent to TVA reservoirs is likely related to the development status of the shoreline. The mainstem reservoirs are more likely to have a greater shoreline area with wetlands than are the tributary reservoirs that experience greater changes in water elevations.

3.12 Threatened and Endangered Species

Information presented in Section 3.11, Ecological Resources indicates that a wide variety of aquatic and terrestrial animal and plant species occur across the Tennessee River Valley and in the TVA reservoir system. The southern Appalachian Mountain region is a major center of diversity for many types of plants and animals. Much of the original biological diversity in this region was originally associated with the wide variety of forest, grassland, and stream habitats that occurred here prior to human habitation.

By the 1920s, virtually all of the land in the land in the Valley had been "developed" in one way or another, and development of the river system proceeded with the completion of the mainstem Tennessee River reservoirs by about 1945 and the completion of tributary reservoirs by about 1980. All of the various human-induced changes in the landscape and streams in this region were intended to improve the lives of the people who lived in the Valley. At the same time, however, many of those changes also degraded the habitats for a majority of the non-human species that existed in the region. This section focuses on the surviving native species that are not thriving in the modified Tennessee Valley region—the species that are considered to be endangered, threatened, or of special concern in this region.

The present status of many protected species, especially aquatic and other water-dependent species, occurring in the Tennessee Valley region is closely tied to habitat conditions along the reservoirs and regulated stream reaches. Changes in the ways the dams are operated have also resulted in a variety of effects on those species, as has shoreline development and the use of the reservoirs for recreation, industry, water supply, power generation, and other human uses.

3.12.1 Regulatory and TVA Management Activities

The federal ESA directs the USFWS to establish national lists of animals and plants that meet identified criteria for endangered or threatened species status. Laws in each of the Valley states direct or encourage wildlife resource or conservation agencies to establish similar state lists of species that meet endangered, threatened, or various levels of special-concern criteria. In each case, the intent of placing species on the lists is to recognize their risk of extinction and to focus attention on ways to help those species survive and recover at least part of their former abundance. Some states also have established legal penalties for actions that would negatively affect species on their protected lists.

Under the ESA, federal agencies are required to consider the potential effects of their proposed actions on species federally listed as endangered and threatened, and on areas designated as critical habitats for those species. In addition, NEPA requires federal agencies to consider the potential effects of proposed actions on the human environment, including rare and protected species. TVA, along with each of the seven Valley states, maintains copies of the lists of species that are federally and state-listed as endangered, threatened, or otherwise protected. TVA also keeps track of where those species have been encountered in the region. This occurrence information is routinely stored in a Natural Heritage database, where a common format and compatible storage systems facilitate sharing data among agencies. For the 201-county area included in the TVA Power Service Area, the TVA Natural Heritage database includes occurrence information on approximately 2,200 federally and state-protected species.

The federal and state protection requirements, accompanied by considerable public interest in at least some rare species, have resulted in a wide variety of monitoring and management activities focused on endangered and other protected species. Recovery plans prepared for each species on the federal endangered or threatened species lists describe monitoring and management activities that would lead to the enhancement and eventual recovery of each animal or plant.

Federal agencies, state agencies, and other interested groups have modified habitats to improve conditions for protected species, and have augmented or reintroduced protected species populations with individuals produced in the laboratory or relocated from other areas. TVA has conducted or participated in many enhancement and management activities focused on protected species, including distribution and monitoring surveys, establishment and protection of natural areas, habitat improvement projects, and restocking programs. In particular, TVA's RRI Program has enhanced aquatic habitats in several regulated stream reaches to the point that native populations have increased and some protected aquatic species have been reintroduced.

3.12.2 Occurrence Patterns

The study area for the policy alternatives includes the 29 reservoirs with existing FHs, the reservoirs with an existing marina, and reservoirs with a reasonable potential to support commercial marinas in the future. The most extensive review and summary of the occurrence of species that are considered to be endangered, threatened, or of special concern in this region was completed in the ROS EIS (TVA 2004), the results of which are used below to characterize the existing patterns of diversity and habitat use. The analysis in the environmental consequences section (Section 4.12) focuses on species listed as endangered, threatened, or of special concern that are known to occur near existing marinas. The analysis uses the results of a search on the most up-to-date records, representing the addition of several species since the ROS analysis in 2004.

In the ROS analysis, TVA identified the 81 counties in the TVA region and its reservoirs, and then used the Natural Heritage database to identify the protected species that occur (or once occurred) in those counties (TVA 2004). The initial list was reviewed to identify protected species likely to still occur with the potential to be affected. For most animal groups, this review typically included species that have been encountered alive within a 1-mile buffer around any affected waterbody during the last 30 years (since the early 1970s). With regard to plants, the potential for protected species to survive unnoticed for years suggested that all records from the 1-mile buffers should be included regardless of how old those records might be. With regard to wide-ranging protected birds and bats (such as the bald eagle and gray bat), the 1-mile outer boundary was not useful, but records dating from the early 1970s were included because present distribution patterns of those species are fairly well known. The result of this review for the ROS EIS is a list of 526 threatened, endangered, or special concern (TES) species that are considered in this evaluation. The names and listing status of these species are presented in Appendix D6a of the ROS EIS which is available publically and online at http://www.tva.gov/environment/reports/ros_eis/.

The ROS analysis (TVA 2004) found that plants make up the majority of species on the list, about 59 percent of the total (311 of the 526 species), and the 66 fishes and 63 mollusks (each about 12 percent of the total) far outnumber the other animal groups. The 59 animals and plants protected as federal endangered, threatened, or identified candidate species comprise just over 11 percent of the total.

Examining 1-mile buffers around the waterbodies serves as a conservative way to identify any federally or state-protected species that might be affected directly or indirectly by near shoreline activities. Many of the species reported from the 1-mile buffers around the waterbodies, however, are not known to occur in the water or on the land immediately adjacent to the reservoirs or regulated stream reaches.

TVA biologists also reviewed the site-specific information about these records in the Natural Heritage database to determine whether each species had been found in the waterbodies or within much more narrow (200-foot-wide) buffers around them (TVA 2004). Within these narrow buffers, plants still make up a majority of the protected species (72 of the 172 species, almost 42 percent of the total), and mollusks and fish (53 and 29 species, 31 and 17 percent of the total, respectively) still far outnumber the other animal groups. The 37 federally endangered, threatened, or identified candidate species known from the immediate vicinity of the waterbodies constitute 22 percent of the total.

The overall effect of focusing on the 200-foot buffers instead of the 1-mile buffer widths was an increased emphasis on mollusks and fish, and decreased emphasis on plants, arthropods, and other groups or species not as closely associated with aquatic habitats.

TVA also evaluated the occurrence of species in 13 broad habitat types, representing a wide range of very wet to very dry conditions, included specifically because each was important to one or more protected species included in the 2004 evaluation. As indicated in Table 3.12-1, within a 200-foot buffer of these habitats, small rivers and large creeks (61 species) become the most typical habitats supporting protected species (both about 36 percent), followed by ponds and riparian areas (35 species, 20 percent), non-forested wetlands (27 species, 16 percent), and moist woodlands (20 species, 12 percent). (All of these numbers add up to more than 100 percent of the totals because some species typically occur in more than one habitat type.)

Finally, TVA also developed a waterbody classification identifying eight types of waterbodies, ranging from pooled mainstem reaches to warm tributary tailwaters. The eight categories reflect several important differences among the waterbodies, including physiographic relationships, whether the reaches are pooled or flowing, and predominant thermal characteristics. Table 3.12-2 presents a summary of the occurrence information for the five taxonomic groups of protected species associated with the waterbodies (mollusks, fish, amphibians, reptiles, and birds), sorted by waterbody categories. Plants, arthropods, and mammals are excluded from this table because most species in those taxonomic groups are not distributed based on stream-related habitat characteristics—the characteristics used to establish the waterbody categories.

Within a 200-foot buffer of the eight waterbody types, the largest number of protected species occur in or along warm tributary tailwaters (51 of 94 species, 54 percent of the total), followed by flowing mainstem reaches (48 species, 51 percent), pooled mainstem reaches (33 species, 35 percent), and cool-to-warm tributary tailwaters (21 species, 22 percent).

Considered together, the information presented in Tables 3.12-1 and 3.12-2 leads to two general conclusions about the occurrence of protected species as it relates to the evaluation of the policy alternatives. Most protected species known from within or immediately adjacent to the water bodies where activities could take place typically occur in aquatic habitats along the least modified stream habitats (warm tributary tailwaters, flowing mainstem reaches, some pooled mainstem reaches, and cool-to-warm tributary tailwaters). Very few protected species occur in or adjacent to any tributary reservoir, in cold/cool tributary tailwaters, or in the drier terrestrial habitats that exist within 200 feet of any water body. These observations indicate that warm tributary tailwaters, flowing mainstem reaches, and some pooled mainstem reaches and cool-to-warm tributary tailwaters are the waterbody categories where any effects of the policy alternatives on protected species would be most likely to occur.

3.13 Floodplains

A "floodplain" is the relatively level land area along a stream or river that is subjected to periodic flooding. The area subject to a 1-percent annual chance of flooding (a 100-year flood) in any given year is normally called the 100-year floodplain. As a federal agency, TVA is required to evaluate proposed development in the 100-year floodplain to ensure that the project is consistent with the requirements of EO 11988, Floodplain Management. For certain Critical Actions, the minimum floodplain of concern is the area subject to inundation from a 0.2-percent annual chance (a 500-year flood). "Critical Actions" are those for which even a slight chance of flooding would be too great.

Currently for the Tennessee River reservoirs (Fort Loudoun, Watts Bar, Chickamauga, Nickajack, Guntersville, Wheeler, Wilson, Pickwick and Kentucky), the TVA Flood Risk Profile (FRP) elevations consist of the established 500-year flood elevations that have been adjusted for surcharge where appropriate. For the tributary reservoirs, the FRP elevations consist of the established 500-year flood elevations. The FRP (or 500-year flood elevation on tributary reservoirs) has been used since 1993 to evaluate flood-damageable development and possible displacement of flood control storage on and along TVA reservoirs.

Table 3.12-1. Habitat Preferences of TES Species Identified in the 2004 Reservations Operation Study

Habitat Type	Numbers of Species within Major Taxonomic Groups								1-Mile Buffer	200-Foot Buffer
	Plants	Mollusks	Arthropods	Fish	Amphibians	Reptiles	Birds	Mammals		
Big rivers	7 (6)	38 (38)	0 (0)	13 (9)	1 (1)	4 (2)	11 (5)	1 (1)	75	62
Small rivers and large creeks	0 (0)	47 (40)	1 (0)	45 (18)	1 (1)	4 (2)	0 (0)	0 (0)	98	61
Small creeks	0 (0)	12 (5)	2 (0)	33 (8)	5 (1)	1 (0)	0 (0)	0 (0)	53	14
Underground aquifers	0 (0)	0 (0)	5 (1)	2 (2)	1 (0)	0 (0)	0 (0)	0 (0)	8	3
Ponds and riparian areas along creeks	56 (26)	0 (0)	0 (0)	0 (0)	14 (2)	4 (1)	11 (4)	8 (2)	93	35
Gravel bars or boulders in large creeks or rivers	8 (4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)	0 (0)	10	6
Nonforested seeps, wetlands, or wet meadows	56 (25)	0 (0)	0 (0)	0 (0)	1 (0)	2 (0)	8 (2)	2 (0)	69	27
Forested seeps or wetlands	38 (12)	0 (0)	0 (0)	0 (0)	10 (1)	1 (1)	1 (1)	3 (0)	53	15
Moist woodlands	113 (16)	1 (0)	0 (0)	0 (0)	3 (0)	1 (0)	2 (1)	11 (3)	131	20
Xeric hardwood or coniferous forests, or mountain woods	42 (2)	0 (0)	0 (0)	0 (0)	0 (0)	5 (0)	3 (0)	2 (1)	52	3
Prairies, fields, roadsides, fencerows, or early successional woodlands	40 (1)	0 (0)	0 (0)	0 (0)	1 (0)	3 (0)	1 (1)	2 (0)	47	2

	Numbers of Species within Major Taxonomic Groups									
Habitat Type	**Plants**	**Mollusks**	**Arthropods**	**Fish**	**Amphibians**	**Reptiles**	**Birds**	**Mammals**	**1-Mile Buffer**	**200-Foot Buffer**
Limestone, sandstone, or granite outcrops (including cedar glades)	32 (2)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	33	2
Caves, sinkholes, rock houses, boulders, bluffs, and cliff faces	56 (10)	0 (0)	8 (0)	0 (0)	6 (0)	0 (0)	3 (0)	8 (4)	81	14
Total species in 1-mile buffers	311	63	15	66	18	14	23	16	526	
Total species in 200-foot buffers	72	53	1	29	2	3	8	4		172

Notes:
"TES species" includes species listed as endangered, threatened, or of special concern. Numbers of species are shown within a 1-mile buffer of water bodies and a 200-foot buffer (shown in parentheses).
Entries in the columns are not additive because some species occur in more than one habitat type.
Sources: TVA Natural Heritage database and TVA (2004).

Table 3.12-2. Known Occurrences of TES Species around Eight Waterbody Categories

Waterbody Category	Numbers of Species within Major Taxonomic Groups					1-Mile Buffer		200-Foot Buffer	
	Mollusks	Fish	Amphibians	Reptiles	Birds	Number	Percent	Number	Percent
Flowing mainstem reaches	36 (36)	14 (8)	4 (1)	4 (0)	8 (3)	66	35.9	48	51.1
Pooled mainstem reaches	18 (15)	29 (8)	10 (2)	12 (3)	17 (5)	86	46.7	33	35.1
Blue Ridge-type reservoirs	6 (1)	13 (1)	2 (1)	0 (0)	1 (0)	22	12.0	3	3.2
Ridge and Valley-type reservoirs	4 (0)	5 (0)	1 (1)	1 (0)	3 (1)	14	7.6	2	2.1
Interior Plateau-type reservoirs	3 (0)	7 (2)	2 (0)	0 (0)	3 (1)	15	8.1	3	3.2
Cool/cold tributary tailwaters	5 (5)	4 (1)	1 (0)	1 (0)	1 (0)	12	6.5	6	6.4
Cool-to-warm tributary tailwaters	11 (10)	19 (9)	3 (1)	0 (0)	1 (1)	34	18.5	21	22.3
Warm tributary tailwaters	32 (30)	29 (18)	8 (1)	6 (1)	2 (1)	77	41.8	51	54.2
Total species in 1-mile buffers	63	66	18	14	23	184			
Total species in 200-foot buffers	53	29	2	3	8			95	
Percent of 1-mile totals in 200-foot buffers	84.1	43.9	11.1	21.4	28.6			51.6	

Notes:
"TES species" includes species listed as endangered, threatened, or of special concern. Numbers of species are shown within a 1-mile buffer of water bodies and a 200-foot buffer (shown in parentheses).
Entries in the columns are not additive because some species occur in more than one category.
Source: TVA (2004).

This page intentionally left blank

Determining flood flows and resultant flood levels involves uncertainty because many factors can affect flood elevations, especially on a reservoir system. Estimates must consider urbanization that can affect inflows into the system, historical flood data, changes in streambed elevations, changes in reservoir operating policies, gate reliability, and other factors that tend to increase flood elevations. In addition, floods larger than the 500-year flood can, and do, occur.

Floodplains provide and support many natural and beneficial functions of considerable economic, social, and environmental value. Floodplains are discussed in detail in the following sections of this EIS: Recreation, Visual Resources, Water Quality, Ecological Resources, Terrestrial Habitats, Aquatic Habitats, Wetlands, and Threatened and Endangered Species.

This page intentionally left blank

CHAPTER 4 – ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

Chapter 4 addresses the direct, indirect, and cumulative environmental impacts of the six alternatives as they affect the 12 resource areas. This chapter is organized by resource area and provides the scientific, analytical, and technical basis for assessing the impacts on those resources. Measurement indicators were developed to gauge the effects of the alternatives on each resource.

4.1.1 Projected Number of Floating Houses and Nonnavigable Houseboats by Alternative

To complete the environmental analysis, TVA needed to estimate the future number of FHs/NNs under each of the alternatives. These estimates are uncertain and were used only to illustrate the potential magnitudes of positive and negative impacts. TVA has data for 16 reservoirs for 2011 and data for Norris Lake for several years: 1997, 2006, and 2011. Another 13 reservoirs have marinas or could have a marina in the future but did not have known FHs or NNs in 2011.

No Action Alternative

To estimate the potential number of FHs/NNs in the future under the No Action Alternative, TVA assumed the following:

- The 13 reservoirs that did not have known FHs/NNs in 2011 would have FHs by 2021.
- In all of the 29 potentially affected reservoirs, the rate of increase (linear trend) in the total number of FHs/NNs would follow that observed at Norris Lake from 1997 to 2011.

The linear trend was used to predict the rate of increase in FHs on reservoirs that currently have FHs/NNs. The estimated relationship was then used to predict the number of FHs at reservoirs where FHs/NNs do not currently exist. The regression equation was also used along with reservoir-specific factors (e.g, the size of the reservoir, the number of marinas) to estimate the future number of FHs at reservoirs currently without FHs/NNs. The results are presented in Appendix D.

The projected number of FHs/NNs under the No Action Alternative and the action alternatives is shown in Table 4.1-1. Under the No Action Alternative, the number of FHs on the 29 reservoirs would increase from the current 1,836 to 2,365 in the year 2021 and to 3,692 in the year 2045. The projections of increases in FHs for the individual reservoirs are provided in Appendix D.

Table 4.1-1. Projected Number of Floating Houses/ Nonnavigable Houseboats by Alternative

Yearc	Alternative					
	No Action	A	B1	B2	C	D
Current	1,836	1,836	1,836	1,836	1,836	1,836
2021	2,365	1,906	1,377	1,377	918	1,337
2045	3,692	3,233	1,377	0	918	2,016

Action Alternatives

TVA then used the details of the action alternatives (described in Section 2.1), the estimated background rate of increase in FHs, and certain assumptions to estimate the potential number of structures at the 29 reservoirs for the action alternatives. The summary results are shown in Table 4.1-1, and the projections for the individual reservoirs are provided in Appendix D. The details for each action alternative are described briefly below.

No data are available on the number of existing FHs/NNs that would be removed under Alternative A. For the purposes of illustrating the potential socioeconomic impacts, TVA assumed that 25 percent of existing FHs/NNs would initially be removed. After the initial removal of noncompliant structures, new FHs meeting the updated standards would be allowed. TVA assumed that the overall trend in the increasing number of FHs would be similar to that under the No Action Alternative.

Under Alternative B1, as in Alternative A, TVA assumed that 25 percent of the existing FHs/NNs would not be able to meet the new standards and requirements and would be removed. Because new FHs would not be permitted under Alternative B1, TVA assumed that the number of FHs/NNs would remain constant after the initial decline.

TVA assumed that 25 percent of existing FHs/NNs would be removed under Alternative B2. No new FHs would be permitted; therefore, the number of FHs/NNs would remain constant for a 30-year period. Under Alternative B2, TVA would require the removal of all FHs and NNs within 30 years. It was assumed that there would be zero FHs/NNs by 2045.

Under Alternative C, only the existing NNs with a valid permit would be grandfathered. All FHs would be removed, and no new FHs would be allowed. The number of remaining NNs was assumed to remain constant if compliant with a valid permit.

Alternative D would require more enforcement of existing regulations on FHs. For purposes of this analysis, the TVA assumed that 25 percent of FHs that do not comply with the regulations would be modified to meet the navigable houseboat criteria under current regulations. This would allow the modified FHs to remain and new structures to be built (meeting current criteria) at the same rate assumed under the No Action Alternative, except for Norris Reservoir.

Summary

The largest predicted increase in the number of FHs would occur under the No Action Alternative (Table 4.1-1). Alternative A would result in the second highest increase in the number of FHs on TVA reservoirs over a 30-year period. The largest predicted decrease in the number of FHs/NNs would occur under Alternative B2 at the end of the 30-year period. Under Alternative C, permitted NNs would be allowed and all existing FHs would be removed from TVA reservoirs within 18 months, with no further reduction over the 30-year period. Under Alternative B1, approximately 25 percent of the existing FHs/NNs would be removed within the first 18 months, with no further reduction over the remainder of the 30-year period.

These numbers may overstate the actual change in FHs/NNs for several reasons. First, economic theory suggests that the rate of growth will slow as the aggregate supply (the total number of FHs/NNs available for purchase or rent) approaches the aggregate quantity demanded (the total number that consumers are willing to purchase or rent given market prices). Second, the trend at Norris Reservoir, which has the most FHs/NNs of any TVA reservoir, may not be representative of other reservoirs. Third, the 13 reservoirs that currently do not have FHs may not develop FHs/NNs.

However, the numbers may understate the actual change for several reasons. The trend used to forecast into the future overlaps the economic downturn in the late 2000s. If the economy improves, then the number of FHs could increase more rapidly than this trend would suggest. Competition and innovation among builders may result in lower construction costs compared to current conditions, which would stimulate faster growth than the above trend line represents.

Considering all available information, TVA believes that the above process of estimating FHs is reasonable for the purposes of illustrating the potential magnitudes of socioeconomic impacts of the various policy alternatives in this EIS. The reader is cautioned to interpret these results while recognizing that a high level of uncertainty exists.

4.1.2 Cumulative Impact Background

A cumulative impact results from the incremental or collective effect of the action when combined with other past, present, and reasonably foreseeable future actions (CEQ Regulations, Section 1508.7). This section sets the background for the cumulative impacts of the Floating Homes Policy alternatives together with other reasonably foreseeable actions, and the potential cumulative impacts are described for each resource area below.

In this chapter, cumulative effects are examined within the Tennessee Valley Watershed over the next 30 years in the context of gradually increasing population, land development, and shoreline development. When determining the potential direct, indirect, and cumulative impacts on the environment, all programs and activities described in Chapters 1 through 4 were taken into consideration. Because of the 30-year time frame for the EIS, and the broad geographic scope of the evaluation, predicting future resource conditions involves substantial uncertainty.

In recent years, TVA has made key policy decisions in the Shoreline Management Policy and NRP that, through their implementation, will affect the reasonably foreseeable future actions and future trends in the Tennessee Valley Watershed. The Shoreline Management Policy is based on the SMI and EIS completed in 1999, by which TVA, with public input, examined its system for granting permits for docks and other shoreline development. The Shoreline Management Policy established a Valley-wide policy to improve the protection of shoreline and aquatic resources while allowing reasonable access to the water. The Shoreline Management Policy is a composite of standards for vegetation management, docks, shoreline stabilization, and other residential shoreline alterations on 30 TVA reservoirs.

The NRP was developed by TVA and finalized in 2011 to guide its natural resource stewardship efforts, including management of biological, cultural, and water resources; recreation; reservoir lands planning; and public engagement. The NRP analyzed TVA's current activities, goals for improving current programs and beginning new programs, and the benefits associated with the implementation of programs in each of the six resource areas addressed. Implementation of the NRP resource management programs will be staged over a 20-year period (TVA 2011a).

The EISs that were completed during development of the Shoreline Management Policy and the NRP included cumulative impact analyses that are particularly relevant to the Floating Homes Policy and this EIS. Both of the EISs included information on past, present, and reasonably foreseeable environmental conditions; that information is used herein as a partial basis for the cumulative impact analysis.

4.1.3 Future Conditions and Trends

Past and present activities in the TVA region have resulted in a region shaped, in part, by TVA's actions to improve navigation, reduce flood damage, provide for the proper use of marginal lands, support industrial development, and provide affordable power—all for the general purpose of fostering the physical, economic, and social development of the region (TVA 2011a). In addition to TVA land, land within the TVA region is owned and managed by private individuals, non-governmental organizations (e.g., The Nature Conservancy), and state and federal agencies. Similar to TVA, the US Forest Service and National Park Service manage land in the region, with goals for conservation, public access, and recreational opportunities. Future cumulative impacts can result not only from foreseeable actions of TVA but also from those of other agencies and the public.

The existing conditions of the TVA region are described in Chapter 3. The TVA region covers a total of 76,738 square miles, with 44,783 square miles extending outside the Valley watershed. TVA reservoir lands total approximately 293,000 acres (458 square miles) and encompass parts of the seven Valley states. In addition, TVA manages approximately 9,100 acres of land at its power facilities throughout the region. Historically, TVA has made approximately 485,300 acres of land available for resource conservation purposes, including recreational developments (TVA 2011a). Today, TVA manages between 5 and 10 percent of the recreation facilities in the region. Approximately 6 percent of TVA reservoir lands are developed, 12 percent are pasture or cropland, and 81 percent are forested.

In the NRP EIS, TVA described the following general trends that are anticipated over the next two decades:

- Increasing human population
- Increasing proportion of residents in metropolitan areas
- Increasing demand for public recreation opportunities associated with population growth
- Increasing development of natural habitat in rural and suburban areas

Foreseeable future actions in the TVA region have been described in long-range and regional planning documents such as the ROS EIS (TVA 2004), TVA's NRP (TVA 2011a), and the NRP EIS (TVA 2011b). Other future activities generally include the following:

- TVA's maintaining compliance with applicable laws, regulations, guidance, and policies designed to reduce impacts on sensitive biological and cultural resources.
- Continued development of shoreline properties in private ownership.
- State agency efforts to conserve natural resources and provide dispersed and developed recreation opportunities in state parks, gamelands, and state forests.
- State agency efforts to reduce regional impacts on water quality through the total maximum daily load, water quality certifications, and other programs.
- Federal agency conservation and recreation efforts with a trend toward improving biodiversity, recreation, and less timber harvest.
- Regional coalitions producing conservation plans geared toward reducing impacts on water and forest resources. An example of this type of effort is the Cumberland Habitat Conservation Plan (http://www.cumberlandhcp.org/about.html).
- Local efforts generated by various levels of governmental and nongovernmental agencies. For example, the Southeast Watershed Forum is working with local city and county leaders, resource organizations, and TWRA staff to integrate comprehensive plans with preserving priority habitat and shaping growth away from natural areas. Other local efforts can be found at http://wcs.conservationregistry.org/.

These future conditions and trends are part of the reasonably foreseeable future actions for the cumulative impacts analysis. Together with future TVA management programs described above and in Chapter 1, they also describe management activities that would in some cases reduce the potential for impacts for any selected policy alternative.

4.2 Socioeconomics and Environmental Justice

This section discusses how the current and alternative management policies being considered by TVA are expected to affect different socioeconomic groups in the region surrounding TVA reservoirs. The potential effects discussed below are expectations that follow from the basic economic theories of supply and demand and substitution in consumption.

The relevant expectations from the theory of supply and demand can be summarized as follows. In a reasonably competitive market,

- An increase in demand for a good will lead to a higher market price.
- A decrease in demand for a good will lead to lower market price.
- An increase in supply of a good will lead to a lower market price.
- A decrease in supply of a good will lead to a higher market price.

- An increase in market price will reduce the quantity demanded of a good.
- A decrease in market price will lead to an increase in the quantity demanded of a good.

Some of the management alternatives being considered by TVA would limit or reduce the potential number of FHs/NNs. The expected effects are then considered as a decrease in supply. Some alternatives would create new requirements that might raise the costs of constructing or maintaining FHs/NNs. The expected effects are then considered as an increase in price.

The theory of substitution in consumption extends supply and demand to related goods. It posits that changes in the market for one good will affect the demand for similar goods. For example, if the price of Brand A of soda rises, then the quantity demanded of Brand A will fall (from the theory of supply and demand) and the demand for Brand B will increase (from the theory of substitution in consumption). This is relevant for this analysis because there are two likely economic substitutes for FHs/NNs: commercially built navigable houseboats and shoreline property. Because of substitution in consumption, changes in the FH market may result in changes in these two markets.

While the expected direction of changes in demand, supply, or prices can be reasonably determined based on the above theories, the *absolute* magnitudes of such changes (i.e., measuring the effects in dollars) cannot be determined without additional information describing the quantitative relationship between supply and demand for the different markets. However, the potential *relative* magnitudes can be based on theory (i.e., that larger disruptions in the market will lead to larger changes in demand, supply, and price). These relative magnitudes are discussed in this EIS.

It should also be noted that the significance of potential effects depends on the scale of consideration. An effect that may be very significant for an individual homeowner or business may be insignificant or even undetectable at a county or regional level. As discussed below, the effects of some of the alternatives being considered in this EIS would affect relatively small groups of people; these are the types of impacts that would be diluted in regional analyses. Therefore, this discussion focuses on potential effects to individuals or groups rather than effects to the broader economy.

The discussion characterizes individuals as being “better off” or “worse off” under one alternative compared to other alternatives or to current conditions. “Current conditions” as used in this socioeconomics section refers to the conditions that are present in 2015.

The next subsections describe the socioeconomic groups potentially affected by the alternatives, the socioeconomic impact indicators that were used to characterize the nature and potential magnitudes of the impacts, and the expected effects.

4.2.1 Socioeconomic Groups Potentially Affected

The alternatives TVA is considering may affect the number, location, and design of FHs/NNs. Different socioeconomic groups may be affected by the alternatives in different ways. TVA has identified the following socioeconomic groups as the most likely to be affected by the alternatives. This section presents a summary of the groups and how each might be generally affected.

4.2.1.1 Owners of Floating Houses and Nonnavigable Houseboats

The owners of the existing 1,836 FHs/NNs could be affected by the alternatives in several ways. Some alternatives would require some owners to remove their structures, which would lead to the owner's loss of use and enjoyment of the structure, would lead to loss of equity and potential rental income, and would impose costs on the owners to remove the structures. Comments from FH/NN owners received during scoping process stressed that their enjoyment goes beyond mere recreation; they consider their FHs/NNs to be crucial in creating family memories and part of their legacy to pass down to future generations.

Some alternatives would require existing owners to modify or relocate FHs/NNs to meet new standards, which would result in costs to the owners. Comments from owners noted that the costs could be substantial and would be difficult for bear for some owners, particularly those who are retired or are on fixed incomes.

Some alternatives may positively or negatively affect the market values of current FHs/NNs. Some alternatives would limit the future extent of the market, which could affect potential future owners in addition to current owners.

4.2.1.2 Renters of Floating Houses

Alternatives that allow growth of the FH market are expected to result in more choices and lower rental prices, both of which would generally benefit renters. Conversely, alternatives that restrict growth of the FH market would generally negatively affect renters.

4.2.1.3 Marinas

As discussed in Section 3.2, FHs/NNs generate several streams of revenue for marinas, accounting for approximately $16 million of revenue throughout the study area. Some alternatives would change the number of FHs/NNs located at marinas and therefore would affect marina revenue and employment. Comments from marinas received during the scoping process indicated concern over reductions in revenue, potential bankruptcy, and associated effects on the ability for marinas to secure loans. In general, alternatives that would result in more FHs located at marinas would provide the most benefits (i.e., revenue) for marinas.

4.2.1.4 Other Directly Associated Businesses

Businesses directly associated with FHs/NNs other than marinas include construction and maintenance services, such as waste pump-out. These types of businesses would generally benefit from alternatives that allow additional FHs. Some alternatives would require removal of FHs/NNs. These alternatives would benefit demolition and solid waste hauling businesses.

4.2.1.5 Indirectly Associated Businesses

Some public comments expressed concern with potential negative effects of alternate management policies on local businesses and the economy. Some businesses are not directly associated with FHs/NNs but are indirectly affected by changes in expenditures made by owners and renters of FHs/NNs. Expenditures made by owners and renters include local goods and services such as retail goods, fuel, food and drink, entertainment, and others. Revenue accruing to these businesses would be affected if the alternatives change the number of FHs/NNs. In general, these businesses would benefit from alternatives that allow continued increases in the number of FHs.

4.2.1.6 Shoreline Property Owners

Most shoreline property owners are, in general, negatively affected by FHs/NNs. Comments from current shoreline property owners received during scoping indicated several concerns. First, the comments noted that unpermitted FHs in some locations have resulted in reduced enjoyment of shoreline property through negative impacts on aesthetics such as noise, visual impacts, and waste discharge. Shoreline property owners were also concerned about safety issues and negative effects on the environment. These impacts are most likely to occur when FHs or NNs are located outside of approved marina harbor limits and in areas that otherwise would not have structures on or near the water (for example, in an otherwise quiet cove away from commercial development or highways). In addition, these impacts are expected to be more severe near poorly-built, dilapidated, or abandoned FHs/NNs.

Some owners expressed concern about the potential impacts of FHs/NNs on shoreline property value. If the effects noted above are severe enough, these factors could lead to a reduction in shoreline property market values near these structures. In addition, shoreline property is likely an economic substitute for FHs. Therefore, increases in the number of FHs may tend to lower shoreline property market values. For the reasons above, alternatives that limit FHs will tend to benefit shoreline property owners compared to alternatives that do not limit FHs.

4.2.1.7 Recreational Users

As discussed in Section 3.2, comments received during the public scoping process raised several concerns about the negative impacts of FHs/NNs on recreation. Commenters noted that FHs/NNs in some locations can result in negative aesthetic impacts such as noise and visual impacts that reduce the quality of recreational experiences. As with shoreline property owners, this type of impact is most likely to be substantial near FHs/NNs that are located outside of approved marina harbor limits and in areas that would otherwise not have permanent structures.

In addition, commenters noted that, in some locations, FHs/NNs prevent or restrict recreational activities. This type of impact is likely to be most severe when structures are clustered together outside of approved marina harbor limits. In addition, several commenters noted that, in some locations, FHs/NNs have placed wires across coves in order to block recreational access.

Finally, FHs/NNs located at marinas use space that otherwise might be used by recreational boaters. The additional demand for marina space that would result from policies that allow more FHs would potentially drive up the cost of acquiring space in or using marinas. For these reasons, alternatives that restrict FHs/NNs would generally benefit recreational users.

4.2.1.8 General Public

Members of the general public not included in the above categories may also be affected by FHs/NNs due to the effects on ecological resources and services. Ecological resources provide services that benefit the general public. As discussed in other sections, alternatives that restrict FHs/NNs may improve ecological resources and services or may prevent their deterioration. Therefore, alternatives that limit FHs/NNs are expected to benefit members of the general public, and alternatives that allow additional FHs are expected to negatively affect members of the general public. The potential magnitude of these effects depends on the degree of resource changes; relatively small changes in resources would yield relatively small benefits to members of the general public.

The general public is also negatively affected when unpermitted FHs result in unauthorized appropriation of public resources as private property without appropriate compensation. Several public commenters expressed frustration that some unpermitted FHs located outside of marina harbor limits are using public resources without having to pay appropriate compensation.

4.2.2 Indicators of Potential Socioeconomic Impacts

This policy review relies on several quantitative indicators to illustrate the potential magnitudes of positive and negative socioeconomic impacts on the included socioeconomic groups. These indicators are based on the best information currently available to TVA. The available data are limited. Therefore, the reader should recognize that the estimated changes in indicators have a high degree of uncertainty. TVA has concluded that inclusion of these indicators provides a more thorough picture of the potential positive and negative socioeconomic impacts of the alternatives than would a purely qualitative analysis. The current conditions for the indicators are described in Section 3.2 and include the following:

- The current market value of the existing FH/NN inventory
- The value of the FH/NN rental market
- Levels of marina revenue and employment that are attributable to FHs/NNs
- Number of FHs/NNs not associated with marinas

4.2.3 No Action Alternative – Current Management

Tables 4.2-1 through 4.2-6 describe the anticipated changes in socioeconomic impact indicators over the next 30 years under the No Action Alternative.

Table 4.2-1. Projected Aggregate Market Value of Floating Houses/ Nonnavigable Houseboats under the No Action Alternative ($ millions)

Alternative	Reservoir	Market Value by Year		
		Current	2021	2045
No Action	Norris	59.7	74.8	116.8
	Fontana	7.9	9.9	15.4
	Other	33.5	45.7	71.4
	Total	**101.0**	**130.1**	**203.1**

Table 4.2-2. Projected Aggregate Rental Revenue of Floating Houses/ Nonnavigable Houseboats under the No Action Alternative ($ millions)

Alternative	Reservoir	Rental Revenue by Year		
		Current	2021	2045
No Action	Norris	3.4	4.3	6.7
	Fontana	0.9	1.2	1.8
	Other	1.1	1.5	2.4
	Total	**5.5**	**7.1**	**11.0**

Table 4.2-3. Projected Aggregate Rental-Days of Floating Houses/ Nonnavigable Houseboats under the No Action Alternative

Alternative	Reservoir	Rental-Days by Year		
		Current	2021	2045
No Action	Norris	55,606	69,734	108,858
	Fontana	21,774	27,306	42,625
	Other	34,063	46,534	72,641
	Total	**111,443**	**143,552**	**224,090**

Table 4.2-4. Projected Marina Revenue from Floating Houses/ Nonnavigable Houseboats under the No Action Alternative ($ millions)

Alternative	Reservoir	Marina Revenue by Year		
		Current	2021	2045
No Action	Norris	5.4	6.8	10.6
	Fontana	1.5	1.9	2.9
	Other	9.1	12.5	19.5
	Total	**16.1**	**20.7**	**32.3**

Table 4.2-5. Projected Marina Employment from Floating Houses/ Nonnavigable Houseboats under the No Action Alternative

Alternative	Reservoir	Marina Employment by Year		
		Current	2021	2045
No Action	Norris	54	68	107
	Fontana	15	19	29
	Other	92	125	195
	Total	**161**	**207**	**324**

Table 4.2-6. Projected Number of Floating Houses/ Nonnavigable Houseboats Not Associated with Marinas under the No Action Alternative

Alternative	Reservoir	Percentage by Year		
		Number	2021[a]	2045[a]
No Action	Norris	0	0	0
	Fontana	0	0	0
	Other	138	177	277
	Total	**138**	**177**	**277**

[a] Assumes that the future percentage of FHs/NNs not associated with marinas is the same as current conditions.

As with all alternatives, TVA expects that some positive and some negative socioeconomic impacts would result from the No Action Alternative. The potential effects under the No Action Alternative were compared to current (2015) conditions. TVA expects that the number of FHs/NNs would approximately double over the next 30 years. Groups that directly use and enjoy or receive income from FHs/NNs would generally be better off under the No Action Alternative than any other alternative, as the No Action Alternative has the least restrictions on FHs/NNs. Conversely, groups that are negatively affected by FHs/NNs, including shoreline property owners, recreators, and the general public, would be worse off under the No Action Alternative than any other alternative.

The number of people using FHs/NNs (including owners and renters) is expected to increase under the No Action Alternative. The number of owners receiving rental income from FHs/NNs is expected to increase. No additional direct costs would be imposed by TVA on existing owners. TVA expects that the aggregate market value of FHs/NNs would increase as their total number increases. The market value per FH/NN, however, is expected to decrease compared to current trends as the total supply expands. Similarly, the number of units available for rent is expected to increase, and the rental price per FH/NN is expected to decrease compared to current trends.

Marinas are expected to request expansions of harbor limits to accommodate new FHs. Marina harbor limits would be periodically adjusted if justified (with fees adjusted accordingly), based on marina-specific considerations, including any problems caused by the mooring of FHs. Therefore, marinas are expected to have increased revenues compared to current trends. Similarly, the revenues of other directly related businesses (e.g., construction or maintenance of FHs) and indirectly related businesses (e.g., food and drink, retail, and entertainment) are expected to increase. The increased revenues at marinas and other related businesses are expected to stimulate local economic income and employment. While this would not likely be significant at a regional scale, it could be substantial for individual marinas and businesses near reservoirs.

Shoreline property owners would likely be worse off under the No Action Alternative compared to current (2015) conditions in two main ways. First, the number of shoreline property owners who might experience negative aesthetic impacts of FHs/NNs would likely increase. This is particularly true in areas where additional FHs are not associated with marinas. It is likely that the number of FHs that are not associated with marinas would increase under the No Action Alternative. It was assumed that the percentage of FHs/NNs not associated with marinas would be similar to current (2015) conditions. Second, the continued growth of the FH market could depress the value of shoreline property compared to current trends. This effect is not expected to be significant at the regional level. It is most likely to occur at reservoirs where additional shoreline development has limited land availability, either because of land use constraints or because land is already mostly developed.

As noted above, recreational users would likely be worse off compared to current (2015) conditions due to negative aesthetics impacts, a reduction in safely accessible areas, and reduced availability or increased prices of space at marinas. As the number of FHs increases under the No Action Alternative, the number of recreational users and recreation-days affected is expected to increase.

The general public is expected to be worse off compared to current (2015) conditions, as the potential ecological impacts of FHs would likely increase. In addition, the No Action Alternative would result in increased unauthorized appropriation of public resources as private property.

4.2.4 Alternative A – Allow Existing and New Floating Houses

Alternative A would result in an initial decrease in number of FHs/NNs, followed by an increase to approximately 3,233 over the next 30 years. Tables 4.2-7 through 4.2-13 describe the anticipated changes in socioeconomic impact indicators over the next 30 years under Alternative A.

Table 4.2-7. Projected Number of Floating Houses/ Nonnavigable Houseboats under Alternative A

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	**2021**	**2045**
A	Norris	921	925	1,573
	Fontana	357	358	610
	Other	558	623	1,050
	Total	**1,836**	**1,906**	**3,233**

Table 4.2-8. Projected Aggregate Market Value of Floating Houses/ Nonnavigable Houseboats under Alternative A ($ millions)

Alternative	Reservoir	Market Value by Year		
		Current	2021	2045
A	Norris	59.7	59.9	101.9
	Fontana	7.9	7.9	13.4
	Other	33.5	37.4	63.0
	Total	**101.0**	**104.9**	**177.9**

Table 4.2-9. Projected Aggregate Rental Revenue of Floating Houses/ Nonnavigable Houseboats under Alternative A ($ millions)

Alternative	Reservoir	Rental Revenue by Year		
		Current	2021	2045
A	Norris	3.4	3.4	5.8
	Fontana	0.9	0.9	1.6
	Other	1.1	1.3	2.1
	Total	**5.5**	**5.7**	**9.6**

Table 4.2-10. Projected Aggregate Rental-Days of Floating Houses/ Nonnavigable Houseboats under Alternative A

Alternative	Reservoir	Rental-Days by Year		
		Current	2021	2045
A	Norris	55,606	55,833	94,956
	Fontana	21,774	21,862	37,182
	Other	34,063	38,018	64,125
	Total	**111,443**	**115,691**	**196,229**

Table 4.2-11. Projected Marina Revenue from Floating Houses/ Nonnavigable Houseboats under Alternative A ($ millions)

Alternative	Reservoir	Marina Revenue by Year		
		Current	**2021**	**2045**
A	Norris	5.4	5.5	9.3
	Fontana	1.5	1.5	2.5
	Other	9.1	10.2	17.2
	Total	**16.1**	**16.7**	**28.3**

Table 4.2-12. Projected Marina Employment from Floating Houses/ Nonnavigable Houseboats under Alternative A

Alternative	Reservoir	Marina Employment by Year		
		Current	**2021**	**2045**
A	Norris	54	55	93
	Fontana	15	15	25
	Other	92	102	173
	Total	**161**	**167**	**284**

Table 4.2-13. Projected Number of Floating Houses/ Nonnavigable Houseboats Not Associated with Marinas under Alternative A

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	**2021**	**2045**
A	Norris	0	0	0
	Fontana	0	0	0
	Other	138	124[a]	124[a]
	Total	**138**	**124**	**124**

[a] Assumes that an estimated 90 percent of the FHs/NNs not currently associated with marinas are permitted based on TVA data. Assumes that all currently permitted structures would be modified or maintained to stay in compliance with existing permits.

As with all alternatives, TVA expects a mix of positive and negative socioeconomic impacts under Alternative A. Alternative A would result in three important differences compared to the No Action Alternative:

- Some FHs/NNs would be modified, relocated, or removed, resulting in potential costs to current owners and fewer FHs/NNs compared to the No Action Alternative.
- Most FHs/NNs would be associated with marinas, and only FHs/NNs meeting appropriate standards and requirements would be allowed outside of marinas.
- Potential ecological and safety issues would be largely reduced.

The effects of these differences on each socioeconomic group are discussed below.

Differential effects would occur to current owners depending on the condition and location of individual FHs. Under Alternative A, TVA would require owners to modify sub-standard FHs/NNs to meet the new standards, relocate FHs/NNs (if necessary) to within approved marina harbor limits, or remove the FHs/NNs. Owners who need to remove FHs/NNs would be worse off in several ways: they would lose future use and enjoyment of the structure, would lose any equity and rental income, and would need to pay the cost of removal. In addition, some owners may have a mortgage that would still need repaying. Owners of current FHs/NNs that are modified to meet the minimum standards and/or relocated within approved marina limits would experience some positive and some negative impacts. The main negative impact would be the cost of modifying and relocating the structure, if necessary. The removal of some FHs/NNs and the increase in construction or maintenance costs due to the new standards would decrease the overall number of FHs/NNs. This reduction in supply is expected to increase the market value and rental prices of the remaining FHs/NNs, a positive impact on their owners compared to the No Action Alternative. Owners of current FHs/NNs that meet minimum requirements would be better off under Alternative A compared to the No Action Alternative. They would not face any additional costs, and the market value and rental income of their FHs/NNs may increase as noted above.

The aggregate number and market value of FHs/NNs would increase compared to present (2015) conditions but would be lower than under the No Action Alternative due to some houses needing to be removed and the more restrictive future standards.

Alternative A would be better for renters compared to current (2015) conditions, due to a higher supply of FHs/NNs leading to more choices and lower prices. However, Alternative A would not be as beneficial for renters as the No Action Alternative because there would be fewer FHs/NNs.

FHs/NNs currently owned by or moored at marinas that cannot be cost-effectively modified to meet standards would be removed under Alternative A, resulting in loss of revenue to marinas. However, this loss would eventually be offset by the requirement to locate all new FHs within approved marina harbor limits. Marinas are expected to request expansions of harbor limits to accommodate new FHs. Harbor limits for all marinas would be periodically adjusted if justified (with fees adjusted accordingly), based on marina-specific considerations, including any problems caused by the mooring of FHs. Overall, marinas are expected to be better off than current (2015) conditions but worse off compared to the No Action Alternative.

In general, other businesses that directly or indirectly receive income from FHs/NNs are expected to be better off than current (2015) conditions but worse off than under the No Action Alternative. Exceptions include demolition and solid waste removal businesses, which would be better off under Alternative A compared to the No Action Alternative due to the removal of some structures.

The increased revenues at marinas and other businesses is expected to stimulate local economic income and employment compared to current (2015) conditions. While this would not likely be significant at a regional scale, it could be significant for individual marinas and businesses near reservoirs.

Shoreline property owners, recreational users, and the general public would be worse off under Alternative A compared to current (2015) conditions but better off compared to the No Action Alternative for several reasons. First, the overall numbers of FHs/NNs would increase compared to current conditions but would be lower than under the No Action Alternative. Second, most FHs/NNs would be located within marina harbor limits, reducing the potential severity of negative aesthetic impacts. Third, FHs/NNs would be required to meet minimum standards that would significantly reduce potential negative impacts on ecological resources and public health and safety.

Because most existing and all new FHs/NNs would be required to be located within approved marina harbor limits, Alternative A would reduce the unauthorized appropriation of public resources as private property compared to current (2015) conditions and the No Action Alternative.

4.2.5 Alternative B1 – Grandfather Existing and Prohibit New

Under Alternative B1, TVA would approve existing unpermitted FHs that meet minimum standards and allow mooring within permitted marina harbor limits. TVA would continue to allow NNs they approved prior to February 15, 1978, and that are in compliance with a current permit. TVA would require modifying or removing unapproved structures. TVA would prohibit new FHs designed and used primarily for human habitation rather than navigation and transportation. TVA would update its rules to clarify that new FHs are prohibited.

Tables 4.2-14 through 4.2-20 describe the anticipated changes in socioeconomic impact indicators over the next 30 years under Alternative B1.

Table 4.2-14. Projected Number of Floating Houses/ Nonnavigable Houseboats under Alternative B1

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	2021	2045
B1	Norris	921	691	691
	Fontana	357	268	268
	Other	558	419	419
	Total	**1,836**	**1,377**	**1,377**

Table 4.2-15. Projected Aggregate Market Value of Floating Houses/ Nonnavigable Houseboats under Alternative B1 ($ millions)

Alternative	Reservoir	Market Value by Year		
		Current	2021	2045
B1	Norris	59.7	44.8	44.8
	Fontana	7.9	5.9	5.9
	Other	33.5	25.1	25.1
	Total	**101.0**	**75.8**	**75.8**

Table 4.2-16. Projected Aggregate Rental Revenue of Floating Houses/ Nonnavigable Houseboats under Alternative B1 ($ millions)

Alternative	Reservoir	Rental Revenue by Year		
		Current	2021	2045
B1	Norris	3.4	2.6	2.6
	Fontana	0.9	0.7	0.7
	Other	1.1	0.8	0.8
	Total	**5.5**	**4.1**	**4.1**

Table 4.2-17. Projected Aggregate Rental-Days of Floating Houses/ Nonnavigable Houseboats under Alternative B1

Alternative	Reservoir	Rental-Days by Year		
		Current	2021	2045
B1	Norris	55,606	41,705	41,705
	Fontana	21,774	16,330	16,330
	Other	34,063	25,548	25,548
	Total	**111,443**	**83,582**	**83,582**

Table 4.2-18. Projected Marina Revenue from Floating Houses/ Nonnavigable Houseboats under Alternative B1 ($ millions)

Alternative	Reservoir	Marina Revenue by Year		
		Current	2021	2045
B1	Norris	5.4	4.1	4.1
	Fontana	1.5	1.1	1.1
	Other	9.1	6.9	6.9
	Total	**16.1**	**12.0**	**12.0**

Table 4.2-19. Projected Marina Employment from Floating Houses/ Nonnavigable Houseboats under Alternative B1

Alternative	Reservoir	Marina Employment by Year		
		Current	2021	2045
B1	Norris	54	41	41
	Fontana	15	11	11
	Other	92	69	69
	Total	**161**	**121**	**121**

Table 4.2-20. Projected Number of Floating Houses/ Nonnavigable Houseboats Not Associated with Marinas under Alternative B1

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	2021	2045
B1	Norris	0	0	0
	Fontana	0	0	0
	Other	138	124[a]	124[a]
	Total	**138**	**124**	**124**

[a] Assumes that an estimated 90 percent of the FHs/NNs not currently associated with marinas are permitted based on TVA data. Assumes that all currently permitted structures would be modified or maintained to stay in compliance with existing permits.

As with all alternatives, TVA expects a mix of positive and negative socioeconomic impacts under Alternative B1. Impacts would be generally similar to those described for Alternative A. However, the market values and rental prices of FHs/NNs are expected to be higher under Alternative B1 than Alternative A because no new FHs would be allowed.

For current owners that would need to remove FHs/NNs, socioeconomic impacts under Alternative B1 are the same as those under Alternative A. Current owners that would not need to remove their FHs/NNs would be better off under Alternative B1 than Alternative A. Because no new FHs would be allowed, the likelihood and potential amount for the market values of remaining FHs/NNs to increase would be higher than in Alternative A. In addition, the prohibition on new FHs would reduce the future number of FHs at marinas, preventing potential decreases in enjoyment of FHs/NNs due to crowding. Potential future FH owners would be worse off under Alternative B1 than the No Action Alternative and Alternative A, as new FHs would not be allowed, limiting choices and likely raising prices.

The aggregate market value of FHs/NNs would be lower under Alternative B1 than Alternative A. The prohibition on new FHs is expected to stimulate the commercially built navigable houseboat and/or shoreline property markets, partially offsetting the reduction in FH/NN market value.

FH/NN renters would be worse off under Alternative B1 compared to current (2015) conditions, the No Action Alternative, and Alternative A, due to fewer choices and likely higher prices.

Marinas would be worse off under Alternative B1 than current (2015) conditions, the No Action Alternative, and Alternative A, due to fewer FHs/NNs. TVA estimates that the future total number of FHs/NNs under Alternative B1 would be approximately 25 percent lower than current (2015) conditions. Similarly, other related businesses would have lower revenues from FHs/NNs than under current conditions, the No Action Alternative, and Alternative A.

Shoreline property owners, recreational users, and the general public would be better off under Alternative B1 compared to current (2015) conditions, the No Action Alternative, and Alternative A because the future number of FHs/NNs would be reduced, the FHs/NNs that remain would meet appropriate standards, and most FHs/NNs would be located within approved marina harbor limits.

As with Alternative A, because all unpermitted FHs would be required to move within approved marina harbor limits, Alternative B1 would reduce the unauthorized appropriation of public resources as private property compared to current conditions and the No Action Alternative.

4.2.6 Alternative B2 – Grandfather but Sunset Existing and Prohibit New

Alternative B2 is the same as Alternative B1, except for a 30-year sunset period for all FHs/NNs. Assuming that the new regulations are implemented in 2015, all FHs and pre-1978 grandfathered NNs would need to be removed no later than 2045.

Tables 4.2-21 through 4.2-27 describe the anticipated changes in socioeconomic impact indicators associated with FHs over the next 30 years under Alternative B2.

Table 4.2-21. Projected Number of Floating Houses/ Nonnavigable Houseboats under Alternative B2

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	2021	2045
B2	Norris	921	691	0
	Fontana	357	268	0
	Other	558	419	0
	Total	**1,836**	**1,377**	**0**

Table 4.2-22. Projected Aggregate Market Value of Floating Houses/ Nonnavigable Houseboats under Alternative B2 ($ millions)

Alternative	Reservoir	Market Value by Year		
		Current	2021	2045
B2	Norris	59.7	44.8	0.0
	Fontana	7.9	5.9	0.0
	Other	33.5	25.1	0.0
	Total	**101.0**	**75.8**	**0.0**

Table 4.2-23. Projected Aggregate Rental Revenue of Floating Houses/ Nonnavigable Houseboats under Alternative B2 ($ millions)

Alternative	Reservoir	Rental Revenue by Year		
		Current	2021	2045
B2	Norris	3.4	2.6	0.0
	Fontana	0.9	0.7	0.0
	Other	1.1	0.8	0.0
	Total	**5.5**	**4.1**	**0.0**

Table 4.2-24. Projected Aggregate Rental-Days of Floating Houses/ Nonnavigable Houseboats under Alternative B2

Alternative	Reservoir	Rental-Days by Year		
		Current	2021	2045
B2	Norris	55,606	41,705	0
	Fontana	21,774	16,330	0
	Other	34,063	25,548	0
	Total	**111,443**	**83,582**	**0**

Table 4.2-25. Projected Marina Revenue from Floating Houses/ Nonnavigable Houseboats under Alternative B2 ($ millions)

Alternative	Reservoir	Marina Revenue by Year		
		Current	2021	2045
B2	Norris	5.4	4.1	0.0
	Fontana	1.5	1.1	0.0
	Other	9.1	6.9	0.0
	Total	**16.1**	**12.0**	**0.0**

Table 4.2-26. Projected Marina Employment from Floating Houses/ Nonnavigable Houseboats under Alternative B2

Alternative	Reservoir	Marina Employment by Year		
		Current	2021	2045
B2	Norris	54	41	0
	Fontana	15	11	0
	Other	92	69	0
	Total	**161**	**121**	**0**

Table 4.2-27. Projected Number of Floating Houses/ Nonnavigable Houseboats Not Associated with Marinas under Alternative B2

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	2021	2045
B2	Norris	0	0	0
	Fontana	0	0	0
	Other	138	124[a]	0[b]
	Total	**138**	**124**	**0**

[a] Assumes that an estimated 90 percent of the FHs/NNs not currently associated with marinas are permitted based on TVA data. Assumes that all currently permitted structures would be modified or maintained to stay in compliance with existing permits.

[b] Under Alternative B2, all FHs/NNs would need to be removed after a 30-year sunset period.

Until 2045, the potential positive and negative impacts of Alternative B2 would be similar to those described under Alternative B1, with the exceptions discussed below.

FH/NN owners would be worse off compared to all alternatives discussed above. The market values of FHs/NNs are expected to be lower than under Alternative B1 due to the removal of FHs/NNs after the sunset period. Market values may decrease initially once TVA announces the implementation of a 30-year sunset period. The values may then stabilize, but would decrease over time as the sunset date approaches, eventually equaling zero or salvage value (any resale value of materials minus the cost of demolition and removal), whichever is greater. All owners would incur costs to remove FHs/NNs at the end of the sunset period.

In addition to losing any market value, FH/NN owners would lose use and enjoyment of FHs/NNs after the sunset period ends. As previously noted, comments received from FH owners through the scoping process indicate that they view their structures as more than sources of recreation and investments; many view their FHs as part of making family memories and a legacy to pass to future generations.

Marinas and FH/NN-related businesses would be worse off than current (2015) conditions and the other alternatives discussed above. However, Alternative B2 would stimulate demolition and solid waste businesses, particularly near and shortly after the end of the sunset period.

Shoreline property owners, recreational users, and the general public would be better off under Alternative B2 than current (2015) conditions and any of the alternatives discussed above. In addition to the benefits of Alternatives B1, all negative impacts of FHs/NNs would cease at the end of the sunset period. Alternative B2 would eliminate unauthorized appropriation of public resources as private property.

4.2.7 Alternative C – Prohibit New and Remove Unpermitted Floating Houses

Under Alternative C, TVA would prohibit new and existing FHs. TVA would continue to allow pre-1978 permitted NNs that comply with their current permit conditions. TVA would require removal of all unpermitted FHs and noncompliant, pre-1978 permitted NNs. TVA would amend its regulations to clarify its navigability criteria. TVA would not issue new standards.

Tables 4.2-28 through 4.2-34 describe the socioeconomic impact indicators over the next 30 years under Alternative C.

Table 4.2-28. Projected Number of Floating Houses/ Nonnavigable Houseboats under Alternative C

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	2021	2045
C	Norris	921	461	461
	Fontana	357	179	179
	Other	558	279	279
	Total	**1,836**	**918**	**918**

Table 4.2-29. Projected Aggregate Market Value of Floating Houses/ Nonnavigable Houseboats under Alternative C ($ millions)

Alternative	Reservoir	Market Value by Year		
		Current	2021	2045
C	Norris	59.7	29.8	29.8
	Fontana	7.9	3.9	3.9
	Other	33.5	16.7	16.7
	Total	**101.0**	**50.5**	**50.5**

Table 4.2-30. Projected Aggregate Rental Revenue of Floating Houses/ Nonnavigable Houseboats under Alternative C ($ millions)

Alternative	Reservoir	Rental Revenue by Year		
		Current	2021	2045
C	Norris	3.4	1.7	1.7
	Fontana	0.9	0.5	0.5
	Other	1.1	0.6	0.6
	Total	5.5	2.7	2.7

Table 4.2-31. Projected Aggregate Rental-Days of Floating Houses/ Nonnavigable Houseboats under Alternative C

Alternative	Reservoir	Rental-Days by Year		
		Current	2021	2045
C	Norris	55,606	27,803	27,803
	Fontana	21,774	10,887	10,887
	Other	34,063	17,032	17,032
	Total	**111,443**	**55,722**	**55,722**

Table 4.2-32. Projected Marina Revenue from Floating Houses/ Nonnavigable Houseboats under Alternative C ($ millions)

Alternative	Reservoir	Marina Revenue by Year		
		Current	2021	2045
C	Norris	5.4	2.7	2.7
	Fontana	1.5	0.7	0.7
	Other	9.1	4.6	4.6
	Total	**16.1**	**8.0**	**8.0**

Table 4.2-33. Projected Marina Employment from Floating Houses/ Nonnavigable Houseboats under Alternative C

Alternative	Reservoir	Marina Employment by Year		
		Current	2021	2045
C	Norris	54	27	27
	Fontana	15	7	7
	Other	92	46	46
	Total	**161**	**81**	**81**

Table 4.2-34. Projected Number of Floating Houses/ Nonnavigable Houseboats Not Associated with Marinas under Alternative C

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	**2021**	**2045**
C	Norris	0	0	0
	Fontana	0	0	0
	Other	138	124[a]	124[a]
	Total	**138**	**124**	**124**

[a] Assumes that an estimated 90 percent of the FHs/NNs not currently associated with marinas are permitted based on TVA data. Assumes that all currently permitted structures would be modified or maintained to stay in compliance with existing permits.

As with all alternatives, TVA expects a mix of positive and negative socioeconomic impacts under Alternative C. All unpermitted FHs and noncompliant NNs would be removed under Alternative C, which TVA estimates would reduce the total number of structures on TVA reservoirs by half. .

Owners of unpermitted FHs would be worse off under Alternative C than current (2015) conditions and the No Action Alternative. Alternative C would result in loss of use and enjoyment of the FHs, loss of any equity and rental income, and the cost to remove the structure. In addition, some owners may have mortgages that would still need to be repaid.

In contrast, owners of permitted NNs would be better off than under any of the alternatives discussed above. Because the FH supply would be reduced compared to current conditions and would be fixed, market values and rental prices for permitted NNs are expected to increase compared to current conditions and compared to the alternatives discussed above.

Marinas and other industries that receive income from FHs/NNs are expected to be worse off than under the alternatives discussed above, as there would be fewer FHs than under those alternatives (except under Alternative B2 after the sunset date). Demolition and solid waste businesses would be better off under Alternative B2 than current (2015) conditions and the No Action Alternative due to the removal of unpermitted FHs.

Shoreline property owners, recreational users, and the general public would be better off under Alternative C than current (2015) conditions and the No Action Alternative for the reasons discussed above for other alternatives. Because only permitted NNs would be allowed, Alternative C would reduce unauthorized appropriation of public resources as private property.

4.2.8 Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

Under Alternative D, TVA would enforce current Section 26a regulations and require compliance with the criteria for navigable house boats. TVA would manage the proliferation of FHs by restricting marina mooring and operations within existing marinas' approved harbor limit space, and through the conditions and covenants in marina land use agreements and Section 26a permits. TVA would require marina owners to move all structures and vessels inside their permitted harbors and not allow expansions for FHs/NNs. TVA would not update regulations and would require modification or removal of unapproved structures. Pre-1978 NNs in compliance with a current permit would continue to be allowed. All FHs not meeting the five navigable houseboat criteria in Section 26a would be removed at the owners' expense. Any marina with a noncompliant NN or FH could not apply for expansion. FHs/NNs could not be moved to a marina that did not have these structures as of January 2016.

Tables 4.2-35 through 4.2-41 describe the anticipated changes in socioeconomic impact indicators over the next 30 years under Alternative D.

Table 4.2-35. Projected Number of Floating Houses/ Nonnavigable Houseboats under Alternative D

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	2021	2045
D	Norris	921	417	417
	Fontana	357	309	561
	Other	558	610	1,038
	Total	**1,836**	**1,337**	**2,015**

Table 4.2-36. Projected Aggregate Market Value of Floating Houses/ Nonnavigable Houseboats under Alternative D ($ millions)

Alternative	Reservoir	Market Value by Year		
		Current	2021	2045
D	Norris	59.7	27.0	27.0
	Fontana	7.9	6.8	12.3
	Other	33.5	36.6	62.3
	Total	**101.0**	**73.5**	**110.9**

Table 4.2-37. Projected Aggregate Rental Revenue of Floating Houses/ Nonnavigable Houseboats under Alternative D ($ millions)

Alternative	Reservoir	Rental Revenue by Year		
		Current	2021	2045
D	Norris	3.4	1.5	1.5
	Fontana	0.9	0.8	1.5
	Other	1.1	1.2	2.1
	Total	**5.5**	**4.0**	**6.0**

Table 4.2-38. Projected Aggregate Rental-Days of Floating Houses/ Nonnavigable Houseboats under Alternative D

Alternative	Reservoir	Rental-Days by Year		
		Current	2021	2045
D	Norris	55,606	25,177	25,177
	Fontana	21,774	18,866	34,186
	Other	34,063	37,256	63,363
	Total	**111,443**	**81,132**	**122,337**

Table 4.2-39. Projected Marina Revenue from Floating Houses/ Nonnavigable Houseboats under Alternative D ($ millions)

Alternative	Reservoir	Marina Revenue by Year		
		Current	2021	2045
D	Norris	5.4	2.5	2.5
	Fontana	1.5	1.3	2.3
	Other	9.1	10.0	17.0
	Total	**16.1**	**11.7**	**17.6**

Table 4.2-40. Projected Marina Employment from Floating Houses/ Nonnavigable Houseboats under Alternative D

Alternative	Reservoir	Marina Employment by Year		
		Current	2021	2045
D	Norris	54	25	25
	Fontana	15	13	23
	Other	92	100	170
	Total	**161**	**117**	**177**

Table 4.2-41. Projected Number of Floating Houses/ Nonnavigable Houseboats Not Associated with Marinas under Alternative D

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	2021	2045
D	Norris	0	0	0
	Fontana	0	0	0
	Other	138	124[a]	124[a]
	Total	**138**	**124**	**124**

[a] Assumes that an estimated 90 percent of the FHs/NNs not currently associated with marinas are permitted based on TVA data. Assumes that all currently permitted structures would be modified or maintained to stay in compliance with existing permits.

TVA expects that Alternative D would result in the removal of approximately 75 percent of currently unpermitted FHs (38 percent of the total current FHs/NNs) because modifying the FHs to meet the criteria of a navigable houseboat would be cost prohibitive. TVA estimates that approximately 25 percent of the unpermitted FHs would be modified to meet the current criteria for navigable houseboats. The removal of these FHs would be required within 18 months. Remaining FHs meeting the navigable houseboat criteria would then be relocated to within currently approved marina harbor limits. Currently permitted pre-1978 NNs could stay at their current locations. TVA then expects that new FHs designed to meet the five criteria of a navigable houseboat would be built and located at marinas. TVA would not allow an increase in marina harbor limits to accommodate these new FHs; therefore, the current marina harbor limits serve as a limit on future growth.

Because many marinas are currently exceeding their approved harbor limits at Norris Reservoir, TVA assumes that there would be no future growth in the number of FHs at Norris. However, growth is expected at most other reservoirs. By 2045, TVA estimates that approximately 2,000 FHs/NNs would be in the study area under Alternative D. The number at reservoirs other than Norris would be slightly fewer than under Alternative A. In total, the number of FHs/NNs in 2045 under Alternative D would be about two-thirds of the number under Alternative A. The number of FHs/NNs in 2045 under Alternative D would be higher than under Alternatives B1, B2, and C.

As with other alternatives that require removal of some FHs/NNs, owners of structures that are removed would be worse off than current (2015) conditions and owners of modified FHs meeting the navigation criteria, and owners of permitted NNs that remain would generally be better off than current conditions.

Marinas would have a short-term loss of revenue during the period when FHs are being removed. However, a portion of these losses would likely be offset by marinas participating in the process of removing FHs or through expenditures made by demolition and solid waste businesses. In the long term, marinas and other related businesses would be better off under Alternative D than under current (2015) conditions but worse off than under the No Action Alternative.

Shoreline property owners, recreation users, and the general public would be better off under Alternative D than the No Action Alternative for the reasons discussed above for other alternatives. Because only permitted pre-1978 NNs and FHs meeting the navigable houseboat criteria would be allowed, Alternative D would minimize unauthorized appropriation of public resources as private property.

4.2.9 Environmental Justice

TVA does not anticipate any disproportionate adverse impacts on environmental justice communities under any of the alternatives. As outlined in Section 3.2.2, the study area does include several counties with a higher level of poverty than the respective states. However, impacts associated with the FH policy are expected to be greatest for shoreline home owners, FH/NN owners, boat users, and marina owners. Because these groups generally do not fall within the low-income category, disproportionate impacts on low-income populations are not expected.

The vast majority of counties surrounding TVA reservoirs have a smaller proportion of minority residents than their respective states. TVA does not have any data to suggest that FH/NN owners, shoreline home owners, boat users, or marina owners have a higher proportion of minority populations than the surrounding communities.

The large population of Native Americans associated with the Qualla Boundary near Fontana Reservoir has the potential to be affected by the FH policy. To address this, TVA notified the residents of the area of TVA's plan to prepare an EIS during the scoping period. Additionally, one of the five scoping meetings was held near the land trust in Bryson City, Swain County. No concerns over environmental justice issues were raised during the scoping period. TVA does not have any information to suggest that the Native American community near Fontana Reservoir would be disproportionately affected by any of the alternatives.

4.2.10 Cumulative Impacts

While localized impacts on marinas and FH/NN owners may be substantial, cumulative socioeconomic impacts associated with the alternatives are expected to be minor. As shown in Table 4.2-42, annual rental revenues may reach an estimated $11 million under the No Action Alternative, and potential annual marina revenue may reach $32 million. Combined, this is approximately 0.03 percent of the total Gross Domestic Product for the study area, which is estimated at over $147 billion. Similarly, the estimated 324 marina employees associated with FHs/NNs (Table 4.2-42) account for approximately 0.02 percent of the study area's civilian labor force of 1,714,739 (Table 3.2-3).

Other TVA management policies currently in place such as the NRP and Shoreline Management Policy provide for increased recreational opportunities on TVA public lands, which would help to offset the increased demand created by any of the alternatives that reduce the numbers of FHs/NNs. Additionally, these policies are designed to protect and enhance use of reservoir public land, which will increase demand and help offset some losses that may occur at marinas due to any losses in revenue associated with the alternatives.

4.2.11 Summary

Table 4.2-42 summarizes the socioeconomic impact indicators for the year 2045 under each of the alternatives. Each policy alternative TVA is considering has potential positive and negative socioeconomic impacts.

Table 4.2-42. Summary of Projected Socioeconomic Impact Indicator Values under All Alternatives (2045)

Indicator	Alternative					
	No Action	A	B1	B2	C	D
Number of FHs/NNs	3,692	3,233	1,377	0	918	2,015
Market value of FHs/NNs ($ millions)	203.1	177.9	75.8	0.0	50.5	110.9
Rental revenue of FHs/NNs ($ millions)	11.0	9.6	4.1	0.0	2.7	6.0
Rental-days of FHs/NNs	224,090	196,229	83,582	0	55,722	122,337
Marina revenue from FHs/NNs ($ millions)	32.3	28.3	12.0	0.0	8.0	17.6
Marina employment from FHs/NNss	324	284	121	0	81	177
Number of FHs/NNs not associated with marinas	138	124	124	0	124	124

The relative impacts of the alternatives on each socioeconomic group are illustrated in Table 4.2-43. Note that this table presents relative impacts separately for each socioeconomic group. The fact that each group represents significantly different numbers of people is not reflected in the table. Therefore, one cannot simply count the number of positive and negative relative impacts to determine the overall socioeconomic impact of an alternative. The quantitative indicators presented for each alternative help to illustrate the potential numbers of people affected by each socioeconomic group and alternative.

Key findings with respect to the potential socioeconomics effects include:

- All alternatives involve some groups being better off compared to current conditions and some groups being worse off. FH/NN owners and renters, marinas, and other industries that derive income from FHs/NNs would experience positive impacts from additional FHs. In contrast, shoreline property owners, recreational users, and the general public would experience negative impacts from additional FHs.
- The groups that benefit the most from more FHs (future FH owners, renters, and marinas) represent a much smaller number of individuals than the groups that benefit from fewer FHs (shoreline property owners, recreation users, and the general public).
- The potential negative impacts per individual are generally higher for individuals that benefit from FHs/NNs compared to individuals that benefit from fewer FHs/NNs. For example, current FH/NN owners that must remove their structure incur relatively substantial monetary costs and financial losses, and lose the use and enjoyment of their FH/NN. In addition, these are permanent impacts. Shoreline property owners and recreation users who are negatively affected by FHs/NNs would not generally

face substantial monetary or financial losses, and economic impacts are more likely to be transitory.

- Therefore, TVA's decision regarding alternative policies involves a likely trade-off between relatively large impacts on a smaller number of individuals and relatively smaller impacts for a larger number of individuals.
- The extent to which current FH/NN owners are positively or negatively affected by the alternatives depends on the current condition, the location of their houses, and the policy decision TVA makes. Owners of currently unpermitted FHs who cannot be modified to meet current or new standards are the most likely group of owners to be made worse off.
- Alternatives that limit FHs/NNs are not necessarily bad for current owners, depending on the alternative and the condition and location of their structure. In particular, owners of current FHs/NNs that are permitted, meet new standards, or can be cost-effectively modified to meet new standards, will likely be better off if FHs/NNs are limited.
- The alternatives involve trade-offs between current FH/NN owners and potential future FH owners; alternatives that limit new FHs are good for current owners but bad for future owners.
- Although all of the action alternatives make marinas worse off compared to the No Action Alternative, marinas would be better off than current (2015) conditions in three of the five action alternatives.

Table 4.2-43. Summary of Potential Socioeconomic Impacts under All Alternatives

Socioeconomic Group	Alternative					
	No Action	A	B1	B2	C	D
Current NN owners (permitted NN)						
Current FH owners (unpermitted but meet new requirements)						
Current FH owners (modification required to meet new requirements)						
Current FH/NN owners (removal required)						
Future FH owners						
FH/NN renters						
Marinas						
Construction and maintenance businesses						
Demolition and solid waste businesses						
Local goods (retail, fuel, food and drink, entertainment)						
Shoreline property owners						
Recreational users						
General public						

All impacts are relative to the current (2015) conditions:

indicates substantially better off compared to current (2015) conditions.

indicates better off compared to current (2015) conditions.

White indicates about the same as current (2015) conditions.

indicates worse off compared to current (2015) conditions.

indicates substantially worse off compared to current (2015) conditions.

Impacts are relative within each socioeconomic group and should not be directly compared across groups.

4.3 Recreation

4.3.1 Introduction and Methods

The presence of FHs/NNs may affect the quantity and quality of recreation on TVA reservoirs. This section discusses the impacts of the various policy alternatives on surface water users and shoreline users. Within the surface water user group, the impacts on FH/NN users are discussed. To summarize the data, the estimates for the two reservoirs with the most FHs/NNs (Norris and Fontana Reservoirs), and the estimates for a total of all other reservoirs are presented.

To gauge the level of impacts, the estimated number of FHs/NNs is referred to under each alternative. With the exception of the FH/NN users, the estimated impacts on recreational user days are discussed qualitatively for each of the alternatives. For FH/NN users, the total number of recreation days for each alternative was estimated based on the estimated number of FHs/NNs. The FH/NN occupancy rates were assumed to remain constant into the future under all the alternatives.

The presence of FHs/NNs on TVA reservoirs has the potential to affect recreation in several ways. FHs/NNs affect recreation most directly through their actual use. Another potential effect could result if potential increases in the numbers of FHs reduce the availability of boat slips at marinas for other recreational users. As mentioned in Section 1.8.5, other issues that were raised during TVA's scoping process that may affect recreation include concerns expressed related to water quality, electrical safety, and access to public shoreline. Impacts associated with water quality are addressed separately in Section 4.10, and impacts related to electrical safety are discussed in Section 4.4. Public concern about these issues also has the potential to affect decisions on how and where the public chooses to recreate.

Discussions in this chapter are limited to the impacts on the quantity and quality of recreation. Many of the affected users may experience impacts in terms of lost property or lower property values, but these impacts are addressed in Section 4.2.

4.3.2 No Action Alternative

Under the No Action Alternative, the number of FHs is expected to continue to increase. Across all the TVA reservoirs in the study area, the number of FHs/NNs would increase from the current total of 1,836 structures to an estimated 3,692 by 2045 (Table 4.3-1).

Table 4.3-1. Projected Number of Floating Houses under the No Action Alternative

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	2021	2045
No Action	Norris	921	1,155	1,803
	Fontana	35c7	448	699
	Other	558	762	1,190
	Total	**1,836**	**2,365**	**3,692**

4.3.2.1 Surface Water Recreation

Surface water users experience negative impacts associated with FHs/NNs. These impacts may affect both the quantity and quality of recreation.

Surface water users compete with the FHs/NNs for space on the surface area of the reservoirs; therefore, more FHs/NNs means less space for other surface water activities. The largest potential impact would occur at marinas, but in some cases congestion may occur where the expansion of FHs has moved outside of marina harbor limits. More FHs would lead to more congestion at marinas, which surface water users also use to access the water. More congestion at marinas and to a lesser extent in other areas outside marina limits may lead to less surface water recreation.

In addition, as expressed in public comments during the scoping process, surface water users may experience negative impacts on the quality of their recreation. Congestion and crowding may lead to a lower quantity of recreation, but for the recreation that remains it may also lead to a lower quality of recreation. More new FHs would lead to continued water quality concerns and hindered views while on the water. Poorly moored FHs/NNs would continue to pose safety concerns with unregulated electrical hookups and potentially insufficient anchoring. Under the No Action Alternative, the present concerns over the quality of surface water recreation would continue.

Recreational Navigation

Navigation in and around marinas may become more congested as more FHs are built. Most FHs/NNs are located in and around marinas where they can be monitored; however, in some instances, structures are not associated with a marina. For these structures, there is a possibility of neglected structures breaking free from moorings or sinking and creating hazards for navigation and recreation. This could potentially create safety concerns for recreational boaters.

Floating House and Nonnavigable Houseboat Users

Opportunities for recreation for FH/NN users would continue to increase under the No Action Alternative. The number of total user days would more than double from a current level of 274,150 to 551,262 user days in 2045 (Table 4.3-2).

Table 4.3-2. Projected Floating House/Nonnavigable Houseboat Visitation Days under the No Action Alternative

Alternative	Reservoir	Visitation by Year (days)		
		Current	2021	2045
No Action	Norris	136,791	171,546	267,790
	Fontana	53,563	67,172	104,859
	Other	83,796	114,420	178,613
	Total	**274,150**	**353,138**	**551,262**

While the quantity of recreation available to FH/NN users would increase, the quality of recreation may decrease. As with other surface water users, the existing FH/NN users would experience the negative impacts of more congestion on the water and at marinas, along with the possible negative impacts of lower quality water and views.

4.3.2.2 Shoreline Recreation

Shoreline-based recreation may experience similar impacts at developed and undeveloped locations. Under the No Action Alternative, FHs would continue to increase in numbers. It is estimated that the current harbor limit acreage is being exceeded by 41 percent on Norris Reservoir and by 2 percent across all other reservoirs. This is in part due to the presence of FHs/NNs. Shoreline impacts may occur where FHs/NNs are present outside approved harbor limits or are anchored to trees or otherwise obstruct access to the reservoir. In other locations, FHs/NNs may obstruct the natural views of the reservoir from shoreline locations. More shorelines would become inaccessible, and shoreline recreation may decrease. Additionally, public concerns about water quality and obstructed views may lower the quality of recreation.

4.3.3 Alternative A – Allow Existing and New Floating Houses

Alternative A would result in an initial decline in the number of FHs/NNs, followed by an increase. It is estimated that 25 percent of FHs/NNs would not be able to meet the conditions of mooring within harbors and meeting new minimum standards and size restrictions. Under this scenario, the number of total FHs/NNs is expected to drop from 1,836 to 1,377 as structures that cannot meet the new requirements are removed. After the initial decline, the number of structures is estimated to continue to increase and by 2045 would reach an estimated 3,233 FHs/NNs (Table 4.3-3).

Table 4.3-3. Projected Number of Floating Houses/ Nonnavigable Houseboats under Alternative A

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	2021	2045
A	Norris	921	925	1,573
	Fontana	357	358	610
	Other	558	623	1,050
	Total	**1,836**	**1,906**	**3,233**

4.3.3.1 Surface Water Recreation

Surface water recreation may experience negative impacts under Alternative A. The number of new FHs is expected to increase, and the negative impacts associated with FHs/NNs would potentially increase as well. Increased competition for space within marinas may limit the availability of boat slips for other boaters as FH numbers increase. Alternative A does offer some methods of reducing negative impacts. Unpermitted FHs would be expected to meet new standards, which would reduce the degradation of water quality and limit the surface water congestion to harbor limits of marinas. Marinas may seek to expand harbor limits to accommodate new FHs; however, TVA would be able to regulate any expansion consistent with its other goals and management plans. The addition of new marinas may also contribute to an increase in new FHs. Impacts on views would be limited to marina and harbor areas, which already have some level of development and therefore would cause less impact on undisturbed natural areas.

Recreational Navigation

Congestion in marinas may continue and increase under Alternative A, as the number of new FHs in marina harbor limits would likely increase over time. Navigation outside of marina harbor limits would be improved as FHs/NNs would be forced to move into the more regulated areas inside harbor limits.

Floating House/Nonnavigable Houseboat Users

Alternative A would affect the recreation of several FH/NN users. Initially, the opportunities for recreation in FHs/NNs would decrease as the number of FHs/NNs decreased. After the initial decline in FHs, it is estimated that the number of FHs/NNs would eventually increase to levels higher than the current level and user days would increase to 482,724 by 2045 (Table 4.3-4). In the longer term, this increase equates to a greater opportunity for FH/NN recreation.

Table 4.3-4. Projected Floating House/ Nonnavigable Houseboat Visitation Days under Alternative A

Alternative	Reservoir	Visitation by Year (days)		
		Current	2021	2045
A	Norris	136,791	137,348	233,592
	Fontana	53,563	53,782	91,468
	Other	83,796	93,471	157,665
	Total	**274,150**	**284,600**	**482,724**

The quality of FH/NN recreation may increase because of improvements to water quality but may decrease because of limiting the areas available to moor and possibly increasing the congestion in marina harbors where the FHs/NNs would be limited to.

4.3.3.2 Shoreline Recreation

Alternative A would result in both positive and negative impacts on shoreline recreation. For areas where FHs/NNs are moored to shorelines outside of marina harbor limits, FHs without a valid permit would be moved, which may improve the quality of shoreline recreation access and views. New standards would improve mooring practices and reduce discharges into the reservoirs, which would improve water quality. Shoreline users along marina harbor limits may be negatively affected because a greater concentration of FHs/NNs could occur in these areas.

4.3.4 Alternative B1 – Grandfather Existing and Prohibit New

Under Alternative B1, it is estimated that 25 percent of FHs/NNs would be removed because they could not come into compliance with new standards and requirements. Additionally, TVA would permit no new FHs. This change equates to a drop in the total number of FHs/NNs from 1,836 to 1,377, where it would stay (Table 4.3-5).

Table 4.3-5. Projected Number of Floating Houses/ Nonnavigable Houseboats under Alternative B1

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	2021	2045
B1	Norris	921	691	691
	Fontana	357	268	268
	Other	558	419	419
	Total	**1,836**	**1,377**	**1,377**

4.3.4.1 Surface Water Recreation

Surface water recreation could possibly improve under Alternative B1. The reduction in the number of FHs/NNs would improve scenic views on the reservoirs and open up surface area access. Congestion at marinas would be reduced, and new standards for permits would help improve water quality.

Recreation Navigation

Marina harbor congestion would be expected to decrease in most areas after the reduction in total FHs/NNs. Ifn areas with a high number of FHs/NNs outside harbor limits, marina congestion may increase as the structures are moved into the marinas. Navigation outside marina harbor limits would improve as FHs/NNs are moved into marinas.

Floating House/Nonnavigable Houseboat Users

Recreation for FH/NN users would be reduced under Alternative B1 as the number of FHs/NNs decreases. Opportunities would be limited, and total visitation is expected to decline from 274,150 to 205,613 user days (Table 4.3-6). A large impact is expected for the FH/NN owners who cannot meet the new standards and requirements and therefore would be forced to remove their structures. For the FH/NN users that remain, the quality of recreation is expected to improve as less congestion, cleaner water, and safer mooring practices would occur.

Table 4.3-6. Projected Floating House/ Nonnavigable Houseboat Visitation Days under Alternative B1

Alternative	Reservoir	Visitation by Year (days)		
		Current	2021	2045
B1	Norris	136,791	102,593	102,593
	Fontana	53,563	40,173	40,173
	Other	83,796	62,847	62,847
	Total	**274,150**	**205,613**	**205,613**

4.3.4.2 Shoreline Recreation

The total number of FHs/NNs would decrease under Alternative B1, decreasing the obstructions for shoreline users and improving views of the reservoirs. Some FHs/NNs that are currently moored along shorelines outside harbor limits would be moved into marina harbor limits, which could improve conditions for some shoreline users. Shoreline users around marina harbor limits may see an increase in the density of FHs/NNs. All shoreline users would benefit from improved water quality and better mooring practices that would result from the new regulations.

4.3.5 Alternative B2 – Grandfather but Sunset Existing and Prohibit New

Alternative B2 is similar to Alternative B1 except that all FHs and NNs would be removed by 2045. The initial reduction of FHs/NNs from 1,836 to 1,377 would be the same as Alternative B1, as it is estimated that approximately 25 percent of existing FHs/NNs would not be able to come into compliance with new standards (Table 4.3-7). It is expected that after the FHs/NNs that cannot meet the new standards are removed, the remaining 1,377 FHs/NNs would remain until the final year of the sunset requirement.

Table 4.3-7. Projected Number of Floating Houses/ Nonnavigable Houseboats under Alternative B2

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	2021	2045
B2	Norris	921	691	0
	Fontana	357	268	0
	Other	558	419	0
	Total	**1,836**	**1,377**	**0**

4.3.5.1 Surface Water Recreation

As the number of FHs/NNs declines, the available space for other surface water recreation would increase. More space inside marinas would become available for other boats and users. Similarly, the number of unobstructed natural views may increase and the water quality would increase. Surface water recreation should improve under Alternative B2.

<u>Recreational Navigation</u>

The decline in FHs would improve navigation inside marina harbor limits with lower congestion. Moving FHs into marina harbor limits would improve navigation outside harbor limits. By 2045, all FHs would be removed and there would be no impact on navigation from FHs.

<u>Floating House/Nonnavigable Houseboat Users</u>

Under Alternative B2, all FH/NN owners would eventually be forced to remove their structures, which would eliminate FH/NN recreation by 2045. Visitation would drop from 274,150 to 205,613 after removing FHs/NNs that could not meet new permit standards and would be further reduced to zero by 2045 (Table 4.3-8). This alternative would affect the owners of FHs/NNs, especially those who cannot meet the revised permit standards.

Initially, the quality of recreation may be improved because of the standards that would require less water pollution and safer mooring. Over time, it is expected that the quality of recreation would decline for FH users, as owners would be hesitant to invest in upgrades and improvements if they know they must remove the structures in the future.

Table 4.3-8. Projected Floating House/Nonnavigable Houseboat Visitation Days under Alternative B2

Alternative	Reservoir	Visitation by Year (days)		
		Current	2021	2045
B2	Norris	136,791	102,593	0
	Fontana	53,563	40,173	0
	Other	83,796	62,847	0
	Total	**274,150**	**205,613**	**0**

4.3.5.2 Shoreline Recreation

The reduction in the number of FHs/NNs would improve the quality of shoreline recreation and would increase the shoreline access in areas where FHs/NNs were once moored. Eventually, the obstructed views would be removed and the shoreline would be returned to a more natural state. Water quality and mooring safety should improve once the new standards are in place, and as the FHs/NNs are removed those concerns would go away.

4.3.6 Alternative C – Prohibit New and Remove Unpermitted

Under Alternative C, TVA would allow only NNs approved by TVA prior to February 15, 1978, and in compliance with a current permit. All unpermitted FHs would be removed, reducing the total structures from 1,836 to 918 (Table 4.3-9).

Table 4.3-9. Projected Number of Floating Houses/ Nonnavigable Houseboats under Alternative C

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	2021	2045
C	Norris	921	461	461
	Fontana	357	179	179
	Other	558	279	279
	Total	**1,836**	**918**	**918**

4.3.6.1 Surface Water Recreation

The reduction in the number of FHs would lead to improved surface water recreation for other users as more of the surface area of the reservoir could be devoted to other surface water-based recreational activities. More views of natural shoreline would be available as the FHs are removed. Because Alternative C would not include revised safety and wastewater standards, some public concern for safety risks or water quality issues may continue.

<u>Recreational Navigation</u>

Recreational navigation would be improved due to lower numbers of structures and lower congestion both in marina harbor limits and outside marina harbor limits.

Floating House/Nonnavigable Houseboat Users

It is estimated that FH/NN recreation would be reduced in half under Alternative C. The current level of 274,150 user days would decrease to 137,075 and remain there (Table 4.3-10). This change represents a large negative impact on the FH owners who do not have a permit and would lose their FHs. For the NNs that are allowed to remain, little would change in the quality of recreation, but some improvement may occur due to less congestion.

Table 4.3-10. Projected Floating House/Nonnavigable Houseboat Visitation Days under Alternative C

Alternative	Reservoir	Visitation by Year (days)		
		Current	2021	2045
C	Norris	136,791	68,396	68,396
	Fontana	53,563	26,782	26,782
	Other	83,796	41,898	41,898
	Total	**274,150**	**137,075**	**137,075**

4.3.6.2 Shoreline Recreation

As fewer structures would be moored along shorelines, Alternative C is expected to result in positive impacts on shoreline recreation. Views would be less obstructed, and access to the reservoir along the shorelines would increase. Opportunities for shoreline recreation should therefore be increased. Because the NNs that remain would not need to meet any additional permit requirements, concerns about water quality and mooring safety around the remaining structures may continue.

4.3.7 Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

Impacts under Alternative D by comparison are expected to fall between project impacts associated with Alternatives A and B1 in that FHs initially would decrease as regulations are consistently enforced and marinas are restricted to use of their approved harbor limit areas. However, the numbers of FHs is expected to increase over time where marina space allowed. TVA would step up efforts to enforce current regulations, and it is expected that steps would be taken by some FH owners to meet the criteria for navigability and prevent the removal of structures. TVA estimates that 75 percent of structures without a TVA permit would not be able to come into compliance and would be removed under Alternative D. This would lead to an initial decrease from the current 1,836 FHs/NNs to 1,140. Over time, new structures would be built that meet the current criteria for navigability. Marina space is expected to accommodate this growth–except on Norris Reservoir, where the current number of FHs/NNs far exceeds approved marina harbor capacity. After the initial decline, Norris Reservoir is expected to have no room for additional FHs. With the increase in FHs on other reservoirs, the number of FHs/NNs is expected to reach 2,015 by the year 2045 (Table 4.3-11)

Table 4.3-11. Projected Number of Floating Houses/ Nonnavigable Houseboats under Alternative D

Alternative	Reservoir	Number of Floating Houses/Nonnavigable Houseboats by Year		
		Current	**2021**	**2045**
D	Norris	921	417	417
	Fontana	357	309	561
	Other	558	610	1,038
	Total	**1,836**	**1,337**	**2,015**

4.3.7.1 Surface Water Recreation

Under Alternative D, surface water-based recreation may improve. Areas outside marinas would largely be made available for other surface water recreational activities, and water quality and safety issues would be reduced. Marinas would eventually become more congested with the moderate increase in FH recreation over the 30-year period.

Recreational Navigation

Congestion in some marinas is expected to decrease, which would improve navigation. In marinas with a large amount of FHs/NNs outside the harbor limits, such as on Norris Reservoir, the initial reduction of FHs in the marina would be replaced by FHs/NNs being moved into the marina harbor limits. Over time, marinas are expected to become more congested as more FHs meeting regulatory criteria are built. Navigation outside marina harbor limits would improve as the FHs/NNs would be moved into marina harbors.

Floating House Users

After an initial decrease in the number of FHs, the total opportunity for FH/NN recreation for structures meeting the navigable houseboat critieria is expected to increase. Total FH/NN visitation is expected to decrease from a current 274,150 user days to approximately 199,916 user days in 2021, but then gradually increase to 301,796 by 2045 (Table 4.3-12). The quality of FH/NN recreation is expected to increase initially as congestion will be reduced, but it may decrease over time as the surface waters at marinas become more congested. The increase in FHs may also degrade water quality, as Alternative D does not propose to update the permitting standards.

Table 4.3-12. Projected Floating House/ Nonnavigable Houseboat Visitation Days under Alternative D

Alternative	Reservoir	Visitation by Year (days)		
		Current	**2021**	**2045**
D	Norris	136,791	61,935	61,935
	Fontana	53,563	46,411	84,097
	Other	83,796	91,570	155,764
	Total	**274,150**	**199,916**	**301,796**

4.3.7.2 Shoreline Recreation

Alternative D would positively affect shoreline users by reducing the number of areas where FHs/NNs can be moored. FHs/NNswould be forced to move into marina harbor limits, and the impacts in shoreline areas outside the harbor limits would be reduced. The reduced number of FHs may also lessen concerns about water quality.

4.3.8 Cumulative Impacts

Many of TVA's current policies directly affect recreation on its reservoirs. Any analysis of recreation must also take into account the cumulative impacts of these other policies.

The Shoreline Management Policy regulates impacts on undeveloped shoreline and could therefore help to mitigate any impacts on shoreline recreation that may result from the proposed alternatives. Under the No Action Alternative, a greater increase in FHs is expected, some of which could be in future marinas along areas of currently undeveloped shoreline which could further limit recreation opportunities in these areas. Impacts would still be possible in the event that new marinas are permitted due to congestion at other marinas.

A goal of the NRP is to enhance and expand recreation opportunities. Improvements under this goal may help to increase recreational use of the reservoirs, which would help to recover lost recreation user days that may occur under alternatives B1, B2, or C. On the other hand, alternatives that would increase FH use such as the No Action Alternative, Alternative A, or Alternative D may create congestion at marinas. Implementation of the NRP may help to alleviate congestion as marinas expand or upgrade facilities.

Reduced access to undeveloped shorelines could create some cumulative impacts on recreation but, in general, the alternatives would not result in significant cumulative impacts on recreation. FH/NN recreation user days represent less than 5 percent of the 15.5 million total user days around the potentially affected reservoirs; in many ways, the policies already in place would minimize impacts of the FH policy alternatives.

4.3.9 Summary

The alternatives presented in this section have varying degrees of impacts on recreational groups around TVA reservoirs. Table 4.3-13 summarizes the estimated FH/NN recreation user days under each alternative. In general, the alternatives that allow for more FHs would negatively affect other surface water users and shoreline users. Alternatives that reduce the number of FHs/NNs would negatively affect the FH/NN users and especially structure owners. The quality of recreation would improve for all users under alternatives that offer updated requirements for safety and wastewater treatment.

Table 4.3-13. Projected Floating Recreation User Days by Alternative and Year

Year	Alternative					
	No Action	A	B1	B2	C	D
Current	274,150	274,150	274,150	274,150	274,150	274,150
2021	353,138	284,600	205,613	205,613	137,075	199,916
2045	551,262	482,724	205,613	0	137,075	301,796

4.4 Public Safety

The analysis for public safety includes only the 29 TVA reservoirs where FHs are present or likely to be moored. As noted in Section 3.4, public safety concerns related to FHs/NNs include poorly moored structures, abandoned or derelict structures, and unsafe electrical systems. Implementation of any of the action alternatives would result in beneficial effects to public safety, as TVA would address these issues through enforcement of existing regulations or development of new regulations. Under any of the action alternatives, access to demolition/removal areas would be restricted by safety zones to minimize potential safety hazards.

4.4.1 No Action Alternative – Current Management

Under the No Action Alternative, TVA would not demolish the unapproved structures, some of which would not meet TVA's safety standards or objectives. Under the No Action Alternative, current safety issues, including improper mooring and anchoring practices that create recreational boating hazards, lack of structural integrity, and concerns relating to unsafe electrical systems, would remain at the 29 reservoirs where FHs/NNs are present or likely to be constructed. The continued presence of dilapidated and poorly maintained FHs/NNs would result in increased potential public safety issues over time.

In the absence of new standards, safety issues would persist and could increase as greater numbers of structures are developed. Under implementation of this alternative, public concerns about safety issues on TVA reservoirs would continue, similar to those described in Section 3.4, Public Safety for current conditions. Therefore, adverse direct and indirect public safety impacts would continue under the No Action Alternative.

4.4.2 Alternative A – Allow Existing and New Floating Houses

Under Alternative A, TVA would require that unapproved structures be modified or removed. TVA's Section 26a regulations would be updated to set minimum standards to enhance safety. TVA's new minimum standards likely would require FHs and noncompliant NNs to meet pertinent state electric codes and local codes if they exist. In addition, TVA's minimum standards likely would establish mooring requirements for FHs/NNs.. The public would be allowed to comment on proposed standards as part of the public rulemaking process that TVA would conduct to amend its regulations.

Implementation of Alternative A would reduce public safety risks through the minimum standards that TVA would establish. In addition, FHs that do not meet and are not upgraded to meet TVA's standards would need to be removed from its reservoirs.

4.4.3 Alternative B1 – Grandfather Existing and Prohibit New

Implementation of Alternative B1 would result in beneficial safety-related impacts because TVA would develop and enforce standards to address safety, including minimum separation and spacing for existing FHs and compliance with electrical ground fault protection standards. With new standards, this alternative would result in properly constructed and maintained structures on TVA reservoirs. This would greatly reduce the potential safety impacts from existing FHs on TVA reservoirs and bring TVA regulations and standards into alignment with most states' safety regulations. TVA would also not allow new FHs beginning on the date of the Final Rule, which would limit the number of FHs present on the reservoirs.

NNs with permits would not be subject to new standards if they comply with current permit conditions. If they are not in compliance, the structures would need to be updated to meet new standards or be removed. These steps would decrease the potential for safety issues to persist. Over time, existing structures would likely need to be upgraded to avoid deterioration in their performance and subsequent safety issues. Therefore, these actions would result in beneficial effects to public safety.

4.4.4 Alternative B2 – Grandfather but Sunset Existing and Prohibit New

Implementation of Alternative B2 is similar to Alternative B1 since TVA would establish and enforce new standards to address safety issues, approve existing compliant FHs, ban the construction of new FHs, and require the removal of all noncompliant FHs. However, under Alternative B2, all permitted and compliant structures (FHs and NNs) would be subject to a 30-year sunset date.

Implementation of Alternative B2 would reduce safety risks through minimum standards that TVA would establish through a subsequent rulemaking process. Relative to the other action alternatives, except Alternative C, Alternative B2 would result in greater long-term beneficial effects to public safety because no new FHs would be added to the reservoirs and all FHs/NNs would be removed after 30 years.

4.4.5 Alternative C – Prohibit New and Remove Unpermitted

Under Alternative C, TVA would not develop new standards to address safety issues; however, TVA would update its rules to clarify that the 1978 prohibition of NNs applies to structures like FHs. Since all unpermitted structures would be removed, there would be proportionate beneficial effects to public safety. TVA would enforce current regulations that would decrease unsafe mooring and anchoring practices and unsafe electrical systems.

The prohibition of new FHs and removal of all existing FHs would greatly reduce potential adverse safety impacts.

Implementation of Alternative C would result in beneficial effects for public safety because all FHs and noncompliant NNs would be permanently removed. Reducing the number of such structures on TVA reservoirs would result in a proportionate reduction in the associated safety issues.

4.4.6 Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

Under Alternative D, existing safety concerns associated with improper mooring and anchoring practices and unsafe electrical systems would be minimized by the enforcement of current regulations. Therefore, potential adverse public safety impacts from those structures that are not in compliance at this time would be reduced. Alternative D would also result in minor beneficial effects for public safety with the removal of unpermitted structures.

4.4.7 Cumulative Impacts

The impacts of the policy alternatives examined addressed direct and indirect impacts on public safety, including improper mooring and anchoring practices that create recreational boating hazards, lack of structural integrity, fire hazards, and unsafe electrical systems. These conditions and their impact are somewhat unique to FHs/NNs on TVA reservoirs, and no other pervasive safety conditions were identified by TVA with the potential to combine or interact with other future actions and trends throughout the Tennessee Valley Watershed that would result in any more than negligible cumulative impacts on public safety.

As part of developing the NRP, TVA considered the potential risks of public health and safety across the range of its biological, cultural, recreation, water, and public engagement programs. Measures were built into the selected plan to address public safety. For example, the NRP implementation plan Phase II in Years 4–5 include measures to improve public health and safety to ensure that stakeholders are safe while enjoying TVA-managed reservoir lands. Examples include mitigation of potentially hazardous conditions (e.g., hazardous trees, dump sites, user conflicts and target shooting, meth lab dumping), improved signage (boundary and interpretive), and dam safety. Also included in Years 8-10 is the commitment to complete a land conditions assessment of all undeveloped TVA lands that includes addressing all identified safety issues. Together with TVA's future actions described above and state agency efforts to provide more dispersed and developed recreation areas and the enforcement of laws and regulations, cumulative impacts related to public safety are expected to be negligible.

4.4.8 Summary

The potential cumulative effects to public safety from Alternatives A, B1, B2, C, and D would be beneficial. The potential cumulative impacts on public safety from the No Action Alternative would be adverse because existing safety issues would continue to be present at the 29 reservoirs with FHs/NNs.

4.5 Navigation

FHs/NNs are a concern to navigation because they could pose a threat to the safety of other vessels if they become unmoored when equipment fails. Once dislodged, these structures are unable to maneuver effectively because of their large surface (sail) area and minimal to no capabilities for self-propulsion. Consequently, they could drift into navigable channels, where they could collide with other vessels.

Regardless of the alternative, TVA could permit new marinas or expansion of an existing marina's harbor limit. In both instances, TVA would conduct appropriate Section 26a reviews to ensure that the new facility or expansion of existing facilities would not encroach upon the commercial navigation channel. All new construction and expansions would be restricted to Zone 6 (Developed Recreation), or Zone 1 (Flowage Easement), which TVA established during the original development of individual reservoir land plans. Considering these reviews and restrictions—and the locations of most marinas in branches, embayments, and coves off the commercial navigation channel, the construction of new marinas or the expansion of existing harbor limits would cause negligible impacts on commercial navigation under any alternative.

Potential navigation impacts related to recreational boaters are discussed in Section 4.3.

4.5.1 No Action Alternative – Current Management

Although the number of FHs/NNs would increase under this alternative, the potential for adverse effects would not increase substantively. The current risk of FHs/NNs dislodging from moorings and drifting into the commercial navigation channel is minimal. More than 66 percent of the projected increase in the number of FHs/NNs would occur on Norris, Fontana, and other reservoirs that do not involve the main navigation channel. The limited increase in the number of FHs/NNs on the nine reservoirs that are part of the main navigation channel would not notably increase the risk for collisions between the structures and commercial traffic.

In addition, NNs have been on the reservoirs for over 50 years, and they have not collided with commercial traffic using the main navigation channel. No incidents or accidents between FHs and commercial traffic on the Tennessee River have been recorded. Few incidents or accidents are expected because most, if not all, of the FHs/NNs would be moored in branches, embayments, and coves away from the main navigation channel. Moreover, the primary conditions that would drive the structures into the navigation channel would occur during inclement weather, when commercial traffic would be tied off in safety harbors and landings or pushed up against the banks. Consequently, the risk for accidents or incidents resulting from FHs/NNs would remain low; and the potential for direct, indirect, and cumulative effects to commercial navigation would be low.

4.5.2 Alternative A – Allow Existing and New Floating Houses

Although the number of FHs/NNs would increase under this alternative, the potential for adverse effects to navigation would not increase substantively. The risk of FHs/NNs dislodging from moorings and drifting into the commercial navigation channel would be lower than under current conditions. As in the No Action Alternative, more than 66 percent of the projected increase in the number of FHs/NNs would occur on Norris, Fontana, and other reservoirs that do not involve the main navigation channel. The limited increase in the number of FHs/NNs on the nine reservoirs that are part of the main navigation channel, combined with permits and enforced minimum standards (new FHs moored within marina harbor limits), would not result in a material increase in the risk for collisions between the structures and commercial traffic.

Furthermore, NNs have been on the reservoirs for more than 50 years, and they have not posed any major risk to commercial traffic using the main navigation channel. No incidents or accidents between FHs/NNs and commercial traffic on the Tennessee River have been recorded. Few incidents or accidents are expected because most, if not all, of the FHs/NNs would be moored in branches, embayments, and coves within marina harbor limits away from the main navigation channel. In addition, they would be subject to permitting and minimum standards, which would eliminate derelict houses over time. Moreover, the primary conditions that would drive the structures into the navigation channel would occur during inclement weather, when commercial traffic would be tied off in safety harbors and landings or pushed up against the banks. Typically, in the event that an FH/NN would be dislodged from its mooring, reservoir users (e.g., the general public and marina owners) help to secure the structures and/or inform TVA of the issue. TVA and the public are very responsive to these issues and have reduced the likelihood of an incident or accident between FHs/NNs and commercial traffic. Consequently, the risk for accidents or incidents resulting from FHs/NNs would remain low; and the potential for direct, indirect, and cumulative effects to commercial navigation would be low.

4.5.3 Alternative B1 – Grandfather Existing and Prohibit New

Unlike the previous alternatives, the number of FHs/NNs would not increase under Alternative B1, and the potential for adverse effects to navigation would decrease. The risk of FHs/NNs dislodging from moorings and drifting into the commercial navigation channel would be lower than under current conditions. Unpermitted FHs/NNs would be moved into marinas, where they would be less likely to become dislodged from their moorings.

As noted above, NNs have been on the reservoirs for more than 50 years, and they have not posed any major risk to commercial traffic using the main navigation channel. No incidents or accidents between FHs/NNs and commercial traffic on the Tennessee River have been recorded. Few incidents or accidents are expected because most, if not all, of the FHs/NNs would be moored in branches, embayments, and coves away from the main navigation channel. Moreover, the primary conditions that would drive the structures into the navigation channel would occur during inclement weather, when commercial traffic would be tied off in safety harbors and landings or pushed up against the banks. Typically, in the event that an FH/NN would be dislodged from its mooring, reservoir users (e.g., the general public and marina owners) help to secure the structures or inform TVA of the issue. TVA and the public are very responsive to these issues and have reduced the likelihood of an incident or accident between FHs/NNs and commercial traffic. Consequently, the risk for accidents or incidents resulting from FHs/NNs would be negligible; and the potential for direct, indirect, and cumulative effects to commercial navigation would be negligible as well.

4.5.4 Alternative B2 – Grandfather but Sunset Existing and Prohibit New

Under Alternative B2, the number of FHs/NNs would decrease over time, and the potential for adverse effects to navigation would decrease similarly. The risk of FHs/NNs dislodging from moorings and drifting into the commercial navigation channel would be lower than under current conditions because all of these structures would be removed over time.

As noted previously, NNs have been on the reservoirs for more than 50 years, and they have not posed any major risk to commercial traffic using the main navigation channel. No incidents or accidents between FHs/NNs and commercial traffic on the Tennessee River have been recorded. Few incidents or accidents are expected because the FHs/NNs would be moored in branches, embayments, and coves away from the main navigation channel until they are all removed. Moreover, the primary conditions that would drive the structures into the navigation channel would occur during inclement weather, when commercial traffic would be tied off in safety harbors and landings or pushed up against the banks. Typically, in the event that an FH/NN would be dislodged from its mooring, reservoir users (e.g., the general public and marina owners) help to secure the structures or inform TVA of the issue. TVA and the public are very responsive to these issues and have reduced the likelihood of an incident or accident between FHs/NNs and commercial traffic. Consequently, the risk for accidents or incidents resulting from FHs/NNs would be negligible initially and zero after all existing FHs/NNs have been removed. The potential for direct, indirect, and cumulative effects to commercial navigation resulting from FHs/NNs would be negligible to nonexistent as well.

4.5.5 Alternative C – Prohibit New and Remove Unpermitted

Under this alternative, the number of FHs/NNs would decrease in a short time, and the potential for adverse effects would decrease accordingly. The risk of NNs dislodging from moorings and drifting into the commercial navigation channel would be lower than under current conditions because all unpermitted structures would be removed over time, and TVA would allow no new NNs and FHs on the reservoirs.

As noted previously, NNs have been on the reservoirs for more than 50 years, and they have not posed any major risk to commercial traffic using the main navigation channel. No incidents or accidents between FHs and commercial traffic on the Tennessee River have been recorded. Few incidents or accidents are expected because the remaining NNs would be moored in branches, embayments, and coves away from the main navigation channel. In addition, unpermitted structures would be removed, which would likely eliminate the more derelict structures over time. Moreover, the primary conditions that would drive the structures into the navigation channel would occur during inclement weather, when commercial traffic would be tied off in safety harbors and landings or pushed up against the banks. Typically, in the event that an FH/NN would be dislodged from its mooring, reservoir users (e.g., the general public and marina owners) help to secure the structures or inform TVA of the issue. TVA and the public are very responsive to these issues and have reduced the likelihood of an incident or accident between FHs/NNs and commercial traffic. Consequently, the risk for accidents or incidents resulting from FHs/NNs would be negligible after all unpermitted FHs/NNs have been removed. The potential for direct, indirect, and cumulative effects to commercial navigation would be negligible as well.

4.5.6 Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

Under Alternative D, the number of FHs/NNs would decrease in a short time, and the potential for adverse effects would decrease accordingly. The risk of FHs/NNs dislodging from moorings and drifting into the commercial navigation channel would be lower than under current conditions because all unpermitted structures would be removed over time.

As noted previously, NNs have been on the reservoirs for more than 50 years, and they have not posed any major risk to commercial traffic using the main navigation channel. No incidents or accidents between FHs/NNs and commercial traffic on the Tennessee River have been recorded. Few incidents or accidents are expected because the remaining FHs/NNs would be moored in branches, embayments, and coves away from the main navigation channel. In addition, unpermitted structures would be removed, which would likely eliminate the more derelict structures over time. The risk for accidents or incidents resulting from FHs/NNs would be negligible after all unpermitted FHs/NNs have been removed. The potential for direct, indirect, and cumulative effects to commercial navigation resulting from FHs/NNs would be negligible as well.

4.5.7 Cumulative Impacts

The risk for accidents or incidents and potential cumulative effects to commercial navigation resulting from FHs/NNs would be low under the No Action Alternative and Alternative A. The risk of accidents or incidents and potential cumulative effects resulting from FHs/NNs would be negligible under Alternatives B1, B2, C, and D.

4.5.8 Summary

NNs have been on the reservoirs for more than 50 years, and they have not posed any major risk to commercial traffic using the main navigation channel. No incidents or accidents between FHs and commercial traffic on the Tennessee River have been recorded. Few incidents or accidents are expected in the future because most, if not all, of the FHs would be moored in marinas. In addition, they would be subject to permitting and minimum standards, which would eliminate derelict structures over time. Moreover, the primary conditions that would drive the houses into the navigation channel would occur during inclement weather, when commercial traffic would be tied off in safety harbors and landings or pushed up against the banks. Typically, in the event that an FH/NN would be dislodged from its mooring, reservoir users (e.g., the general public and marina owners) help to secure the structures or inform TVA of the issue. TVA and the public are very responsive to these issues and have reduced the likelihood of an incident or accident between FHs/NNs and commercial traffic. Consequently, the risk for accidents or incidents resulting from FHs/NNs would remain low, and the potential for direct, indirect, and cumulative effects to commercial navigation resulting from FHs/NNs would be low.

4.6 Solid and Hazardous Wastes

This section describes the impacts associated with the handling and disposal of solid and hazardous wastes generated by demolition and removal activities associated with each alternative. Relative to existing conditions, the amounts of solid and hazardous wastes generated and transported to off-site permitted landfills would increase under any of the action alternatives; however, the types of wastes generated during demolition activities would be the same as those described in Section 3.6, Solid and Hazardous Wastes. It is anticipated that all waste would be disposed of in an approved/permitted landfill in accordance with federal, state, and local regulations. For any of the alternatives, the landfills and truck haul routes to be used for final disposal of non-recyclable materials generated at TVA reservoirs with 50 or more FHs/NNs are anticipated to be the same as those listed in Table 3.6-1. Although conditions would change over time, these landfills currently have adequate capacity to accommodate the volumes of wastes anticipated to be generated by demolition activities associated with all alternatives (Table 3.6-1). If structures are deemed derelict, have been abandoned, or do not comply with TVA's standards (existing and future), they would be removed by the owner or by TVA at the owner's cost.

4.6.1 No Action Alternative – Current Management

Under implementation of this alternative, operation of FHs/NNs would continue to generate limited quantities of solid and hazardous or regulated wastes at rates similar to current conditions. Wastes would continue to be recycled or transported and disposed of at approved, permitted solid waste facilities. Existing Section 26a regulation enforcement at the reservoirs would continue, and there would be no changes that would affect existing solid waste generation. Waste would continue to be managed in accordance with standard TVA procedures and pertinent federal, state, and local requirements.

Under this alternative, unapproved structures would not be removed/demolished, and associated solid and hazardous wastes would not be sent to the local landfills. The hazardous materials currently in or on the FHs/NNs (e.g., lead-based paint; asbestos in building materials; PCBs in light fixtures; and fuels, oils, or chemicals stored in buildings) could be released into the environment as the structures degrade and the structural integrity decreases (see Figures 3.6-1 and 3.6-2). Quantities of solid and hazardous wastes on TVA reservoirs have the potential to increase as FHs/NNs deteriorate with age. Potential effects from solid and hazardous wastes associated with FHs/NNs would remain similar to current conditions.

4.6.2 Alternative A – Allow Existing and New Floating Houses

Under Alternative A, TVA would require that unapproved structures be modified or removed. TVA's rules would be updated to set minimum standards that TVA would enforce. Any future minimum standards would be developed as part of the review process with public input. Potential standards that address waste management would be considered.

Demolition activities conducted under Alternative A would result in generation of larger quantities of solid and hazardous wastes compared to current conditions. Demolition and removal crews, hired by TVA or by the structure owner, would be responsible for complying with federal, state, and local regulations and requirements.

The sizes of the FHs/NNs vary greatly; however, 1,000 square feet with a 9-foot height was used as a "typical" structure size for this analysis. This is a reasonable approximation because many NNs are smaller than 1,000 square feet and many FHs are larger than 1,000 square feet. For the purposes of this evaluation, a method published in Federal Emergency Management Agency (FEMA) Publication 329 (FEMA 2010) was used to estimate the volume of debris resulting from demolition activities. Using the FEMA Field Estimating Method (FEMA 2010), a typical structure would yield approximately 150 cubic yards of waste and debris.

Under Alternative A, a total of 459 structures would potentially be demolished (see Section 3.2, Socioeconomics) because they would not comply with existing permits. Most of the structures to be demolished are located at Norris and Fontana Reservoirs in Tennessee. Implementation of Alternative A would result in up to 68,850 cubic yards of solid waste, which would be hauled by truck and deposited in off-site landfills.

As described in Section 3.6, Solid and Hazardous Wastes, wastes would be characterized prior to demolition. Based on preliminary estimates, ACM and lead-based paint may be present in approximately 40 to 60 percent of NNs; however, most of the unpermitted FHs do not contain ACM and lead because they were constructed in the 1990s to present. Relatively small quantities of various hazardous wastes would be produced during demolition. When the individual owners are responsible for demolition activities, these wastes would be disposed of as part of their “garbage” because they are not subject to RCRA hazardous waste regulations. If demolition contractors cannot rely on this regulatory exemption, they would have to comply with applicable state or federal requirements governing the management, movement, and disposal of such wastes.

With implementation of the standard procedures for spill prevention and cleanup and waste management protocols in accordance with pertinent federal, state, and local requirements, the effects of an inadvertent spill are expected to be insignificant because there would be no or negligible release of these materials to the environment. Therefore, no measureable direct or indirect adverse effects related to solid or hazardous wastes are anticipated from demolition activities.

4.6.3 Alternative B1 – Grandfather Existing and Prohibit New

Under Alternative B1, TVA would require that previously unapproved structures be modified or removed. NNs with permits would not be subject to new standards if they comply with current permit conditions. However, if these structures are not in compliance or deemed unsafe or derelict, they must be updated to meet the new standards.

Under Alternative B1, a total of 459 structures (25 percent of existing structures) are estimated to be FHs that would not be upgraded to meet new standards or noncompliant NNs. These structures would potentially be demolished, resulting in approximately 68,850 cubic yards of solid waste that would be hauled by truck and deposited in off-site landfills.

Under Alternative B1, fewer structures would be removed in 2021 and 2045 relative to Alternative A, as no new FHs would be permitted. Therefore, smaller quantities of wastes would be generated and transported to off-site landfills. Although smaller quantities of wastes would be generated under Alternative B1, the potential long-term effects associated with solid and hazardous wastes would be similar to those described for Alternative A. With implementation of the standard procedures for spill prevention and cleanup and waste management protocols in accordance with pertinent federal, state, and local requirements, no measurable direct or indirect adverse effects related to solid or hazardous wastes re anticipated from demolition activities.

4.6.4 Alternative B2 – Grandfather but Sunset Existing and Prohibit New

Under Alternative B2, a total of 459 structures (25 percent of existing structures) are estimated to be FHs that would not be upgraded to meet new standards or noncompliant NNs. These structures would potentially be demolished within the first few years, resulting in approximately 68,850 cubic yards of solid waste that would be hauled by truck and deposited in off-site landfills. The remaining structures (n = 1,378) would be removed from the reservoirs 30 years after TVA finalizes its new standards and rules. Approximately 206,700 cubic yards of solid waste would be disposed of over 30 years, with the majority of the solid waste being disposed of between 20 and 30 years as the structures degrade.

Under Alternative B2, all structures would be removed by 2045. Therefore, larger quantities of wastes would be generated and transported to off-site landfills relative to Alternatives A and B1. Although larger quantities of wastes would be generated, these disposal activities would occur over a longer period. Therefore, the potential long-term effects associated with solid and hazardous wastes would be similar to those described for Alternatives A and B1. With implementation of the standard procedures for spill prevention and cleanup and waste management protocols in accordance with pertinent federal, state, and local requirements, no measurable direct or indirect adverse effects related to solid or hazardous wastes are anticipated from demolition activities.

4.6.5 Alternative C – Prohibit New and Remove Unpermitted

Under Alternative C, TVA would prohibit FHs, require all unapproved structures to be removed, and clarify current regulations. A total of 918 structures (50 percent of existing structures) would potentially be demolished, resulting in approximately 137,700 cubic yards of solid waste that would be hauled by truck and deposited in offsite landfills.

Under Alternative C, more structures would be removed within the first few years, with fewer FHs removed over the 30-year period relative to Alternative A. Reducing the number of structures removed over the 30-year period would result in smaller quantities of wastes being generated and transported to off-site landfills relative to Alternative A. Although larger quantities of wastes would be generated under Alternative C, the potential long-term effects associated with solid and hazardous wastes would be similar to those described for Alternative A. With implementation of the standard procedures for spill prevention and cleanup and waste management protocols in accordance with pertinent federal, state, and local requirements, no measurable direct or indirect adverse effects related to solid or hazardous wastes are anticipated from demolition activities.

4.6.6 Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

Under Alternative D, all existing FHs that do not meet the five navigation criteria listed in the current regulations and derelict structures would be removed at the owner's expense within 18 months. Permitted NN structures would be allowed to stay on the reservoirs, but they would need to be compliant with current regulations. TVA thinks that few if any of the existing FHs in their current condition meet all the navigable houseboat criteria. Unless owners modify their structures to meet the criteria, a total of 1,377 structures (75 percent of existing structures) would potentially be demolished. Demolition of these structures would result in approximately 206,550 cubic yards of solid waste that likely would be hauled by truck and deposited in off-site landfills.

Under Alternative D, more structures would be removed within the first few years relative to Alternatives A, B1, and C. Fewer FHs would be removed over the 30-year period as all structures would be required to meet the five criteria. Although larger quantities of wastes would be generated under Alternative D, the potential long-term effects associated with solid and hazardous wastes would be similar to those described under the other action alternatives. With implementation of the standard procedures for spill prevention and cleanup and waste management protocols in accordance with pertinent federal, state, and local requirements, no measurable direct or indirect adverse effects related to solid or hazardous wastes are anticipated from demolition activities.

4.6.7 Cumulative Impacts

Implementation of any of the action alternatives would incrementally contribute to solid and hazardous waste generation during demolition; however, this generation would cease once demolition is completed. The cumulative effects would be as much as 275,550 cubic yards (Alternative B2) of additional waste disposed of at local or regional permitted landfills over 30 years. This contribution to Subtitle D landfills would reduce the capacity available for municipal waste and would reduce the operational life of the landfills. As demolition activities occur over time, landfills (nonhazardous solid wastes and hazardous wastes) would need to be evaluated to determine whether they have the capacity to handle the increased volumes of wastes from removal of FHs/NNs.

4.6.8 Summary

With implementation of the standard TVA procedures and compliance with federal, state, and local regulations, no adverse effects related to solid and hazardous wastes are anticipated from demolition activities.

4.7 Visual Resources

The scenic value or quality of visual resources commonly is based on human perceptions of intrinsic beauty as expressed in the forms, colors, textures, and visual composition seen in each landscape. Human perceptions of shoreline development such as marinas and FHs no doubt varies widely among users and recreationist depending on their preferences and expectations. The assessment of scenic quality is often evaluated using scenic attractiveness (e.g., outstanding natural features, scenic variety, seasonal change, and strategic location), scenic integrity (e.g., visual unity and wholeness of the natural landscape character), human sensitivity (e.g., the expressed concern of people for the scenic qualities of the project area derived or confirmed by public input), and viewing distance (i.e., how far an area can be seen by observers and the degree of visible detail). The impacts of TVA's Floating Houses Policy alternatives on visual resources were qualitatively evaluated considering the scenic quality characteristics described above.

As described in Section 3.7, the presence of FHs/NNs is an existing characteristic of the scenic quality on some TVA reservoirs, and the existing visual impacts vary widely among reservoirs based on the size and shape of the reservoir and location of the existing FHs/NNs. Drawdowns result in substantial seasonal changes in the scenic quality and integrity of the TVA reservoirs and can increase the visual prominence of FHs/NNs and other marina features when the drawdowns occur.

Impacts on visual resources from FHs/NNs would result from changes in marina boundaries, construction of new marinas, the density of FHs/NNs within the marinas, and the placement of FHs/NNs in areas outside of marinas. The impacts occur from the presence of the FHs/NNs as well as the increased land-based support facilities and other indirect development. The types and visual characteristics of FHs/NNs such as height, material, and condition also affect scenic quality in the reservoirs.

The FHs/NNs and associated development would affect the scenic quality of the views from the reservoir and the shorelines. Views from the reservoir, particularly for marinas located in coves, would generally be limited to the areas immediately adjacent to the marinas. In these areas, the views would often be limited to the first row of FHs/NNs and other vessels. Allowing additional FHs on the shoreline side of these marinas would cause limited impacts on the scenic quality of the view from the reservoir. General shoreline and views for owners of nearby residences or businesses would similarly be limited to areas close to the marina or mooring location. The topography and vegetation would screen development from much of the shoreline.

Views from vistas or other scenic view points would also be affected by FHs/NNs and associated development. Although the topography and vegetation would often limit these views to the middleground or background view, in some areas, the higher elevation would afford an obstructed view of the entire marina. Some of the FHs/NNs could be visible from vistas in the GSMNP, particularly near the dam and the portion of the Appalachian Trail that passes southeast of Fontana Dam. Views of the entirety of Fontana Marina would be available from the Appalachian Trail on the ridge in the Nantahala National Forest above the marina.

In general, alternatives that result in construction of fewer FHs, promote the removal of existing FHs/NNs, or provide limitations on the types of construction allowed would result in positive impacts on the scenic quality of the reservoirs. As an inventory of scenic value has not been conducted, the impacts of the alternatives are described qualitatively based on the range of conditions influencing scenic quality at the reservoirs.

4.7.1 No Action Alternative – Current Management

Under the No Action Alternative, the rate of development of FHs would stay the same, with a gradual increase in the number of FHs. The scenic quality of all reservoirs where FHs are developed would decrease due to the presence of additional FHs, expanded facilities at the marinas to accommodate the new FHs, and more marinas accommodating FHs. FHs/NNs would be visible in areas beyond the marinas and would affect more of the reservoir. The amount of decrease in visual quality would vary based on the number of new FHs and the existing conditions (e.g., Norris Reservoir currently has 921 existing FHs/NNs, and the additional 234 FHs projected by 2021 would blend in with the existing development at the 24 marinas). Although a much smaller number, the addition of the projected six FHs by 2021 to a reservoir such as Bear Creek with no existing FHs/NNs and 70 percent of the land within 0.25 mile of the shoreline classified as natural area would result in greater impacts on the scenic quality. Under the No Action Alternative, impacts on the visual quality of areas in the GSMNP with views of Fontana Reservoir would continue from the presence of additional FHs in the reservoir.

4.7.2 Alternative A – Allow Existing and New Floating Houses

Under Alternative A, development of new FHs would continue, and the scenic quality of the reservoirs—particularly in areas adjacent to the existing marinas—would decrease from the current conditions. The requirements to move existing and currently unpermitted FHs outside of marina harbor areas within harbors or off of the reservoir would concentrate the visual impacts on areas within the harbor. The impacts on the marina areas from increased FHs would be low because these areas are already visually disturbed and the presence of the FHs/NNs is part of the existing condition. Limitations on the size of the FHs would cause positive impacts on scenic quality, particularly on the views from the shoreline, elevated scenic vistas, and portions of the reservoir more removed from the marina, because the restrictions on their footprint would make the FHs more difficult to see. Positive impacts also would result from requirements to remove FHs/NNs that do not meet the minimum standards. No new impacts on visual quality would occur from continuing to allow existing permitted NNs at dispersed locations in the reservoir. Impacts on the visual quality of GSMNP areas with views of Fontana Reservoir from the presence of existing FHs/NNs and new FHs would continue, but the impacts would concentrated in the areas with marinas.

4.7.3 Alternative B1 – Grandfather Existing and Prohibit New

Under Alternative B1, no new FHs would be allowed anywhere in the reservoir, which would result in a neutral impact on the scenic quality of the 16 reservoirs with existing FHs/NNs. Alternative B1 would not affect visual quality in the 13 reservoirs without existing FHs/NNs. The requirements to move existing and currently unpermitted FHs outside of marina harbor areas within harbors or off of the reservoir would concentrate the visual impacts on areas within the harbor. The impacts on the marina areas from increased FHs would be low because these areas are already visually disturbed and the presence of the FHs/NNs is part of the existing condition. Limitations on the size of the FHs and types of construction would have positive impacts on scenic quality, particularly on the views from the shoreline, elevated scenic vistas, and portions of the reservoir more removed from the marina, because the restrictions on their footprint would make the FHs more difficult to see. Positive impacts would result from requirements to remove FHs/NNs that do not meet the minimum standards. No new impacts on visual quality would occur from continuing to allow existing permitted NNs at dispersed locations in the reservoir.

4.7.4 Alternative B2 – Grandfather but Sunset Existing and Prohibit New

The impacts on visual quality under Alternative B2 would be the same as for Alternative B1, except that after the sunset period expires and all FHs/NNs are removed, the visual quality of the entire reservoir would be positively affected for the 16 reservoirs with existing FHs/NNs. Alternative B2 would positively affect views from GSMNP and the Nantahala National Forest.

4.7.5 Alternative C – Prohibit New and Remove Unpermitted

Under Alternative C, no impact would occur to the scenic quality of the 13 reservoirs without FHs/NNs. The scenic quality of reservoirs such as Fontana and Norris with a significant number of FHs/NNs would be negatively affected in the short term by the use of equipment and other activities required to remove the existing unpermitted FHs and noncompliant, permitted NNs. The long-term scenic quality from the reservoir, shoreline, and elevated scenic vistas, including those from GSMNP and the Nantahala National Forest, would improve as fewer FHs would detract from views of the reservoir and surrounding natural features.

4.7.6 Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

Under Alternative D, the presence of FHs/NNs would continue to degrade the scenic quality of the reservoirs. However, positive impacts on scenic quality would occur as some FHs would likely not meet the five navigation criteria and would be removed. Additionally, more stringent enforcement of requirements would deter some owners from mooring new FHs on the reservoirs and would result in a long-term positive impact. Restricting marina mooring and operations to the existing, approved marina harbor limit space would improve the scenic quality in areas where FHs are currently moored beyond the existing limits.

4.7.7 Cumulative Impacts

Cumulative visual impacts may occur when visual impacts from FHs and NNs at existing and future marinas combine with visual impacts from surrounding land uses to produce an additive effect on scenic quality. The No Action Alternative and Alternative A have the greatest potential to negatively affect the scenic quality of the reservoirs. In general, adverse cumulative visual impacts would be greater on reservoirs with the largest amount of existing developed shoreline and reservoirs with shoreline planned for future development. Particularly, highly altered shorelines adjacent to marinas with surrounding industrial or TVA project operations land uses would experience the greatest potential for adverse cumulative visual impacts. Alternatives B1, B2, C, and D would result in fewer FHs/NNs, reducing the potential for adverse cumulative visual impacts. In the long term, Alternative B2 has the greatest potential to positively affect the scenic quality, with the greatest reduction in the number of FHs..

4.7.8 Summary

In summary, the No Action Alternative and Alternative A have the greatest potential to negatively affect the scenic quality of the reservoirs. Alternatives B2 (long term) and C (short term) have the greatest potential to positively affect the scenic quality. Alternatives B1 and D would have little impact on the scenic quality of the reservoirs.

4.8 Land Use

Several of the alternatives being considered for management of FHs/NNs on TVA reservoirs may result in a change in land cover type for reservoir lands. However, none of these changes would result in a change to the land use designation, as assigned by TVA through the NRP. To assess the impacts on land use for each proposed alternative, any increase in FHs was assumed to result in expansion of marinas, and any decrease in the number of FHs/NNs was assumed to produce few changes to marinas. Any marina expansions would be required to meet all TVA permit requirements prior to construction. No impacts on prime farmland are expected under any of the alternatives.

4.8.1 No Action Alternative – Current Management

Under the No Action Alternative, TVA would continue to use discretion in enforcement against FHs/NNs that are not compliant with the current regulations. If the number of NNs and FHs is allowed to remain unchecked, marinas would likely seek TVA approval to expand their facilities to account for the increase, including construction of new marinas. Construction of these expanded and new marinas would be limited to land categorized as Zone 6 or Zone 1 as defined by TVA. These expansions could result in an overall land use change along Zone 6 or Zone 1 shorelines from undeveloped to developed. However, this land use change would be restricted to land within Zone 6 and Zone 1 and would not affect land within other more sensitive land management zones.

4.8.2 Alternative A – Allow Existing and New Floating Houses

Under Alternative A, TVA would allow existing and new FHs as long as they meet the new standards developed by TVA. NNs would be allowed if they meet the standards and conditions in their existing permits under the 1978 regulations. Part of the new established standards would be the requirement that all existing and new FHs are moored within a marina. This requirement could result in requests for TVA to approve the expansion of most of the marinas within the reservoirs, as well as construction of new marinas. These expansions would result in development of land to accommodate the expansions. However, given the new standards that would be required under Alternative A, the number of new FHs that would be built would be fewer than under the No Action Alternative.

Alternative A would likely result in fewer land use impacts than the No Action Alternative. As with the No Action Alternative, the land use change would be restricted to land within Zone 6 or Zone 1 and would not affect land within other more sensitive land management zones.

4.8.3 Alternative B1 – Grandfather Existing and Prohibit New and Alternative B2 – Grandfather but Sunset Existing and Prohibit New

Land use impacts under Alternatives B1 and B2 would be similar and would be less than under the No Action Alternative and Alternative A. All existing FHs/NNs in compliance would be allowed to remain; however, no new FHs would be allowed on TVA reservoirs. Existing NNs would be required to meet the standards listed in their existing permit or, if out of compliance, would be required to meet TVA's new standards and requirements, which would include the requirement to be moved into marina harbor limits. This requirement may result in the need for some marinas to expand their facilities and/or their harbor limits. The expansion of the facilities would be limited to Zone 6 and Zone 1 lands, which would be compatible with the allowed use of the land as planned by TVA

4.8.4 Alternative C – Prohibit New and Remove Unpermitted and Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

Under Alternative C, TVA would prohibit new and existing FHs and would update its current rules to replace the NN prohibition with a broader prohibition on FHs. The NNs permitted under 1978 regulations would remain valid if compliant with current permit conditions. Under Alternative D, the current TVA policy would not change. However, unlike the No Action Alternative, TVA would devote more resources to enforcement of its regulations resulting in the removal of all unpermitted FHs that do not meet the five navigation criteria listed in 18 CFR 1304.101(a) and would prohibit all new FHs. Under these alternatives, it is not expected that marinas would need to expand their footprint or harbor limits to accommodate FHs, resulting in limited to no land use changes in Zone 6 or Zone 1 lands.

4.8.5 Cumulative Impacts

No adverse cumulative impacts are anticipated for land use based on the proposed alternatives. Any land use changes that would occur due to the alternatives would be required to meet the land management policies outlined in the NRP, reservoir LMPs, and the SMI—as are any other projects that would occur within the reservoirs. While some of the proposed alternatives may require expansion of marinas, these expansions would be limited to the allocated land use zone for recreation (Zone 6), and non-TVA land (Zone 1). Any other projects that occur within the reservoir would also be required to adhere to the designated land use zones. Therefore, no cumulative impacts on land use designations are anticipated. Any residential development of land, whether due to TVA's Floating Houses Policy or to other projects, would be required to meet the policies in the SMI. Since all projects would adhere to these policies, no cumulative impacts are anticipated.

4.9 Cultural Resources

Any disturbance and or change within the APE could adversely affect historic properties. Section 106 review would take place as site-specific actions associated with policy implementation occur. Potential adverse effects to historic properties would be identified and mitigated appropriately under Section 106 of the NHPA. Following the selection of an alternative, Section 106 consultation would be initiated with the SHPO in each respective state. On April 30, 2015, TVA initiated the Section 106 consultation process with the SHPOs from the seven states in the TVA region as well as with federally recognized Indian tribes.

4.9.1 No Action Alternative – Current Management and Alternative A – Allow Existing and New Floating Houses

Alternatives that may lead to an increase in FHs (No Action Alternative and Alternative A) and an associated marina expansion and increased shoreline and reservoir bottom disturbance and increased human activity in the reservoir drawdown zone have the potential to adversely affect historic properties in the APE. The No Action Alternative and Alternative A could lead to this increase by allowing new FHs on the reservoirs. On Norris Reservoir alone, this may adversely affect up to 314 known inundated and unevaluated archaeological sites in these areas; additionally, 22 known NRHP-eligible architectural resources are located in this reservoir area that may be adversely affected by the increase in FHs. In addition, alternatives that may lead to an increase in FHs may adversely affect unknown archaeological sites and architectural resources within the APE.

4.9.2 Alternative B1 – Grandfather Existing and Prohibit New, Alternative B2 – Grandfather but Sunset Existing and Prohibit New, Alternative C – Prohibit New and Remove Unpermitted, and Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

Alternatives B1, B2, C, and D would likely decrease the number of FHs/NNs on the TVA reservoirs and may be beneficial as these alternatives may result in fewer than existing effects to cultural resouces caused by bottom disturbance and human activity in the drawdown zone. This decrease would likely reduce adverse effects from FHs/NNs sitting on the shoreline during drawdown and shoreline erosion within the APE, which could reduce the likelihood of adverse effects to inundated historic properties. Under Alternative D, however, after an initial decrease in the number of structures, the number of structures designed and used primarily for habitation would increase over time, thereby increasing potential adverse effects.

Per Section 106 of the NHPA, site-specific development within TVA lands that lack recent survey data could require the following actions, minimizing the potential impacts of new or expanded marinas on cultural resource:

- Identification of historic properties (Phase I survey, identify properties potentially eligible for listing in the NRHP)
- Assessment of potential effects (Phase II testing, to evaluate NRHP eligibility)
- Resolution of potential effects (Phase III mitigation, for properties determined eligible for listing in the NRHP)

4.9.3 Cumulative Impacts

There is a potential for adverse effects to historic properties regardless of which alternative is chosen. As identified in prior EIS documents, the potential for cumulative effects is related, directly or indirectly, to the reservoir operations policy. Previous studies have identified factors such as soil erosion, exposure by water level fluctuations, development of back-lying lands, and increased exposure to looting or vandalism as principal factors relating to cumulative effects to both archaeological sites and architectural resources.

Residential shoreline development has been identified as the largest contributor to cumulative effects to historic properties within TVA-managed lands. Commercial recreation facilities like marinas and campgrounds can also result in adverse effects to historic properties and contribute to cumulative impacts. These developments, although localized, tend to develop a higher percentage of land on a given parcel than residential shoreline development. When aggregated throughout a management area, these developments may result in adverse effects to historic properties.

Section 106 review would take place on each site-specific action associated with implementation of the Floating Houses Policy (undertaking); and potential adverse effects to historic properties would be identified and mitigated appropriately under Section 106 of the NHPA.

4.9.4 Summary

Based on the proposed alternatives, the the No Action Alternative and Alternative A may have the potential to adversely affect historic properties, due to a potential increase of FHs in the APE and the associated shoreline and bottom disturbance and human activity within the reservoir drawdown zones. Alternatives B1, B2, C, and D may be less likely to affect historic properties due to the potential decrease of FHs in the APE and a presumed decrease in erosion.

In summary, all of the alternatives have the potential to adversely affect historic properties within the APE. Once a preferred alternative is chosen, these potential adverse effects will be addressed under Section 106 of the NHPA.

4.10 Water Quality

As stated earlier, TVA has listed certain TVA reservoirs as No Discharge reservoirs. No Discharge zones are areas of water that require greater environmental protections. On No Discharge reservoirs, for instance, Type I and Type II MSDs on vessels cannot be used and must be secured to prevent discharge (e.g., closing and padlocking the seacock, using a nonreleasable wire-tie, or removing the seacock handle would be sufficient). Generally, all freshwater lakes and similar freshwater impoundments or reservoirs with no navigable connections to other waterbodies, and rivers not capable of interstate vessel traffic, are by definition considered No Discharge zones.

Even the discharge of treated sewage could be harmful, which is why it is regulated by the USCG for vessels and by state environmental agencies that are responsible for issuing NPDES permits for facilities that discharge sewage or other wastewaters. Discharges of sewage on land, not to surface waters, are usually regulated by the local county environmental agency. Such discharges are normally treated through septic tank/adsorption field systems or other on-site wastewater treatment systems.

Only four reservoirs listed as No Discharge reservoirs have a high estimated probability of FH increases: Norris, Fontana, Boone, and Watauga. Nine reservoirs have a high estimated probability of FH increases where discharges from Type I and Type II MSDs on boats are currently allowed. These nine reservoirs are listed in Table 4.10-1. Except for South Holston, which is a tributary reservoir, all of these reservoirs are mainstem reservoirs.

Table 4.10-1. Reservoirs with High Probability of Increases in Floating Houses Where MSD Discharge Is Allowed

Reservoir	Current Number	MSD Discharge Allowed?	Ecological Health
South Holston	117	Yes	Fair
Fort Loudoun	100	Yes	Fair
Kentucky	55	Yes	Good
Nickajack	30	Yes	Good
Chickamauga	20	Yes	Good
Guntersville	12	Yes	Good
Pickwick	2	Yes	Good
Watts Bar	2	Yes	Fair
Wheeler	0	Yes	Fair

MSD = marine sanitation device

Of the five reservoirs that this review focuses on, TVA has listed Norris, Fontana, and Boone Reservoirs as No Discharge reservoirs. South Holston and Fort Loudoun Reservoirs are not classified as No Discharge reservoirs, and discharges from Type I and Type II MSDs on boats are allowed.

4.10.1 Wastewater Discharges

The largest potential source of water quality impacts from existing FHs/NNs and future FHs is wastewater discharges, including sewage. The primary wastewater discussed in this section is sewage (black water and grey water). Black water is normally defined as water from toilets, urinals, bidets, kitchen sinks, dishwashers, and garbage disposals. Generally, grey water is defined as wastewater generated from residential bathroom sinks, bathtubs, showers, clothes washers, and laundry trays (GA 2014).

However, wastewater from maintenance activities, such as pressure washing exterior surfaces with soap or detergents, could also adversely affect water quality. Most house washes contain alkaline detergents or sodium hydroxide. Some also contain bleach or compounds to kill mildew.

Discharge of solid and hazardous wastes, such as paint overspray or fuel spills, into surface waters would also adversely affect surface water quality. No discharges of solid or hazardous wastes should be allowed into surface waters. Potential impacts from solid and hazardous wastes are addressed in Section 4.6, Solid and Hazardous Wastes.

TVA does not have a specific program to monitor water quality at or near marinas. TVA has received information from the public that the discharge of grey water from FHs/NNs is common, and TVA personnel have also observed that discharge of grey water from FHs/NNs is common in some areas. Some FH/NN owners informed TVA staff during the scoping meetings for this EIS that they and other owners directly discharge grey water into reservoirs, including into No Discharge reservoirs (the owners were unaware that such discharges were not allowed). Despite an abundance of anecdotal information, data are limited from water quality sampling related to sewage discharges, both black and grey, from FHs/NNs.

As noted above, discharges of black water are not allowed on No Discharge reservoirs. Because of the noxious nature of black water, most marinas require or encourage use of holding tanks and pump-out services for black water, even on reservoirs where those wastes could technically be discharged through an MSD. Discharge of black water at or near marinas into TVA reservoirs is widely considered undesirable by the public who recreate on the reservoirs. Some in the public have stated that they have less concern for the discharge of grey water into the reservoirs, and the capture and control of grey water through the use of MSDs or holding tanks have not been enforced as strictly as for black water. TVA estimates that large numbers of FHs/NNs discharge grey water directly to surface waters even on No Discharge reservoirs.

In the past, TDEC has investigated reports of swimmers contracting infections in some marinas with FHs/NNs. In one case, an individual had a serious skin infection, reportedly after swimming with an open wound at an FH near Flat Hollow Marina in Campbell County. This FH discharged its grey water untreated straight into the reservoir. While there, TDEC sampled the reservoir water on all four sides of the FH for E. coliform . Three of the samples were <1 unit/100 ml, but the sample from the east side was 579 units/100 ml. This exceeded the individual sample maximum for reservoirs of 487 units/100 ml. (Section 1200-04-03-.03[4][f] of TDEC's rules) (TDEC 2013).

As previously noted, due to the intermittent nature of discharges from FHs/NNs, the impacts of those discharges have been difficult to quantify, resulting in a lack of water quality data that could be directly related to FHs/NNs. Unless a monitoring team just happens to be immediately downflow of one of these short, unscheduled discharges, the sample collected will not be representative of a discharge.

Many FHs/NNs are occupied intermittently, primarily during the late spring through early fall boating and fishing season. Average occupancy rates across all reservoirs increase from approximately 30 to 88–99 percent from May through August. As stated in Chapter 3, some tributaries are already impaired for constituents (E. coliform , nutrients) from agricultural and/or MS4 discharges that also are expected from FHs/NNs. Where those tributaries discharge into areas with nearby marinas, the expected volume of wastewater discharged from FHs/NNs could add pollutants, with resulting potentially adverse impacts on surface water quality. The reservoir water quality data and reservoir ecological health data do not show these adverse impacts at this time. This is probably because of high flow rates through the reservoirs, combined with the relatively small volumes of wastewater generated by FHs/NNs in comparison with agricultural and urban runoff and large municipal and industrial wastewater discharges. However, water quality data and experience from other states, together with the overall water quality body of knowledge, support the conclusion that increasing amounts of FH/NN wastewater discharged to surrounding surface waters would probably result in localized adverse impacts. These impacts would probably first be seen in areas with low flows and flushing rates. The summer season is also the time when high temperatures and potential stratification already result in lower ecological health ratings for some reservoirs.

During the off-season, from late fall through the winter until spring, many FHs/NNs are not occupied. Average occupancy rates across all reservoirs during this time range from 37 percent in November to approximately 30 percent in December–February. In March, the occupancy rate increases back up to 48 percent. The low volume of wastewater discharged during the off-season could allow the ecological health of an area that had been affected during the peak season to recover. How well the surface water quality returned to normal during the off-season would depend on how severely it had been stressed during the peak season. in addition to other factors such as flushing and re-aeration rates.

In the early 2000s, TVA conducted two studies that focused on the performance of land-based, on-site wastewater treatment systems serving marinas and campgrounds. The first screening study evaluated the strength of pump-out wastes and septic tank effluent concentrations. It found that pump-out wastes had significantly higher (from 2 to 20 times) concentrations for several parameters than typical residential wastewaters. For example, 70 percent of the chemical oxygen demand samples of septic tank effluent in these pump-out wastewater treatment systems were from 2 to 10 (200 to 1,000 percent) times stronger than that normally seen in residential septic tank effluent (RSTE). For nutrients, 70 percent of the samples for total Kjeldahl nitrogen were from 2 to 11 (200 to 1,100 percent) times stronger than RSTE. For ammonia nitrogen, 100 percent of the samples were from 2 to 21 (200 to 2,100 percent) times stronger, and 60 percent of the total phosphorus samples were from 2 to 6 (200 to 600 percent) times stronger than RSTE. Some of the increased strength is probably due to less dilution by water because of ultra low-flow or zero-flow toilet fixtures. Some of the high concentrations, such as for ammonia nitrogen, may also be due to compounds added to pump-out tanks to control odor that contain ammonia or nitrogen compounds.

The first study found that additives commonly used in pump-out tanks contained various chemicals or bio-enzymatic compounds. Common chemicals in these pump-out tank additives were formaldehyde, paraformaldehyde, quaternary ammonium compounds, ammonium chloride compounds, sodium nitrate, methyl alcohol, surfactants, or ethylenediaminetetraacetic acid. Common bio-enzymatic compounds were mixtures of bacterial cultures. (TVA Public Power Institute 2003.)

The follow-up study evaluated treatment in the adsorption fields receiving the septic tank effluent. For the three systems evaluated, the adsorption fields provided a high level of treatment despite heavy loading associated with marina campground and pumping wastes. Removal rates for nutrients, chemical oxygen demand, and biological oxygen demand (BOD5) ranged from 83 to 98 percent, except for nitrate-nitrite. Nitrate-nitrite increased in the adsorption fields as expected because of the oxidation of ammonia to nitrate. Most of these facilities were heavily loaded for approximately 6 months per year, so the adsorption fields were able to rest and recover during the off season. (TVA Research & Technology Applications 2007)

Sewage (black water and grey water) volume and constituents from land-based residences have been studied and quantified. It is reasonable to assume that sewage discharges from FHs/NNs would be similar.

Using soaps and other products that are labeled “natural” or “biodegradable” does not eliminate potential water quality impacts from grey water. By definition, biodegradable products are broken down or degraded faster than non-biodegradable compounds. In surface waters, when organic compounds are broken down, it is normally by bacteria that are using the compounds for food. This bacterial respiration and growth consumes oxygen. In confined areas with low flushing rates, this faster degradation could result in a faster drop in DO in the surface water, compared to less biodegradable compounds that would have more time to be flushed out into the main reservoir.

The composition of domestic grey water has also been shown to have increased salinity, with total dissolved solids (TDS) of 200 to 400 mg/L, and total alkalinity, as CaCO3, of 60 to 120 mg/L. Most of the TDS and alkalinity are from cleaning products and detergents. Domestic grey water is also known to contain coliform bacteria and other microorganisms; for example, total fecal coliform concentrations of 105 and 104 organisms/100 milliliters should be expected. (Metcalf and Eddy 2006.)

4.10.1.1 Wastewater Volume Estimates

The average indoor use of water in a water-conserving home has been estimated at approximately 45 gallons per capita per day (gpcd). Typical black water (toilets, dishwashers, kitchen sinks) makes up less than 20 percent, or approximately 9 gpcd of this total. Showers, baths, clothes washers, and bathroom sinks (typical grey water) have been estimated at approximately 68 percent, or 31 gpcd. A conservative average of 2.46 people per house results in an estimated 111 gallons per day (gpd) per residence. Some of the FHs/NNs advertised for rent have capacities for up to 16 people. If that FH/NN was at full capacity (16 occupants), it would generate over 140 gpd of black water from toilets and dishwashers and over 490 gpd of grey water. (Vickers 2001.)

Table 3.3-4 states that occupancy of rental FHs/NNs is over 98 percent during the peak months of June and July. As listed in Table 4.10-2, assuming that 98 percent of the FHs/NNs (1,595 of 1,628) are occupied by 2.46 people on a given day during the peak summer season, those occupied FHs would produce 35,191 gpd of black water on the five targeted reservoirs alone. Those same FHs/NNs would generate approximately 121,826 gpd of grey water.

Table 4.10-2. Estimated Volumes of Black and Grey Wastewater in the Five Targeted Reservoirs [a]

Reservoir	Estimated Current Number of Floating Houses	Black Wastewater (gpd)	Grey Wastewater (gpd)
Norris	921	19,908	68,920
Fontana	357	7,717	26,715
Boone	133	2,875	9,953
South Holston	117	2,529	8,755
Fort Loudoun	100	2,162	7,483
Total	**1,628**	**35,191**	**121,826**

gpd = gallons per day
[a] Based on 98 percent of the current number of FHs/NNs holding 2.46 people.

Adding the existing 202 FHs/NNs on Kentucky, Watauga, Nickajack, Chickamauga, Guntersville, Hiwassee, Blue Ridge, and Fort Patrick Henry Reservoirs would increase these estimates by 12.4 percent. This addition would raise the total peak summer day black and grey wastewater estimates from FHs/NNs in the TVA region to approximately 40,000 gpd and 137,000 gpd, respectively. Occupancy during the winter months may drop significantly, with resulting decreases in generation of wastewater.

The average occupancy rate for a whole year for both rental and owned FHs/NNs is estimated at 16.6 percent. During that year, the existing FHs/NNs on the five targeted reservoirs are estimated to generate 2.2 mg of black water and 7.5 mg of grey water. The 202 existing FHs/NNs on the other 8 reservoirs would increase those values to 2.4 mg of black water and 8.4 mg of grey water during that same year. If 95 percent of all the black water generated is captured and treated, the remaining 5 percent would result in 120,000 gallons of untreated black water being discharged to TVA reservoirs every year.

Based on incidents and practices reported to TVA and observations made by TVA staff, TVA estimates that the amount of grey water discharged without treatment is probably much greater than 5 percent, possibly over 50 percent. On Discharge reservoirs, black water could be discharged through Type I or Type II MSDs. These MSDs provide disinfection but no reduction in organic strength such as measured by BOD. On Discharge reservoirs, therefore, discharge of black water through MSDs could be a contributing factor to low DO conditions.

For example, the Big Sandy Embayment on Kentucky Reservoir is included in Tennessee's Section 303(d) list as impaired for nutrients and low DO. TVA's VSMP also lists the DO levels in Big Sandy Embayment as poor. The probable sources listed in the Section 303(d) report are septics and pasture grazing. Elk River Embayment on Wheeler Reservoir also has poor DO levels according to TVA's VSMP. Alabama's Section 303(d) list identifies the embayment as impaired for nutrients from agricultural sources. Neither of these embayments are currently significantly affected by marinas or FHs/NNs. However, because these areas are already impaired, any additional pollutants from future FHs would add to the problem.

Potential impacts on surface water quality from any discharge are increased when the receiving water has little mixing or flushing action from streamflows (Higgins 2008). If FHs/NNs are located in small coves or embayments fed by small drainage areas, the potential adverse impacts on surface water quality would be greater than similar FHs/NNs located in areas with higher flow rates and, consequently, higher flushing rates. Most marinas on TVA reservoirs are located in coves and embayments that are not near the main river channel. Therefore, most marinas on TVA reservoirs receive less flushing and mixing than would be indicated by total reservoir turnover or discharge rates. Most of the existing FHs/NNs on TVA reservoirs are located in marinas that receive less flushing and mixing than reservoir flow rates suggest.

4.10.2 Regulation of Discharges

The discharge of sewage and grey water is an issue of concern to state regulatory agencies within the region and across the nation, as well as to industry groups. For example, none of the Tennessee Valley states allow any discharge of sewage unless it is from a permitted facility and the discharge(s) meet the terms of that permit.

The follow regulations illustrate that Tennessee law does not allow discharge of sewage unless treated appropriately and authorized by permit. Gray water is considered sewage.

- TN Code 69-9-102 Sewage Disposal
    - Any person, firm, corporation or business entity operating a commercial boating facility, dock or marina that stores or houses vessels equipped with a toilet and sewage collection tank, or when such facilities are operating on waters in this state, shall provide facilities for the sanitary pumping and disposal of sewage from such collection tanks.
- TN Code 69-3-103. Part definitions.
    - (4) “Boat” means any vessel or watercraft moved by oars, paddles, sails or other power mechanism, inboard or outboard, or any vessel or structure floating upon the water whether or not capable of self-locomotion, including, but not limited to, houseboats, barges, docks, and similar floating objects;
    - (32) “Sewage” means water-carried waste or discharges from human beings or animals, from residences, public or private buildings, or industrial establishments, or boats, together with such other wastes and ground, surface, storm, or other water as may be present;

TDEC staff has expressed concerns to TVA about discharges from FHs/NNs in Tennessee and consider discharges from FHs/NNs as being comparable to discharges from houses on the shore with an untreated discharge straight-piped into the reservoir.

North Carolina regulations state that any discharge into surface waters should be covered by and in compliance with an NPDES permit. If a facility discharges from a point source into the waters of the United States, the owner/operator needs an NPDES permit unless the activity is "deemed permitted."

The relevant regulations in other Valley states are substantially the same as Tennessee’s and North Carolina’s in addressing sewage and grey water disposal. All sewage discharges, black water and grey water, should be managed in accordance with all applicable federal, state, and local regulations. The new wastewater standards proposed in Alternatives A, B1, and B2 would align with all applicable federal, state, and local regulations governing wastewater management. This could greatly reduce potential surface water impacts from existing FHs/NNs and new FHs.

In other regions, discharges from FHs have been addressed similarly. For instance, FHs are prevalent in Oregon and have been closely regulated by the State of Oregon. In 1996, the State of Oregon Department of Environmental Quality (ORDEQ) and State Marine Board issued *Guidelines for Sewage Collection and Disposal for Recreational Boats, Commercial Vessels and Floating Structures* (ORDEQ 1996). This document defined grey water to mean any water-carried waste other than black water, such as bath, kitchen, or laundry wastes. Recreational boat and vessel owners are strongly encouraged to collect and properly dispose of grey water and to refrain from discharging it overboard. This document also stated that “Any plumbing fixtures present on structures to include floating homes, boathouses, or combos shall be continuously connected to a Department approved sewerage system as per ORS 468B.080 (includes grey and black water) except structures with only hose bibs. This includes both sole State Waters and federal Navigable Waters.

Discharge of any untreated sewage from any structure on or in sole State Waters or federal Navigable Waters without a DEQ discharge permit is illegal."

The regulation of black and grey wastewaters in marinas is also supported by some industry groups. The Association of Marina Industries (AMI) advocates for marinas to participate in Clean Marina programs and recommends that all marinas in states with Clean Marina programs be certified. The group has stated that the Clean Marina program educates marinas that do not currently meet the Clean Marina requirements about regulatory requirements and new technologies or products to manage wastewaters. In 2014, AMI compiled the common BMPs found in Clean Marina programs across the country in a resource titled *Best Management Practice for Clean Marinas*. In the document (page 9), AMI recommends that discharge of wastewater from vessels be prohibited, with the following recommendations:

- Prohibit discharge of head waste and grey water in your marina as a condition of your lease agreements.
- Post signs indicating the prohibition and directing people to use shoreside restrooms.
- Determine means to ensure valves on holding tanks are closed.

The broad position of state environmental regulatory agencies and the AMI is that no discharge of untreated black or grey water from FHs/NNs should occur. Type I and Type II MSDs would address only the bacterial component of grey water. The added disinfectants could increase the TDS and/or alkalinity associated with grey water.

4.10.2.1 No Action Alternative – Current Management

Under the No Action Alternative, TVA would continue to use discretion in enforcing its Section 26a regulations (at 18 CFR 1304.101[a]) that address FHs/NNs. This alternative assumes that current trends continue and that safety, electrical, mooring, and water quality issues persist (in the absence of new standards) and could increase as greater numbers of structures are developed on reservoirs.

Current regulations forbid new FH/NN structures. However, if the current trend continues, it is likely that new FHs would continue to be developed on TVA reservoirs, especially at Norris and Fontana, by those unfamiliar with the existing restrictions or by those who knowingly build FHs in violation. Also, it is likely that new FHs would eventually appear at reservoirs that do not currently have them, most likely at marinas (with fewer outside of marinas). Valley-wide, the number of FHs/NNs has increased from 527 in 1997, to 860 in the mid-2000s, to 1615 in 2012. The growth from 527 in 1997 to 1615 in 2012 represents an increase of over 300 percent during those 15 years. During the same 15 years, the number of FHs/NNs in Norris Reservoir has doubled. Reservoir recreation specialists have estimated that the number of FHs/NNs could double by 2045. If twice as many FHs/NNs are assumed present in the five targeted reservoirs by 2045, the volume of wastewater generated in these reservoirs could reach the levels listed in Table 4.10-3.

Table 4.10-3. Estimated Average Annual Black and Grey Wastewater Volumes in the Five Targeted Reservoirs (2045)

Reservoir	Projected Number of Floating Houses/ Nonnavigable Houseboats	Black Wastewater (million gallons)	Grey Wastewater (million gallons)
Norris	1803	2.4	8.4
Fontana	699	0.9	3.3
Boone	260	0.36	1.2
South Holston	229	0.3	1.08
Fort Loudoun	196	0.26	0.9
Total	**3,187**	**4.2**	**14.9**

Valley-wide, the estimated doubling in numbers of FHs/NNs could result in 4.8 mg of black wastewater generated each year by 2045. It could also result in 16.8 mg of grey water being generated from all the FHs/NNs during the year. If 95 percent of the black water is captured and properly treated, the remaining 5 percent would result in 0.24 mg of untreated black water discharged to TVA reservoirs every year. Untreated grey water discharged to TVA reservoirs could range from 5 to 50 percent of the total 16.8 mg generated per year (0.84 to 8.4 mg per year).

On a reservoir basis, these discharges would not be significant. For example, as shown in Table 4.10-4, Norris Reservoir has the highest estimated numbers of FHs/NNs and the potential 1,803 FHs/NNs in 2045 could potentially generate 10.89 mg per year of combined black and grey wastewater. However, the average annual flow through Norris Reservoir is 949,730 mg (2,602 million gallons per day [mgd] x 365 days). The potential 10.89 mg per year of wastewater would account for only 0.0011 percent of the flow through Norris Reservoir. Using the daily maximum estimate of 0.178 mgd for a peak summer day results in the wastewater being only 0.0068 percent of the average 2,602-mgd flow through Norris Reservoir.

Table 4.10-4. Average Annual and Daily Maximum Wastewater as Percentages of Mean Annual Reservoir Flows

Reservoir	Mean Annual Flow (mgd)	Average Annual Wastewater Volume (mg)	Average Wastewater as Percent of Mean Annual Flow (%)	Maximum Daily Wastewater (mgd)	Maximum Daily Wastewater as Percent of Mean Annual Flow (%)
Norris	2,602	10.89	0.0011	0.178	0.0068
Fontana	2,442	4.22	0.0005	0.069	0.0028
Boone	1,552	1.57	0.0003	0.026	0.0017
South Holston	593	1.38	0.0006	0.023	0.0038
Fort Loudoun	10,317	1.18	0.00003	0.019	0.0002

mg = million gallons; mgd = million gallons per day

In areas with large numbers of FHs/NNs and low flushing rates, this large growth in FHs could result in adverse impacts on surface water quality from the discharge of untreated sewage (black and grey). These increased wastewater loadings could adversely affect the ecological health of small embayments on TVA reservoirs with low flushing rates. In those localized areas, increased organic and nutrient loadings could lower DO levels. This assumes no change in existing patterns of wastewater discharge. If Valley states and TVA increase enforcement of existing regulations and standards related to wastewater, especially grey water, these values could be significantly reduced.

Localized areas, such as embayments, with the largest numbers of FHs/NNs would be affected more than those with fewer numbers of FHs/NNs. Areas in mainstem reservoirs with higher flushing rates would probably be less affected than areas in the tributary reservoirs with longer retention times and lower flushing rates. Local areas, such as Big Sandy and Elk River Embayments, that are already stressed and in the lower range of conditions for an ecological health measure could be more likely to drop to a lower rating under the No Action Alternative.

The large amount of pump-out wastes generated could require increases in the capacity of pump-out systems and the wastewater treatment systems that handle the pump-out wastes, if those systems are already operating at or near their full capacity. If the capacity of wastewater systems is exceeded, the quality of their discharges could decline and adversely affect the surface water quality of their receiving streams.

4.10.2.2 Alternative A – Allow Existing and New Floating Houses

Under Alternative A, TVA would allow existing and new FHs that meet minimum standards to moor within permitted marina harbor limits at compliant, approved marinas. TVA would require modifying or removing unapproved structures. TVA would update its rules to set minimum standards for safety and wastewater issues, which TVA would enforce.

Implementing the standards and enforcement measures included in Alternative A would result in less untreated black and grey water discharge to surface waters. Permitted NNs in compliance with their permit would not be subject to the proposed new wastewater standards. On No Discharge reservoirs, grey water from FHs would be contained and treated with the black water. On Discharge reservoirs, grey water could be discharged through appropriate treatment systems in accordance with federal, state, and local regulations.

The change in wastewater loadings from the combination of new stricter wastewater standards coupled with a dramatic increase in the number of FHs is less certain than the large increases described for the No Action Alternative. If the new wastewater standards prohibit wastewater discharges (black and grey) for all FHs, the projected increase in number of FHs would not increase wastewater loadings and wastewater impacts could decrease greatly. If the new wastewater standards allow discharge of grey water on Discharge reservoirs, the increase in numbers of FHs on Discharge reservoirs could lead to an increase in grey water discharges.

Total wastewater loadings result from the total number of sources multiplied by the average wastewater volume from these sources, multiplied by the average wastewater concentration from these sources. It is estimated that the number of FHs/NNs would increase by 70 percent by 2045 under Alternative A. A 70-percent increase in the number of sources could be offset by either a 70-percent reduction in the average wastewater volume or by a 70-percent reduction in the average wastewater concentration. It is believed that the combination of stricter wastewater standards and the expected large increase in numbers of FHs are likely to result in total wastewater loadings that are less than or equal to the current loadings.

Wastewater loadings equal to current ones would not cause additional negative impacts on the ecological health of small embayments. Any adverse impacts from wastewater loadings equivalent to current loadings would remain. Small decreases in loadings would probably result in slightly less negative impacts on the ecological health of those embayments. Consequently, the estimated impacts of Alternative A on water quality are less than those estimated for the No Action Alternative.

On a reservoir basis, these discharges would not be significant. As stated above, if the new wastewater standards prohibit all wastewater discharges from current and future FHs, with the exception of permitted NNs in compliance with their permit, this alternative could result in a large reduction in total wastewater loadings to areas with FHs on TVA reservoirs. The estimated impacts are all neutral for embayments with FHs on each of the five targeted reservoirs. If increased loadings are not offset by the new wastewater standards, the embayments with the largest numbers of FHs could be affected more than those with fewer numbers of FHs. Embayments on the mainstem reservoirs with higher flushing rates would probably be less affected than embayments on the tributary reservoirs with longer retention times and lower flushing rates. If loadings are increased to embayments that are already stressed and in the lower range of conditions for an ecological health measure, the health ratings for those reservoirs could drop to a lower rating under Alternative A.

4.10.2.3 Alternative B1 – Grandfather Existing and Prohibit New

Under Alternative B1, TVA would approve existing FHs that meet minimum standards and allow mooring within permitted marina harbor limits. TVA would require modifying or removing previously unapproved structures. TVA would prohibit new FHs. It is estimated that these changes would result in a 25-percent reduction in the number of FHs/NNs by 2045 under Alternative B1. TVA would also establish and enforce new standards to address safety, water, and waste issues.

Implementing the standards and enforcement measures included in Alternative B1 would result in less untreated black and grey water discharge to surface waters. Permitted NNs would not be subject to the proposed new wastewater standard if they are in compliance with their current permit. On No Discharge reservoirs, grey water from existing FHs would be contained and treated with the black water. On Discharge reservoirs, grey water from existing FHs could be discharged through appropriate treatment systems in accordance with federal, state, and local regulations. Therefore, the new standards and enforcement should greatly reduce the surface water quality impacts from existing FHs. The new standards could also reduce the number of existing FHs, if some of the owners chose not to invest in the required upgrades to meet the new standards.

The change in wastewater loadings from the combination of new stricter wastewater standards coupled with a prohibition of new FHs would reduce the wastewater loadings more than under Alternative A. Reducing the average wastewater volume and/or reducing the average wastewater concentration while keeping the number of sources the same would result in total wastewater loadings that are less than the current loadings.

Reduced wastewater loadings under Alternative B1 would result in beneficial impacts on the ecological health of small embayments with FHs on TVA's reservoirs. Small reductions in loadings would probably result in slightly beneficial impacts on the ecological health of those embayments, more beneficial than those estimated for Alternative A. The estimated impacts are all slightly positive for the four ecological health ratings for embayments with FHs on each of the five targeted reservoirs. The reductions in loadings from the new wastewater standards would result in the greatest beneficial impacts in those areas with the largest numbers of FHs. Reduced loadings to areas that are in the upper range of conditions for an ecological health measure could result in those areas receiving an improved ecological health rating under Alternative B1.

4.10.2.4 Alternative B2 – Grandfather but Sunset Existing and Prohibit New

Under Alternative B2, TVA would approve existing FHs that meet minimum standards and allow mooring within permitted marina harbor limits. It is estimated that this would result in a 25-percent reduction in the numbers of FHs/NNs by 2021. However, TVA would establish a sunset date (30 years) by which time all FHs/NNs must be removed from TVA reservoirs. TVA would prohibit new FHs designed and used primarily for human habitation rather than navigation and transportation, and would require modifying or removing previously unapproved structures. Therefore, all FHs/NNs would be removed by 2045. TVA would establish and enforce new standards to address safety and water/waste issues.

As in Alternative B1, implementing the standards and enforcement measures included in Alternative B2 would result in less untreated black and grey water discharge to surface waters. NNs with current permits that are in compliance with that permit would not be subject to the new wastewater standards. On No Discharge reservoirs, grey water from existing FHs would be contained and treated with the black water. On Discharge reservoirs, grey water from existing FHs could be discharged through appropriate treatment systems in accordance with federal, state, and local regulations. Therefore, the new standards and enforcement should greatly reduce the surface water quality impacts from existing FHs. The new standards could also reduce the number of existing FHs, if some of the owners chose not to invest in the required upgrades to meet the new standards. Also, requiring the removal of existing FHs/NNs after the sunset date would ultimately greatly reduce the impacts in comparison to all of the alternatives discussed earlier. After 30 years, discharges from both FHs and currently permitted NNs would no longer occur.

The change in wastewater loadings under Alternative B2 from the combination of new stricter wastewater standards, prohibition of new FHs, and removing all FHs/NNs within 30 years would reduce the wastewater loadings more than under Alternative B1. Reducing the average wastewater volume and/or reducing the average wastewater concentration while keeping the number of sources the same would result in total wastewater loadings for the 30-year sunset period that are less than the current loadings. At the end of the sunset period, when existing FHs/NNs would be removed, wastewater loadings from FHs/NNs would be eliminated.

Reduced wastewater loadings under Alternative B2 would result in beneficial impacts on the ecological health of embayments with FHs/NNs on TVA reservoirs. Large ultimate reductions in loadings would result in large beneficial impacts on the ecological health of those embayments, more than those estimated for Alternative B1.

The estimated impacts are all positive (becoming very positive after 30 years) for the four ecological health ratings for areas with FH/NNs on each of the five targeted reservoirs. The reductions in loadings from the new wastewater standards combined with the sunset removal of existing FHs/NNs would result in the greatest beneficial impacts on those areas with the largest numbers of FHs/NNs. Reduced loadings to areas that are in the upper range of conditions for an ecological health measure could result in those areas receiving an improved ecological health rating under Alternative B2.

4.10.2.5 Alternative C – Prohibit New and Remove Unpermitted

Under Alternative C, TVA would prohibit new and existing FHs built primarily for human habitation rather than for navigation or transportation. TVA would require removing all unapproved, noncompliant structures. It is estimated that this would result in a 50-percent reduction in the number of FHs/NNs by 2021; then the numbers are estimated to remain stable until 2045. Unlike Alternatives A, B1, and B2, TVA would not develop new standards to address safety and wastewater issues but would clarify rules to prohibit FHs. TVA would continue to allow NNs approved by TVA prior to February 15, 1978, that are in compliance with a permit.

Under Alternative C, all FHs would be removed, quickly reducing the number of such structures on TVA reservoirs and reducing the associated surface water quality impacts. TVA would not establish and enforce any new wastewater standards as proposed in Alternatives A, B1, and B2. The removal of all unpermitted FHs would result in less untreated black and grey water discharge to surface waters.

Quick, large reductions in wastewater loadings would have fast, large beneficial impacts on the ecological health of areas with FHs on TVA reservoirs. The immediate beneficial impacts would be greater than those estimated for Alternative B2. After 30 years, however, the beneficial impacts under Alternative B2 would be greater than those under Alternative C because Alternative B2 would result in the removal of the permitted NNs. Permitted NNs would be allowed to remain under Alternative C.

The estimated impacts are very positive for the ecological health ratings of local areas with large numbers of FHs on each of the five targeted reservoirs. The reductions in loadings from the relatively quick removal of existing FHs would cause the greatest beneficial impacts on those areas with the largest current numbers of FHs. Reduced loadings to areas that are in the upper range of conditions for an ecological health measure could result in those areas receiving an improved ecological health rating under Alternative C.

4.10.2.6 Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

Under Alternative D, TVA would increase its resources to improve enforcement of its current TVA Section 26a regulations (18 CFR 1304.101[a]), In addition, it would use its agreements with marinas to better address FHs/NNs. Part of this effort could include working more closely with state regulatory agencies to facilitate enforcement of their restrictions on wastewater discharges. TVA would not update its current rules; therefore, implementation of Alternative D could begin fairly quickly. It is estimated that the future number of FHs/NNs in 2045 would be 2,015 under Alternative D (approximately 45 percent fewer) compared to 3,692 under the No Action Alternative.

Enhancing compliance with relevant TVA and state regulations should reduce the existing wastewater loadings from FHs/NNs that are currently not in compliance. Uncertainty about the number of noncompliant FHs and the timing of increased enforcement efforts makes it difficult to estimate potential impacts on surface water quality under Alternative D. Stronger enforcement could reduce water quality impacts in comparison with the No Action Alternative. Lack of new wastewater standards would probably result in less reduction in wastewater loadings than expected under Alternatives A through C.

4.10.3 Cumulative Impacts

No adverse cumulative impacts on water quality are anticipated from the proposed alternatives, except for the No Action Alternative. Under all the action alternatives, the impacts are anticipated to range from neutral to very beneficial for water quality. Under the action alternatives, wastewater discharges are expected to be reduced, especially on No Discharge reservoirs. Any remaining FHs/NNs would be required to meet applicable local, state, and federal wastewater regulations. Consequently, no cumulative adverse impacts on water quality are anticipated.

The No Action Alternative would result in adverse impacts on water quality because it does not affirmatively address current wastewater discharge issues. Thus, an increase in the number of FHs is expected to contribute to potential water pollution problems, with each NN and FH adding to the total wastewater loading to local surface waters. This alternative would also probably add to localized cumulative surface water quality impacts from current trends in population growth, increases in watershed impervious surface area, and increases in surface water-based recreation.

4.10.4 Summary

The potential impacts of the six alternatives on surface water quality are compared in Table 4.10-5.

Table 4.10-5. Comparison of Potential Localized Surface Water Quality Impacts (through 2045)

Alternative	Reduces Improper Sewage Handling?	Reduces Grey Water Discharges?	Surface Water Quality	Number of Floating Houses/ Nonnavigable Houseboats
No Action	No	No	Negative	Slow increase
A	Yes	Yes on No Discharge reservoirs, MSD on Discharge reservoirs	Neutral to slightly beneficial	Fast increase but fewer than No Action
B1	Yes	Yes on No Discharge reservoirs, MSD on Discharge reservoirs	Slightly beneficial	Slight decrease (noncompliants are removed)
B2	Yes	Yes on No Discharge reservoirs, MSD on Discharge reservoirs	Beneficial to very beneficial in 30 years	Biggest decrease,but 30 years out
C	Yes	No. Current standards do not address grey water.	Very beneficial due to decrease in number	Fastest decrease
D	Maybe	No. Current standards do not address grey water.	Neutral to beneficial	Decrease followed by slight increase

The No Action Alternative would result in the most severe adverse impacts on water quality because it does not affirmatively address current wastewater discharge issues. Without improved wastewater practices, an increase in the number of FHs is expected to increase potential water pollution problems.

Alternative A would result in neutral to beneficial impacts on water quality because the new standards would address the wastewater issues. However, some benefits could be offset by the expected increase in the number of FHs. Alternative B1 would result in beneficial impacts on surface water quality because the new standards would address the wastewater issues. Alternative B1 would be more beneficial than Alternative A because numbers of FHs would not increase. Alternative B2 would result in greater beneficial impacts on water quality than Alternative B1 because the new standards would address the wastewater issues and all FHs and NNs would be removed after 30 years. Alternative C would result in greater beneficial impacts on water quality than Alternative B2 for 30 years because the updated rules would result in a large immediate decrease in numbers of FHs. At the end of the 30-year sunset period, Alternative B2 would result in greater beneficial impacts on water quality than Alternative C because of removal of the permitted NNs that would be allowed to remain under Alternative C.

Under the No Action Alternative, surface water quality would be adversely affected because of the likely growth in the numbers of FHs and the associated increase in wastewater discharges to surface waters, as noted above. This potential impact would not be mitigated by new standards. The No Action Alternative would also probably result in adverse indirect impacts on surface water quality because the growth in numbers would increase the amount of pump-out wastewater. This increase in pump-out wastewater would increase loading on local municipal or on-site wastewater treatment systems and, in turn, their discharges to surface water would probably increase.

As noted, the beneficial impact of new standards under Alternative A would probably be offset by the growth in the numbers of FHs and their wastewater discharges. Therefore, the potential adverse impact on surface water quality would probably be neutral to slightly beneficial. Like the No Action Alternative, Alternative A could result in adverse indirect impacts on surface water quality because the growth in numbers would increase the amount of pump-out wastewater. This increase in pump-out wastewater would increase loading on local municipal or on-site wastewater treatment systems and, in turn, their discharges to surface water could increase.

Alternatives B1, B2, and C would all result in beneficial impacts on surface water quality, with Alternative B1 slightly beneficial, Alternative B2 beneficial to very beneficial in 30 years, and Alternative C very beneficial quickly. Alternatives B1, B2, and C would result in beneficial indirect impacts on surface water quality because the reductions in numbers would reduce the amount of pump-out wastewater. This reduction in pump-out wastewater would reduce loading on local municipal or on-site wastewater treatment systems and, in turn, their discharges to surface water might decrease.

Alternative D would probably result in some neutral to slightly beneficial impacts on surface water quality because of an initial decrease in the number of FHs, followed by a probable increase in number of FHs. This alternative also lacks new wastewater standards, which could offset the initial benefits on water quality from a decrease in numbers of FHs. Alternative D could also possibly result in adverse indirect impacts on surface water quality because the growth in numbers could increase the amount of pump-out wastewater. This increase in pump-out wastewater could increase loading on local municipal or on-site wastewater treatment systems and, in turn, their discharges to surface water would probably increase.

4.11 Ecological Resources

4.11.1 Terrestrial Resources Adjacent to Shorelines

4.11.1.1 No Action Alternative – Current Management, Alternative A – Allow Existing and New Floating Houses, and Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

Under the No Action Alternative and Alternatives A and D, the number of FHs would continue to grow in marinas and alongside private shorelines. In light of this, the potential for upland development due to marina expansion may contribute to land clearing and habitat loss in the surrounding vicinity of the existing and potential marina areas, negatively affecting terrestrial plants and animals and their habitats. The expansion of marinas, however, would be restricted to Zone 1 and Zone 6 as designated in reservoir LMPs. The footprint of these negative impacts would generally be small given the limited extent of marinas and the length of available shoreline. The impacts among these three alternatives would be largest under the No Action Alternative and smallest under Alternative D. New FHs and marina expansions would be limited to Zones 1 and 6, thereby avoiding some of the potentially most important Sensitive Resource Management and Natural Resource Management zones.

4.11.1.2 Alternatives B1 – Grandfather Existing and Prohibit New, B2 – Grandfather but Sunset Existing and Prohibit New, and C – Prohibit New and Remove Unpermitted

Under Alternatives B1, B2, and C, minor beneficial impacts on terrestrial resources along the shoreline would be expected because of fewer FHs and improved management. The potential for change in land use under these alternatives by reducing further development in support of FHs would be minor. Alternative B2 includes the grandfathered provision but has a sunset provision that would phase out all FHs/NNs over a 30-year period. The sunset provision would require FHs/NNs to be removed; however, any impacts on the terrestrial environment that may have been originally associated with marina expansion in the uplands would likely be permanent and would not be required to be removed as a stipulation. This would mean that the benefit of the ultimate removal of FHs/NNs may not reverse the original impacts on the terrestrial environment in the direct vicinity of marinas, as the changes may be permanent.

4.11.2 Waterfowl and Shorebirds

TVA reservoirs provide a mixture of habitats for shorebirds, including debris-covered shorelines; shallow, free-flowing streams and rivers; shallow tailwaters found downstream of most tributary reservoirs; extensive beds of aquatic vegetation found on mainstem reservoirs; and gravel bars surrounding islands throughout the Valley. These habitats are available seasonally and in some cases, such as tailwater habitats and shorelines, throughout the year. These habitats are used by shorebirds considered to have very generalized foraging strategies, such as killdeer (*Charadrius vociferous*) and spotted sandpipers (*Actitis macularius*). The much more important habitats and the primary stopover habitat provided for important migratory waterfowl and shorebirds are mudflats. These habitats are general available at the onset of fall reservoir drawdown through the following April (Henry 2012). Mudflats provide a diverse array of microhabitats, including a vegetated zone used primarily by waterfowl and shorebirds.

The most important of these mudflats are Priority 1 sites with abundant suitable habitat used by high numbers of shorebirds and waterfowl, and Priority 2 sites with moderate amounts of habitat that are often used by shorebirds and waterfowl (Henry 2012). These site are found predominantly on Chickamauga, Douglas, Kentucky, and Wheeler Reservoirs, which are also reservoirs with a current low number of FHs/NNs.

A review of marina locations relative to the location of mudflats indicates that marinas on the reservoirs with associated high-priority mudflats generally are not located close to the high-priority mudflats. In a few cases, however, they are located nearby. This is likely because the mudflat areas in these reservoirs are exposed at lower reservoir levels and can be quite shallow during higher reservoir levels; thus, they are generally unsuitable locations for marinas. Many of these areas are also classified as Zones 3 and 4, thereby excluding marinas and FHs/NNs in some of the potentially most important Sensitive Resource Management and Natural Resource Management zones. However, smaller mudflat habitats also occur in other areas of many of the 29 reservoirs potentially affected by the Floating Houses Policy alternatives, especially those that occur in cove areas where fall-winter drawdowns may expose mudflats in the back of the coves.

4.11.2.1 All Alternatives

Because marinas and FHs/NNs are generally not located near the mudflat habitats of major importance to shorebirds and waterfowl, none of the Floating Houses Policy alternatives are expected to result in more than very minor impacts on waterfowl and shorebirds. The minor impacts would not be at high-priority mudflats for waterfowl and shorebirds. Rather, any minor negative impacts would occur locally near the existing marinas under the No Action Alternative and Alternatives A and D; minor and local beneficial impacts would occur under Alternatives B1, B2, and C. The development of any future marinas or marina expansion would require permits, environmental reviews, and agency consultation. These requirements, together with TVA land use zone classifications protecting some of the most sensitive and important areas for shorebirds and waterfowl, would minimize the potential impact of new marinas on waterfowl and shorebirds.

4.11.3 Aquatic Resources and Ecological Health

Potential impacts on aquatic resources and aquatic ecological health from Floating Houses Policy alternatives may result from a variety of activities, including aquatic shading of the water column and reservoir bottom with the potential for locally reducing productivity, disturbance of bottom habitats from anchoring and anchoring cables and utility lines, and degradation of water quality by discharges of grey and black water (see Section 4.10). These impacts would be increased by expansion of existing marinas and new FHs outside of marinas, and by construction of new marinas. Alternatives that result in more FHs at existing and new marinas and other FHs at private areas would increase these harmful impacts; alternatives that reduce the number of FHs/NNs would result in beneficial impacts on aquatic resources. New standards and regulations and enforcing compliance with existing or new regulations would also improve water quality conditions by reducing the discharge of black and grey water.

4.11.3.1 No Action Alternative – Current Management, Alternative A – Allow Existing and New Floating Houses, and Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

Under the No Action Alternative and Alternatives A and D, negative effects to aquatic habitats in and around marinas would occur. Impacts associated with expansion of marinas and an increase in the number of FHs would be greater under the No-Action Alternative and Alternative A, and considerably less or negligible under Alternative D.

Under the No Action Alternative, surface water quality would be affected because of the likely growth in the numbers of FHs and the associated increase in black and grey water discharges to surface waters. This potential negative impact would not be mitigated by new standards. The No Action Alternative would also probably result in negative indirect impacts on surface water quality because the growth in numbers would increase the amount of pump-out wastewater. This increase in pump-out wastewater would increase loading on local municipal or on-site wastewater treatment systems; in turn, their discharges to surface water would probably increase. Alternative D would probably result in some negative impacts on surface water quality because of a lack of new standards coupled with a probable increase in the number of FHs. Alternative D would also probably result in negative indirect impacts on surface water quality because the growth in FH numbers would increase the amount of pump-out wastewater.

The combined habitat and water quality impacts would be expected to result in some minor to moderate negative impacts on local fish and benthic invertebrate assemblages. As described in Section 4.10, if wastewater loadings were to be increased to embayments of reservoirs with longer retention times that are already stressed and in the lower range of conditions for an ecological health measure, those reservoirs could drop to a lower health rating under the No Action Alternative and Alternative A—at least in monitoring locations near certain marinas. These changes are not expected to be large enough to affect the overall ecological health rating for the reservoir.

4.11.3.2 Alternatives B1 – Grandfather Existing and Prohibit New, B2 – Grandfather but Sunset Existing and Prohibit New, and C – Prohibit New and Remove Unpermitted

Under Alternatives B1, B2, and C, beneficial changes in aquatic habitats in and around marinas would be expected because of a decrease in the number of FHs/NNs. This beneficial effect would ultimately be greatest over time under Alternative B2, which would result in removal of all FHs/NNs after 30 years. These beneficial impacts on aquatic habitat are expected to result in local changes in fish and benthic macroinvertebrate assemblages, but only locally in the immediate vicinity of the marinas.

Alternatives B1, B2, and C would result in direct and indirect beneficial impacts on surface water quality—with Alternative B1 slightly beneficial, Alternative B2 beneficial to very beneficial in 30 years, and Alternative C very beneficial quickly. Implementing the standards and enforcement measures included in Alternatives B1 and B2 would result in less untreated black and grey water discharge to surface waters from FHs. The new standards and enforcement should considerably reduce the surface water quality impacts from existing FHs. The new standards could also reduce the number of existing FHs, if some of the owners chose not to invest in the required upgrades to meet the new standards. The change in wastewater loadings from the combination of new stricter wastewater standards, coupled with a prohibition of new FHs, would reduce total wastewater loadings. Alternatives B1, B2, and C also would result in beneficial indirect impacts on surface water quality because the reductions in numbers would reduce the amount of pump-out wastewater. This reduction in pump-out wastewater would reduce loading on local municipal or on-site wastewater treatment systems and, in turn, their discharges to surface water might decrease.

The combined habitat and water quality impacts under these alternatives would be expected to result in some minor to moderate beneficial impacts on local fish and benthic invertebrate assemblages. As described in Section 4.10, if wastewater loadings were to be decreased in embayments of reservoirs with longer retention times that are already stressed and in the lower range of conditions for an ecological health measure, those areas could receive a higher ecological rating under Alternatives B1, B2, and C—at least in monitoring locations near certain marinas. These changes are not expected to be large enough to affect the overall ecological health rating for the reservoir.

4.11.4 Freshwater Mussels

Many of the potentially affected mussel species in the TVA reservoir system are TES species; therefore, impacts on freshwater mussels are presented in Section 4.12, Threatened, Endangered and Species of Special Concern. Impact associated with the invasive mussel species, the zebra mussel, are discussed below.

4.11.5 Invasive Species

4.11.5.1 All Alternatives

Habitat suitability for some of the invasive fish species of concern—common carp, grass carp, and rusty crayfish, alewives, and blueback herring—would likely be unaffected by all Floating Houses Policy alternatives. Because common carp, grass carp, and rusty crayfish tolerate a wide range of environmental conditions, their populations are expected to continue to increase. The densities of Asiatic clam would likely remain high, and zebra mussel populations would likely continue to increase and expand regardless of the selected alternative. Because natural variability would likely result in potential impacts as great, or greater than, the impacts associated with any alternative, a measurable increase in impacts related to these invasive species is not expected to result under any alternative.

The Floating Houses Policy alternatives are expected to result in minor, local negative or beneficial impacts on invasive species. Overall, suitable habitat for invasive terrestrial animals and their populations is expected to continue to increase because of reasonably foreseeable actions in the Valley under all alternatives. Similarly, invasive terrestrial plant populations are expected to continue to increase as native habitats are altered to accommodate population growth and subsequent development pressures. The Floating Houses Policy alternatives therefore are not expected to directly affect the present or future rate of the establishment or spread of invasive terrestrial animals or plants.

4.11.6 Wetlands

4.11.6.1 All Alternatives

Under all of the Floating Houses Policy alternatives, direct and indirect impacts on wetlands are expected to be minor negative or beneficial impacts. This conclusion is based on several important factors, including the following. The percentage of total reservoir wetlands within 0.25 mile of existing marinas is typically less than 2 percent (Table 3.12-7), many wetlands are already protected in land use zones that cannot use used for marinas (Sensitive Resource Management and Natural Resource Management zones), and wetlands are a highly protected resource as a result of TVA regulations and federal regulations administrated by the USACE. These factors result in the likelihood that marina expansion and new marinas would be developed in areas without wetlands, or that wetlands would need to be delineated, avoided, and mitigated according to Section 404 of the CWA during permitting for marina expansion or new marinas.

The potential minor negative impacts on wetlands that could occur due to increases in FHs within or outside marinas could include shading of wetlands by floating structures or localized water quality impacts. The potential beneficial impacts could include possible reestablishment of fringing wetlands in areas where FHs/NNs have been removed. Again, these impacts are expected to be minor for wetland resources overall.

As more fully described in in Section 1.7, Related Environmental Reviews and Consultation Requirements, any proposed marina or marina expansion would require approval from TVA under Section 26a and a permit from the USACE under Section 10 of the Rivers and Harbors Act or Section 404 of the CWA. State certifications also would be required under Section 401(a)(1) of the CWA. Under all alternatives, TVA and the USACE would continue to protect wetlands in accordance with the requirements of the CWA and EO 11990, requiring compensatory mitigation for losses to wetlands and waters of the United States.

In order to ensure compliance with EO 11990, Protection of Wetlands, any proposal for future land-based improvements or water use facilities in a wetland area would be subject to TVA review and approval prior to construction. In the course of these future reviews of specific proposals, TVA would evaluate the potential impacts on the wetland(s) resulting from such proposals, including those outside the floodplain, and ensure compliance with EO 11990 and its requirement for a "no practicable alternative" determination and minimization of impacts."

The exception to the above would be the potential impacts of FHs or NNs being moored on private shoreline land. These impacts are expected to be minor under all alternatives.

4.12 Threatened and Endangered Species

Potential impacts on threatened, endangered, and special concern (TES) species due to the Floating Houses Policy alternatives could occur as a result of a variety of the activities more fully described in Section 4.11. Activities that may affect TES species include increased aquatic shading of the water column and reservoir bottom, with the potential for locally reducing productivity; disturbance of bottom habitats from anchoring and anchoring cables and utility lines; and degradation of water quality by discharges of grey and black water (see Section 4.10). These impacts would be increased by the expansion of existing marinas and new FHs outside marina limits, and by construction of new marinas. Alternatives that result in more FHs at existing and new marinas and more FHs at private areas would increase impacts; alternatives that reduce the number of FHs/NNs would result in beneficial impacts. Management measures that increase compliance with existing or new regulations would also improve water quality conditions resulting from discharges from FHs/NNs.

In terrestrial habitats along the shoreline near marinas, potential impacts on TES species would include clearance, disturbance, and loss of shoreline habitats used by wildlife, including birds, mammals, reptiles, and amphibians. These impacts would occur directly as a result of activities by individual FH/NN owners and by marina operators. Indirect effects include the same clearance, disturbance, and loss of shoreline habitat impacts, but resulting indirectly from other nearby development to support marinas, such as parking, septic systems, activity areas, and retail.

TVA used the Natural Heritage Database to analyze the occurrence of TES species near existing marinas in order to determine the potential for impacts resulting from marina expansions or the addition of FHs outside marina limits. Table 4.12-1 (at the end of this section) summarizes the number of TES species within 0.25 mile of existing marinas by reservoir. Table 4.12-1 indicates that the occurrence of TES species within the vicinity of existing marinas is relatively common, but the numbers of TES species are low and the habitats are not the preferred habitats of the species. Although TVA does not provide site-specific data on the locational occurrence of protected species, TVA's review of the species occurrence near marinas summarized in the table did allow certain conclusions. Of the TES species occurring near marinas, most are state-listed species and not federally listed as threatened or endangered. For example, the other protected bird species known to occur within 0.25 mile of a marina include bald eagle (*Haliaeetus leucocephalus*), cerulean warbler (*Setophaga cerulean*), osprey (*Pandion haliaetus*), Bewick's wren (*Thryomanes bewickii*), and colonial wading bird colonies (e.g., egrets and herons). None of these species is federally listed as threatened or endangered; and most of these species are migratory, widely ranging, and with large ranges. Expansion of existing marinas is unlikely to cause a noticeable negative effect to TES species under any of the Floating Houses Policy alternatives. A possible exception might be colonial wading bird colonies that could be affected if close to a marina expansion.

TES fish species occurring near marinas are limited as well and include such species as scarlet shiner (*Lythrurus fasciolaris*), spotfin shiner (*Cyprinella spiloptera*), steelcolor shiner (*Cyprinella whipplei*), boulder darter (*Etheostoma wapiti*), and slender chub (*Erimystax cahni*). These fish species are for the most part fluvial-dependent species (require flowing-water habitats in streams and rivers) and, with some possible exceptions, would be unlikely to occur in or near marinas or be dependent on marina areas for viable populations. Some of the TES fish species are not federally listed, but a few are listed as threatened or endangered. Some of the occurrences of these species may be due to proximity to streams or river habitats with 0.25 mile of the marina rather than suitable habitat being present at the marina, such as the two marinas located at the mouth of Shoal Creek on Wheeler Reservoir and the occurrence of slender chub near the Norris Dam Marina.

Observations similar to those for fish are largely true for other aquatic species in Table 4.12-1. The freshwater mussels include such species as pink mucket (*Lampsilis abrupta*), ring pink (*Obovaria retusa*), dromedary pearlymussel (*Dromus dromas*), and orange-foot pimpleback (*Plethobasus cooperianus*). The freshwater snail species include Anthony's riversnail (*Athearnia anthonyi*) and the muddy rocksnail (*Lithasia salebrosa*). Several of the mussels species are federally listed as endangered, but the preferred habitat for most of these species is in streams, rivers, and other flowing-water areas. Some of these species such as the pink mucket have been found living and reproducing in more lentic conditions, such as impoundments, although very infrequently in pools with no current. Often the occurrence of these mussels in TVA impoundments are from historical accounts, older individuals that are remnants from when the river was impounded and present in areas where the habitat is not likely to support sustainably reproducing populations. Due to movement of their fish host species (mussels are briefly parasitic on fish gills and drop off after a short feeding period) individuals are found in reservoirs; in such circumstances, however, viable populations are unlikely because of unfavorable habitat conditions.

Over 10 TES plant species are known to occur in the vicinity of existing marinas; most are state-listed species. One, the large-flowered skullcap, is federally listed and is known to occur in the vicinity of only one marina. Of the small number of mammal species that occur in the vicinity of existing marinas, two are federally listed as threatened: the gray bat (*Myotis grisescens*) and the Indiana bat (*Myotis sodalis*). Three TES reptile species are known to occur in the vicinity of existing marinas, including the alligator snapping turtle, western pigmy rattlesnake, and the northern pine snake—none of these are federally listed.

All of these terrestrial TES species have the potential to be directly affected by land clearance, disturbance, and loss of shoreline habitats as a result of activities by individual FH/NN owners and by marina operators. Similar harmful impacts could result indirectly from other nearby development to support marinas, such as parking, septic, activity areas, and retail.

4.12.1 Critical Habitat

Only one instance of a TVA Habitat Protection Area occurs within 0.25 mile of any marina where the expansion of facilities is likely to occur. The Fairview Slopes TVA Habitat Protection Area (FID 4054) is next to the Big Ridge Yacht Club on Chickamauga Reservoir. No USFWS-defined critical habitat areas would be affected by any of the Floating Houses Policy alternatives.

4.12.2 No Action Alternative – Current Management, Alternative A – Allow Existing and New Floating Houses, and Alternative D – Enforce Current Regulations and Manage through Marinas and Permits

Under the No Action Alternative and Alternatives A and D, minor direct impacts on terrestrial and aquatic habitats would result from expansion of upland marina facilities. These impacts may affect TES species, including federally listed species, if the species occur close enough to the marinas that expand in the future. The increase in the eventual number of FHs under all of these alternatives would result in the habitat and water quality impacts described earlier in this section. New FHs and marina expansions would be limited to Zones 1 and 6, thereby avoiding some of the potentially most important Sensitive Resource Management and Natural Resource Management zones. In terms of potential impacts on aquatic TES species, the No Action Alternatives and Alternatives A and D are most likely to result in impacts on aquatic habitat impacts in the reservoir. As described above, most of these habitats are not suitable for most of the federally listed fish or mussels species reported to be near existing marinas. Therefore, any negative impacts are expected to be minor. As described in Section 4.10, Water Quality, the No Action Alternative would not, and Alternative A and D may not, result in reduction of improper sewage handling and grey water discharges, resulting in continued water quality impacts. The overall impacts on TES species are expected to be minor.

4.12.3 Alternatives B1 – Grandfather Existing and Prohibit New, B2 – Grandfather but Sunset Existing and Prohibit New, and C – Prohibit New and Remove Unpermitted

Under Alternatives B1, B2, and C, minor beneficial impacts on TES species could be expected because of fewer FHs/NNs, better management and compliance with existing and new regulations, and expected improvements in water quality. These alternatives could result in removal of some FHs/NNs that may be contributing to water quality degradation in the reservoirs, which may prove to be beneficial to TES species that use the aquatic environment near marinas. The potential for change in land use under these alternatives by reducing development that currently supports FHs/NNs would be minor and is not expected to affect valuable habitat for TES species. The removal or sale of developed areas may also encourage alternative development in the uplands, and previously disturbed habit may not revert to its original state. The potential beneficial effect to TES species therefore would likely be minor.

4.12.4 All Alternatives

In the case of TES species, it is particularly important to emphasize that none of the policy alternatives would specifically authorize any new marinas, marina expansions, or new FHs. The ultimate policy decision would not authorize any on-the-ground actions or waive environmental review for subsequent individual actions. Under all the alternatives, TVA must comply with the ESA.

Development of any future marinas or marina expansion would require permits, environmental reviews, and agency consultation. Any proposed marina or marina expansion would require approval from TVA under Section 26a and a permit from USACE under Section 10 of the Rivers and Harbors Act and Section 404 of the CWA. State certifications also would be required under Section 401(a)(1) of the CWA. Finally, additional local and state permits associated with sewage treatment, construction, and utility service may be necessary. These permitting and review processes require consultation with state and federal agencies with responsibility over federally and state-listed species, including consultation with the USFWS under the ESA. These processes and reviews provide the opportunity to conduct site-specific surveys, to consult with TVA biologists, to further examine the details contained in the Natural Heritage Database, and to identify appropriate mitigation measures that would considerably reduce the potential impacts of the Floating Houses Policy alternatives.

4.12.5 Cumulative Impacts

As described in the ROS EIS (TVA 2004), if existing management activities and their present results are suitable indicators, future trends related to the protection of TES species in the Tennessee Valley will include a few successes, more failures, and many unknowns. Some well-known and widely appreciated species on the federal lists appear to be responding to the recovery measures that have been conducted—so much so that they may not require federal ESA protection in the future. The vast majority of protected species in the region, however, are likely to remain extremely rare and virtually unknown to the general public. As the human population and human use of land and water resources in the region continue to increase, more natural habitats will be degraded, and some protected species that exist only in those areas may be lost.

As described in Section 3.12, the federal and state protection requirements, accompanied by considerable public interest in at least some rare species, have resulted in a wide variety of monitoring and management activities focused on TES species. Recovery plans prepared for each species on the list of federally endangered or threatened species describe monitoring and management activities that would lead to the enhancement and eventual recovery of each animal or plant. TVA continues to partner with other federal agencies, state agencies, and other interested groups to improve conditions for TES species. TVA has augmented or reintroduced protected species populations with individuals produced in the laboratory or relocated from other areas. TVA has conducted or participated in many enhancement and management activities focused on protected species, including distribution and monitoring surveys, establishment and protection of natural areas, habitat improvement projects, and restocking programs.

Table 4.12-1. Endangered, Threatened, and Special-Concern Species Occurring within 0.25 Mile of Existing Marinas in TVA Reservoirs

		Number of Species within Major Taxonomic Groups					
Reservoir	**Marina Name**	**Mammals**	**Birds**	**Fish**	**Other Aquatic Species**	**Reptiles**	**Plants**
Boone	Serenity Cove Marina and RV Park						1
Chickamauga	Big Ridge Yacht Club						1
	Island Cove Marina and Resort		1				
	Sportsman's Highway 58 Boat Dock		1				
Fontana	Peppertree Fontana Village		1				
	Cast A Way Boat Harbor	1					
Fort Loudoun	International Harbor Marina		1				
	Fort Loudoun Dam Marina			1			
	Willow Point Marina		1				
	Volunteer Landing				2		
Guntersville	Alred Marina						1
	Mountain Lakes Resort, Inc.		1				
	Goosepond Colony		1				
Kentucky	Pebble Isle Marina		1			2	
	Perryville Marina				1		
	Sugar Creek Bay Marina						1

Reservoir	Marina Name	Number of Species within Major Taxonomic Groups: Mammals	Birds	Fish	Other Aquatic Species	Reptiles	Plants
Norris	Norris Dam Marina	3		2	2		
	Beach Island Resort and Marina		1				
	Sugar Hollow Boat Dock						5
	Flat Hollow Marina						1
Pickwick	Eastport Marina		1				
	J. P. Coleman State Park			4			9
	Grand Harbor Marina						1
	Aqua Yacht Harbor				1		
	Pickwick Landing State Park					1	
	Florence Harbor Marina				1	1	
South Holston	Laurel Marina						4
Tellico	Sequoyah Marina			1			
Watauga	Watauga Lakeshores Resort and Marina						1
Watts Bar	Spring City Resort & Marina		1				
Wheeler	Riverwalk Marina				4		
Wilson	Marina Mar			1	2		
	Rollison Marina			1	2		

Source: TVA Natural Heritage Database (April 2015) and staff analysis.

4.13 Floodplains and Flood Risk

4.13.1 All Alternatives

As a federal agency, TVA is subject to the requirements of EO 11988, Floodplain Management. 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" (US Water Resources Council 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 1-percent annual chance (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 0.2-percent annual chance (500-year) flood.

The amount of shoreland made available for development would directly influence the amount of impacts on natural and beneficial floodplain values. None of the Floating Houses Policy alternatives would control the planned extent or intensity of development along reservoir shorelines. The amount and nature of development along TVA reservoir shorelines would be determined by management actions and policy decisions by TVA, including the Shoreline Management Plan, reservoir-specific LMPs, land use allocation zones, the NRP, and other TVA policies.

Without implementation of appropriate BMPs, some shoreline/shoreland development could result in increased sedimentation in the reservoirs, resulting in a loss of reservoir flood control and/or power storage capacity. One source of sediment would be erosion occurring during construction. In many instances, however, sedimentation would be deposited in the reservoir below the lower limits of flood control and power storage. TVA would continue to require BMPs and other measures such as those described in the SMI EIS (TVA 1998) to minimize these impacts. Therefore, the potential loss of flood control and power storage is expected to be negligible under any of the policy alternatives.

Another concern is adequate anchoring. Reservoirs can experience windy conditions, and the higher profiles of FHs/NNs, compared to standard houseboats, would create higher wind loads on mooring cables and other anchoring devices. Additonally, forces due to water velocities in high-flow and flood events would likely be greater as well. To prevent the FHs/NNs from breaking free and crossing outside the harbor limits, the devices used to anchor them would need to withstand these greater wind and water velocity forces.

Impacts on floodplains would be largely determined by expansion of marina harbor limits and development of new marinas to accommodate more FHs. Floodplain impacts would occur primarily as a result of development, placing new structures or fill, in the floodplain directly or indirectly associated with marinas. The number of FHs/NNs at a marina does not in and of itself cause floodplain impacts; rather, the associated development of marina-related facilities has the potential to result in impacts on floodplains. Minor adverse impacts on floodplains would occur under the No Action Alternative and Alternative A; neutral to minor beneficial impacts on floodplains would occur under Alternatives B1, B2, and C; and neutral to minor adverse impacts on floodplains would occur under Alternative D.

Impacts on the natural and beneficial functions of floodplains are discussed in greater detail in the following sections of this EIS: Recreation, Visual Resources, Water Quality, Ecological Resources, Terrestrial Habitats, Aquatic Habitats, Wetlands, and Threatened and Endangered Species.

4.13.2 Cumulative Impacts

Foreseeable future actions or developments that may also affect floodplain values, flood control, and power storage include implementation of the reservoir operations policy for the Tennessee River and reservoir system (TVA 2004), the NRP, and the various reservoir-specific LMPs. Of these management actions, changes in reservoir operations would be the most likely to affect floodplain values. The ROS EIS (TVA 2004) did not identify significant potential cumulative impacts on floodplain values. Under EO 11988, federal agency actions must, to the extent practicable, avoid siting projects in floodplain zones in order to reduce the risk of flood loss; minimize impacts of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values of floodplains. FEMA has identified where floodplains occur, and many local governments have adopted regulations to control the development of these defined floodplains. Because the effects of the Floating Houses Policy alternatives on floodplains would be minimal and because federal management is in place, no cumulative impacts on floodplains are expected.

4.13.3 Summary

Because the maximum potential extent of floodplain impacts is small and the requirements of EO 11988 will be applied to individual projects, effects to the floodplain are expected to be minimal under all of the policy alternatives.

4.14 Irreversible or Irretrievable Commitments of Resources

A commitment of a resource is considered irreversible when the primary or secondary impacts from its use limit the future options for its use. "Irreversible" is a term that describes the loss of future options. It applies primarily to the effects of use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity, that are renewable only over long periods of time. An irretrievable commitment refers to the use or consumption of a resource that is neither renewable nor recoverable for use by future generations. "Irretrievable" is a term that applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.

The Floating Houses Policy alternatives would not result in irreversible or irretrievable commitmentd for resources such as public safety, navigation, and noise. Construction or removal of FHs/NNs and associated facilities and structures during the 30-year period would result in minor irreversible commitments of fuel, energy, and building material resources. These commitments would be largely irretrievable. Such commitments of resources would be greatest for those alternatives that allow for more new FHs in the future (No Action Alternative and Alternative A) and less for the other alternatives.

All of the policy alternatives would result in some minor irretrievable commitment of resources such as aquatic habitat, some recreational uses, economic productivity, visual quality and integrity, water quality, and some ecological resources. Examples include the loss of aquatic habitat and public recreational uses (boating, fishing) and their economic benefits in areas permanently occupied by FHs/NNs during the planning period. These commitments of resources would occur mostly in existing and new marinas, and within the expanded footprint of existing marinas. Such commitments of resources would be greatest under those alternatives that allow for new FHs (No Action Alternative and Alternative A) and less for the other alternatives. For the most part, these would not be irretrievable commitments, because FHs/NNs could be removed at some later date and the associated resource values and uses in the reservoir and along the shoreline returned to their near-original condition naturally or through restoration efforts.

4.15 Mitigation Measures

NEPA and its implementing regulations require that an EIS identify appropriate mitigation measures for the adverse impacts potentially resulting from a proposed action. Under NEPA, mitigation measures are actions that could be taken to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse effects on the environment (40 CFR 1508.20). In its recent updated guidance on mitigation and monitoring, the CEQ (2011) outlined three contexts for considering mitigation; two are appropriate for environmental impact statements—including mitigation as part of project design and by outlining and adopting other means not part of the alternatives that could be used to mitigate adverse environmental impacts (40 CFR 1502.16). This section describes how TVA considered and integrated these considerations into this EIS.

4.15.1 Mitigation in Policy Alternatives

As described in Section 1.1, Purpose and Need, TVA is reviewing its policy on FHs/NNs, in part specifically to address issues associated with the growth of unanticipated uses of the reservoir system by these structures and ongoing impacts on public health and safety, the environment, and public recreation. In developing the range of policy alternatives, TVA specifically identified and considered a range of ways in which the impacts from FHs/NNs could be mitigated—ranging from immediate removal of all FH structures to permitting them permanently or over a 30-year sunset period. The alternatives included a number of individual measures under permitting, management, marina operations, standards, and enforcement that could mitigate the ongoing and potential future impacts—including measures brought forth to TVA by the public during scoping. In this way, TVA fully considered mitigation measures as an integral part of its alternatives analysis (Section 1.1, Description of Alternatives). TVA believes that the five action alternatives and the No Action Alternative – Current Management represent the full range of reasonable measures for addressing mitigation as part of the policy alternatives development.

4.15.2 Other Mitigation Measures

TVA also considered other means, not part of the alternatives, that could be used to avoid, reduce, or minimize adverse environmental impacts. It is important to remember that none of the policy alternatives would specifically authorize any new marinas or FHs (Section 1.4, Decision to be Made). The ultimate policy decision would not authorize any on-the-ground actions or waive environmental review for subsequent individual actions. Therefore, it is not possible at this time to identify specific mitigation measures to be implemented. Site-specific concerns and development of additional mitigation measures would be need to be addressed in project-level reviews, such as when new marinas were developed.

However, at a programmatic and policy level, as well as in ensuring compliance with its authorities and regulations, TVA is actively engaged in a wide range and variety of measures that would mitigate the potential adverse impacts of any selected policy for FHs/NNs. Many of these programs and actions are embodied within implementation of the SMI and NRP, which provide for a more systematic and watershed-wide approach to resource protection and meeting TVA's Environmental Policy and stewardship goals.

The NRP addresses TVA's ongoing management of biological, cultural, and water resources; recreation; reservoir lands planning; and public engagement. Elements of the NRP components include resource protection, management, monitoring, and mitigation that would broadly reduce the potential adverse impacts of the selected policy. For example, in the case of Biological Resource Management, the NRP includes the replacement of nonnative vegetation with native plants; use of construction activity BMPs to avoid or reduce impacts on wetlands, aquatic life, and water quality; and incorporation of design features to lessen the impact on visual integrity when appropriate. The reader is directed to the *Natural Resource Plan* at http://www.tva.gov/environment/reports/nrp/ for further details.

Finally, in addition to its broad management actions, TVA site-specific regulatory and review processes identify actions to avoid or reduce potential adverse impacts that may result from specific actions under any of the Floating Houses Policy alternatives. As more fully described in Section 1.6, Related Permits, Environmental Reviews, and Consultation Requirements, construction projects in or along the Tennessee River system require TVA review and approval under Section 26a to ensure that shoreline construction activities are compatible with all aspects of TVA's integrated management of the river system. Permit approvals for construction under Section 26a are considered federal actions and therefore are subject to NEPA requirements and other federal laws. TVA's jurisdiction under Section 26a is implemented through Section 26a regulations (18 CFR Part 1304). Subpart B of 18 CFR Part 1304 covers the Regulation of Nonnavigable Houseboats. Related environmental reviews that occur during the Section 26a process include the ESA Section 7 consultation process to address impacts on threatened and endangered species; the NHPA Section 106 consultation process to address impacts on cultural resources; and the NEPA review process itself that would identify measures to mitigate, reduce, or avoid impacts on wetlands, floodplains, and other important natural resources. All are subject to the identification of, and possible conditioning with, required measures to mitigate potential adverse impacts.

4.16 Adverse Environmental Impacts That Cannot Be Avoided Should the Proposal Be Implemented

This EIS analyses and summarizes the potential beneficial and adverse impacts on the human and natural environment that would result from implementation of the Floating Houses Policy alternatives. In this chapter, a wide range of potential impacts on physical, biological, and socioeconomic resources were identified. For the most part, these impacts would be minor and could be avoided through mitigation measures that are part of TVA's ongoing natural resource management and compliance with its authorities and regulations under Section 26a of the TVA Act, as also described in this chapter.

The different policy alternatives do, however, have the potential to create a change in the balance of benefits experienced by various socioeconomic groups (e.g., current FH/NN owners, marina owners, shoreline property owners, reservoir recreational users, local retail, and the general public). By definition, there are trade-offs under each alternative, and some user groups would benefit, with adverse impacts occurring on other user groups. In general, policy alternatives that result in greater regulation of or fewer FHs/NNs, would adversely affect FH/NN owners and renters, marinas, and related industries; shoreline property owners, recreational users, and the general public would experience beneficial impacts related to more recreational space on the reservoirs and improved safety and less noise, among others. These societal tradeoffs inherent in the policy alternatives, namely adverse impacts on specific socioeconomic groups, may not be possible to entirely avoid. However, the Floating Houses Policy alternatives were devised to address the proliferation of these structures that has resulted in unanticipated uses of the reservoir system and has raised concerns about impacts on public health and safety, the environment, and public recreation.

4.17 Relationship of Short-Term Uses and Long-Term Productivity

Any project or policy involves tradeoffs between impacts on the natural and human-made environments and the resulting benefits. Each of the policy alternatives would result in varying impacts on the use of reservoir surface space immediately adjacent to shoreline and land on reservoirs with existing commercial marinas, as well as on those reservoirs that are viewed as having a reasonable potential to support commercial marinas in the future. Displacement or replacement of some recreational uses may occur, as well as minor economic changes, increased or decreased noise and visual quality, and loss of natural areas such as wetlands and wildlife habitat. These impacts, however, are not considered to be significant, and in general, can be mitigated. None of the policy alternatives would result in irretrievable long-term commitments of resources that would affect long-term socioeconomic or natural resource productivity that could not be reversed by future removal of FHs and shoreline habitat restoration.

The proposed policy is designed to consider a means of allowing or disallowing FHs in the future in a manner compatible with TVA's overall mission and authorities, and the goals of its Environmental Policy. The policy decision is ultimately expected to result in a long-term improvement in the balance of uses on the reservoirs, reduced adverse impacts from FHs, and improved water quality and safety. It can be concluded, therefore, that the selected policy alternative and its short-term impacts and use of resources would be consistent with the maintenance and enhancement of long-term productivity for the TVA reservoir system.

This page intentionally left blank

CHAPTER 5 – LITERATURE CITED

American Hospital Directory. 2015. Hospital Statistics by State. Available at: http://www.ahd.com/state_statistics.html. Accessed: January 29, 2015.

Amundsen, C. C. 1994. Reservoir riparian zone characteristics in the Upper Tennessee River Valley. Water, Air and Soil Pollution. 77:460–593.

Association of Marina Industries (AMI). 2014. Best Management Practice for Clean Marinas. Available at: https://marinaassociation.org/government/clean-marina/). Accessed: November 2014.

Baker, Tyler. 2003. National Biological Assessment and Criteria Workshop, Coeur d'Alene, Idaho, March 31 – April 4, 2003.

Braun, E. L. 1950. Deciduous Forests of Eastern North America. Hafner Publishing Company. New York, NY.

Brown, S., C. Hickey, B. Harrington, and R. Gill (eds.). 2001. The United States shorebird conservation plan. Second edition. Manomet Center for the Conservation Sciences. Manomet, MA.

Bureau of Labor Statistics. 2013. United States Department of Labor. Quarterly Census of Employment and Wages. Industry Tables for NAICS 713930 Marinas. Available at: http://www.bls.gov/cew/cewind.htm#year=2013&qtr=A&own=5&ind=713930&size=0 Accessed: January 28, 2015.

Bureau of Labor Statistics. 2014a. United States Department of Labor. Unemployment Rates for States. Available at: http://www.bls.gov/lau/ststdnsadata.txt. Accessed: January 21, 2015.

Bureau of Labor Statistics. 2014b. United States Department of Labor. Labor force data by county, not seasonally adjusted, latest 14 months. Available at: http://www.bls.gov/lau/laucntycur14.txt. Accessed: January 21, 2015.

Council on Environmental Quality (CEQ) 2011. CEQ Guidance on the "Appropriate Use of Mitigation and Monitoring and Clarifying the Appropriate Use of Mitigated Findings of No Significant Impact:" Available at: http://ceq.hss.doe.gov/current_developments/docs/Mitigation_and_Monitoring_Guidance_14Jan2011.pdf. Accessed: April 15, 2015.

Curry, Pat. 2015. Rental property management: Yes or no? Available at http://www.bankrate.com/brm/news/real-estate/20051006a1.asp.

Dycus, D. L. and D. L. Meinert. 1991. Reservoir Monitoring, 1990 Summary of Vital Signs and Use Impairment Monitoring on Tennessee Valley Reservoirs. Tennessee Valley Authority, Water Resources. Chattanooga, TN.

El-Ashry, T. 1981. Memorandum to those listed; Subject: Class Review of Certain Repetitive Actions in the 100-Year Floodplain, Dated August 13, 1981.

Federal Emergency Management Agency (FEMA). 2010. Debris Estimating Field Guide. Publication 329. Available at: http://www.fema.gov/pdf/government/grant/pa/fema_329_debris_estimating.pdf.

Google Earth 2015. Version 7.1.2.2041. Imagery: April 2013. Available at: http://www.earth.google.com. Accessed: January 15, 2015.

Henry, T. H. 2012. Results of the Tennessee River Valley Shorebird Initiative. Tennessee Valley Authority, Final Report. July.

Hickman, G. D. 2000. Sport Fishing Index (SFI): a Method to Quantify Sport Fishing Quality. Environmental Science and Policy. 3(2000): S117–S125.

Higgins, John. 2008. Technical Report: Effect of Marinas on Reservoir Water Quality, TVA River Operations. December.

Hunter, W. C., D. N. Pashly, and R. E. F. Escano. 1993. Neotropical Migratory Landbird Species and their Habitats of Special Concern within the Southeast Region. In Status and Management of Neotropical Migratory Birds: Proceedings of Workshop. Eds. D. M. Finch and P. W. Stangel. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. (General Technical Report. RM-229.) Fort Collins, CO.

Laux, John. W. 2008. Waterbird responses to drawdown of two east Tennessee River Valley Reservoirs. Thesis, University of Tennessee. Knoxville, TN.

Lyon, Edwin. 1996. A New Deal for Southeastern Archaeology. University of Alabama Press, Tuscaloosa and Birmingham.

Metcalf and Eddy. 2006. Water Reuse. New York, NY: McGraw-Hill.

National Center for Education Statistics. 2015. US Department of Education. Search for Public School Districts. Available at: http://nces.ed.gov/ccd/districtsearch/. Accessed: January 29, 2015.

Nemerow, Nelson L., F. J. Agardy, P. Sullivan, and J. A. Salvato. 2009. Environmental Engineering – Environmental Health and Safety for Municipal Infrastructure, Land Use and Planning, and Industry. Sixth Edition. John Wiley & Sons, Inc. Hoboken, NY.

North Carolina Department of Environment and Natural Resources (NCDENR). 2014a. Draft North Carolina Statewide Water Quality Assessment. Available at: http://portal.ncdenr.org/web/wq/ps/mtu/assessment/. Accessed: December 2014.

North Carolina Department of Environment and Natural Resources (NCDENR). 2014b. Draft 2014 303(d) List. Available at: http://portal.ncdenr.org/web/wq/ps/csu/swstandards/303d. Accessed: December 2014.

Oregon Department of Environmental Quality and State Marine Board (ORDEQ). 1996. Guidelines for Sewage Collection and Disposal for Recreational Boats, Commercial Vessels and Floating Structures. September.

Salik, Douglas. LCDR Supervisor, US Coast Guard. Email to Loretta McNamee, Environmental Scientist, ARCADIS on February 2, 2015.

Schexnayder, S., B. Stephens, et al. 2009a. Recreation Use on Nickajack Reservoir. University of Tennessee Agriculture Institute. Knoxville, TN.

Schexnayder, S., B. Stephens, et al. 2009b. Recreation Use on Wheeler Reservoir. University of Tennessee Agriculture Institute. Knoxville, TN.

Schiling, E. M. and J. D. Williams. 2002. Freshwater Mussels (Bivalvia: Margaritiferidae and Unionidae) of the Lower Duck River in Middle Tennessee: a Historic and Recent Review. Southeastern Naturalist. 1(4):403–414.

Simons, T. R., K. N. Rabenold, D. A. Buehler, J. Collazo, and K. E. Franzreb. 1998. The Role of Indicator Species: Neotropical Migrant Songbirds. In Ecosystem Management for Sustainability: Principles and Practices Illustrated by a Regional Biosphere Cooperative. Ed. J. Peine. Lewis Publications. Boca Raton, FL.

Skagen, S. K. and F. L. Knopf. 1993. Toward conservation of midcontinental shorebird migrations. Conservation Biology, 7(3):533–541.

Smith, Matthew D. 2006. Spatiotemporal modeling of shorebird habitat availability at Rankin Wildlife Management Area, Tennessee. Thesis, University of Tennessee. Knoxville, TN.

State of Georgia (GA). 2014. Official Code of Georgia Annotated, O.C.G.A 31-3-5.2. Available at: http://law.justia.com/codes/georgia/2010/title-31/chapter-3/31-3-5-2/). Accessed: December 2014.

Stephens, B., A. Griffin, et al. 2007. Recreation Use on Cherokee Reservoir. University of Tennessee Agriculture Institute. Knoxville, TN.

Stephens, B., L. Didier, et al. 2006a. Recreation Use on Douglas Reservoir. University of Tennessee Agriculture Institute. Knoxville, TN.

Stephens, B., L. Didier, et al. 2006b. Recreation Use on Fort Loudoun Reservoir. University of Tennessee Agriculture Institute. Knoxville, TN.

Stephens, B., L. Didier, et al. 2006c. Recreation Use on Kentucky Reservoir. University of Tennessee Agriculture Institute. Knoxville, TN.

Stephens, B., L. Didier, et al. 2006d. Recreation Use on Melton Hill Reservoir. University of Tennessee Agriculture Institute. Knoxville, TN.

Stephens, B., L. Didier, et al. 2006e. Recreation Use on Mountain Group Reservoir. University of Tennessee Agriculture Institute. Knoxville, TN.

Stephens, B., L. Didier, et al. 2006f. Recreation Use on Norris Reservoir. University of Tennessee Agriculture Institute. Knoxville, TN.

Tennessee Department of Environment and Conservation (TDEC). 2012. 305(b) Report - The Status of Water Quality in Tennessee. Division of Water Pollution Control. Nashville, TN. December.

Tennessee Department of Environment and Conservation (TDEC). 2013. Flat Hollow Marina, Campbell County. Division of Water Resources. Knoxville, TN. August.

Tennessee Department of Environment and Conservation (TDEC). 2014. Final 2012 303(d) List. Division of Water Pollution Control, Planning and Standards Section. Nashville, TN. January.

Tennessee Valley Authority (TVA). 1980. The Tennessee Valley Authority adopted the National Environmental Policy Act procedures with approval of the Council on Environmental Quality after publication and public commentary. See 45 Fed. Reg. 54, 511 (August 15, 1980); 47 Fed. Reg. 54, 586 (December 3, 1982); 48 Fed. Reg. 19,264 (April 28, 1983).

Tennessee Valley Authority (TVA). 1998. Shoreline Management Initiative: An Assessment of Residential Shoreline Development Impacts in the Tennessee Valley. Volume 1 – Final Environmental Impact Statement (November 1998). TVA Public Land Management. Norris, TN.

Tennessee Valley Authority (TVA). 2004. Reservoir Operations Study (ROS): Final Programmatic Environmental Impact Statement. Available at: http://www.tva.gov/environment/reports/ros_eis/.

Tennessee Valley Authority (TVA). 2011a. Natural Resource Plan. Knoxville, TN.

Tennessee Valley Authority (TVA). 2011b. Natural Resource Plan Final Environmental Impact Statement. Knoxville, TN.

Tennessee Valley Authority (TVA). 2011c. Comprehensive Valleywide Land Plan. . Knoxville, TN.

Tennessee Valley Authority (TVA). 2011d. Economic Benefits of the Tennessee Valley Authority's Natural Resource Plan, by Dr. Doug MacNair, Barbara Wyse, John Cary, and Rush Childs. Available at: http://www.tva.gov/environment/reports/nrp/pdf/nrp_economic_benefits.pdf. Accessed: January 30, 2015.

Tennessee Valley Authority (TVA). 2012. River Operations Data Repository. River Operations Support Services.

Tennessee Valley Authority (TVA). 2014. Reservoir Ratings. Available at: http://www.tva.com/environment/ecohealth/index.htm. Accessed: December 2014.

Tennessee Valley Authority (TVA). 2015a. TVA Floating Houses Policy Review Environmental Impact Statement Scoping Report. Available at: www.tva.gov/floatinghouses.

Tennessee Valley Authority (TVA). 2015b. TVA database Information. Carolyn Hunt. February 3, 2015. MarinasandHarbors_Feb2_2015.dbf.

TVA Public Power Institute. 2003. Tennessee Valley Marina and Campground Wastewater Characterization Screening Study. October. Available at: www.tva.gov/environment/water/pdf/wastewater_report.pdf. Accessed: May 24, 2015.

TVA Research & Technology Applications. 2007. Tennessee Valley Marina and Campground Wastewater Characterization Screening Study Follow-Up Report. Presented at the Kentucky-Tennessee Water Professionals Conference.

US Army Corps of Engineers (USACE). 2003. Tennessee River Navigation Charts - Paducah, Kentucky to Knoxville, Tennessee. January. Nashville District. Available at: http://www.lrn.usace.army.mil/Missions/Navigation/DownloadableTNRiverCharts.aspx. Accessed: January 20, 2015.

USA Cops. 2015. Law Enforcement Agency Listings. Available at: http://www.usacops.com/. Accessed: January 29, 2015.

US Census Bureau. 2010. American Fact Finder. 2010 US Census. Available at: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml. Accessed: January 28, 2015.

US Census Bureau. 2012. American Fact Finder. 2012 Economic Census. Available at: http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_012_US_71I1&prodType=table. Accessed: January 28, 2015.

US Census Bureau. 2013a. American Fact Finder. 2013 Population Estimates. Available at: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml. Accessed: January 28, 2015.

US Census Bureau. 2013b. American Fact Finder. 2009–2013 American Community Survey. Available at: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml. Accessed: January 28, 2015.

US Department of Agriculture Natural Resource Conservation Service (USDA NRCS). 1993. National Soil Survey Handbook. Available at: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054242.

US Environmental Protection Agency (USEPA). 2014. Landfill Methane Outreach Program, Landfill-level data only (all landfills) updated. August 2014. Available at: chttp://www.epa.gov/lmop/projects-candidates/index.html. Accessed: January 15, 2015.

US Fire Administration. 2015. Federal Emergency Management Agency. National Fire Department Census. Available at: http://apps.usfa.fema.gov/census/search.cfm. Accessed: January 29, 2015.

US Water Resources Council. 1978. Floodplain Management Guidelines for Implementing E.O. 11988. Washington, DC.

Vickers, Amy. 2001. Water Use and Conservation. Amherst, MA: WaterPlow Press.

Webb, D. H., W. M. Dennis, and A. L. Bates. 1988. An analysis of the plant community of mudflats of TVA mainstem reservoirs. Pp. 177–198 In: Proceedings of the First Annual Symposium on the Natural History of Lower Cumberland and Tennessee River Valleys (D. H. Snyder [ed.]). The Center for Field Biology of Land between the Lakes, Austin Peay State University. Clarksville, TN.

Wirwa, Drew W. 2009. Waterbird use and food resource response to drawdown of Kentucky Reservoir. Thesis, University of Tennessee. Knoxville, TN

CHAPTER 6 – LIST OF PREPARERS

Nicole Berger (TVA)

Position:	Navigation Program Manager
Education:	M.S., Engineering Management; B.S., Civil/Environmental Engineering
Experience:	14 years in river forecasting, 1 year in navigation
Involvement:	Navigation

Heath Byrd (Cardno)

Position:	Senior project scientist/Economist
Education:	M.S., Agricultural and Resource Economics; B.S., Environmental Economics and Management
Experience:	15 years in recreation economics, socioeconomics, and NEPA compliance
Involvement:	Socioeconomics, Recreation

David Cameron (ARCADIS)

Position:	Principal Scientist
Education:	M.S., Animal Ecology, B.S., Biology
Experience:	34 years in impact assessment and NEPA compliance
Involvement:	Navigation and NEPA compliance

Kathryn Cloutier (ARCADIS)

Position:	Senior Environmental Scientist
Education:	M.S., Environmental Management/Natural Resources; B.A., Biology
Experience:	27 years in NEPA analysis, permitting, and environmental compliance
Involvement:	Public Safety, Solid and Hazardous Wastes

Adam J. Dattilo (TVA)

Position:	Botanist
Education:	M.S., Forestry; B.S., Natural Resource Conservation Management
Experience:	15 years in ccological restoration and plant ecology; 8 years in botany
Involvement:	Threatened and Endangered Species, Ecological Resources

Lauren Elmore (Cardno)

Position:	Senior Environmental Scientist
Education:	MS, Public Health; Environmental Science & Engineering; BS, Zoology; Environmental Studies Certificate
Experience:	19 years in water resources management and aquatic ecology, regulatory compliance, water quality assessment and monitoring.
Involvement:	EIS preparation

Patricia Bernard Ezzell (TVA)
Position: Program Manager, Tribal Liaison and Corporate Historian
Education: M.A., History with an emphasis in Historic Preservation; B.A., Honors History
Experience: 27 years in history, historic preservation, and cultural resource management; 12 years in tribal relations
Involvement: Tribal outreach

Robert G. Farrell (TVA)
Position: Project Manager
Education: M.S, B.S., Recreation Resource Administration
Experience: 31 years in reservoir land and shoreline management, recreation facilities management, and recreation planning
Involvement: Recreation and permitting, and EIS preparation

Jennifer L. Flathman (Cardno)
Position: Project Architectural Historian
Education: M.S., Historic Preservation ; B.A. Political Science
Experience: 11 Years in cultural resource management, visual resources management, and NEPA compliance
Involvement: Visual Resources

Jerry G. Fouse (TVA)
Position: Recreation Manager
Education: M.B.A.; B.S., Forestry and Wildlife
Experience: 41 years in natural resources – recreation planning and economic development
Involvement: Recreation

Elizabeth B. Hamrick (TVA)
Position: Biologist (Zoologist)
Education: MS, Wildlife, BS Biology
Experience: 8 years in biological surveys and environmental reviews
Involvement: Threatened and Endangered Species (terrestrial animals), Ecological Resources (wildlife)

David B. Harrell (TVA)
Position: Program Manager, Watershed Stewardship
Education: M.S., Natural Resource Management; B.S., Wildlife and Fisheries Management
Experience: 20 years in planning and managing public land; 3 years in environmental education
Involvement: Recreation and permitting

Andrew Henderson (TVA)
Position: Aquatic Endangered Species Biologist
Education: MS, Fisheries Biology (Conservation), BS, Fisheries Biology
Experience: 10 years in aquatic monitoring, rare aquatic species surveys
Involvement: Ecological Resources (aquatic ecology); Threatened and Endangered Species (aquatic species)

Matthew S. Higdon (TVA)
Position: NEPA Specialist
Education: M.S., Environmental Planning; B.A., History
Experience: 12 years in natural resources planning and NEPA compliance
Involvement: NEPA compliance and EIS preparation

Samuel W. Hixson (TVA)
Position: Manager, Waste Permits, Compliance and Monitoring
Education: M.S., Environmental Engineering
Experience: 32 years environmental engineering experience, NPDES and RCRA permitting, water quality, solid waste, groundwater monitoring, and environmental compliance
Involvement: Solid and Hazardous Wastes

Tim L. Keeling (TVA)
Position: Heritage Database Manager
Education: B.S., Computer Science
Experience: 38 years in application and database design
Involvement: Heritage viewer; data quality

Ingrid Kimball (Cardno)
Position: Staff Scientist
Education: M.S., Forest Resources, B.S., Biology
Experience: 3 years experience in NEPA compliance
Involvement: EIS preparation

Paul N. Leonard (Cardno)
Position: Principal in Charge, NEPA Specialist
Education: M.S., Fisheries Science/Statistics, B.S., Aquatic Biology
Experience: 30 years experience with regulated river systems, impact assessment, permitting, and NEPA compliance
Involvement: NEPA compliance and EIS preparation

Carrie C. Mays (TVA)
Position: Civil Engineer, Flood Risk
Education: M.S. and B.S., Civil Engineering, Professional Engineer
Experience: 11 years in compliance monitoring, 3 years in river forecasting, 2 years in flood risk
Involvement: Floodplains

Charles L. McEntyre (TVA)
Position: Environmental Engineer
Education: M.S., Environmental Engineering; B.A., Biology, Minor Chemistry
Experience: 38 years in water and wastewater engineering
Involvement: Water Quality and Ecological Health

Loretta McNamee (ARCADIS)
Position: Staff Environmental Scientist
Education: B.S., Biology
Experience: 7 years in NEPA compliance
Involvement: Assistant project management, NEPA compliance, EIS preparation

Oliver Pahl (Cardno)
Position: Senior Staff Economist
Education: B.S., Environmental Economics, Policy, and Management
Experience: 5 years in natural resource economics and NEPA compliance
Involvement: Socioeconomics, Recreation

Kim Pilarski-Hall (TVA)
Position: Senior Wetlands Biologist
Education: M.S., Geography, Minor Ecology
Experience: 20 years in wetlands assessment and delineation
Involvement: Wetlands

Marianne M. Shuler (TVA)
Position: Archaeologist
Education: B.A., Religion/Middle Eastern Archaeology
Experience: 11 years in archaeology and cultural resource management
Involvement: Cultural Resources

Kimberly M. Sechrist (Cardno)
Position: Senior Staff Scientist
Education: M.S., Environmental Science; B.A., Biology
Experience: 8 years in NEPA compliance
Involvement: Land Use

Garrett W. Silliman (Cardno)
Position: Senior Staff Archaeologist
Education: M.H.P, Heritage Preservation, Public History/Archaeology; B.A., Archaeology
Experience: 20 years in archaeology, cultural resource management, and NHPA Section 106 compliance
Involvement: Cultural Resources

Woodrow J. Speed (Cardno)
Position: Project Scientist
Education: B.S., Environmental Studies
Experience: 8 years in wetland biology, endangered species, and regulatory compliance
Involvement: Terrestrial Ecology (coastal processes), Threatened and Endangered Species

Erica F.Wadl (TVA)

Position:	Program Manager Environmental Support
Education:	M.S., Forestry; B.S., Biology
Experience:	11 years in natural resources and environmental compliance
Involvement:	NEPA compliance

A. Chevales Williams (TVA)

Position:	Senior Environmental Engineer
Education:	B.S., Environmental Engineering
Experience:	10 years in water quality monitoring and compliance; 9 years in NEPA planning and environmental services
Involvement:	Water Quality (surface water and industrial wastewater)

This page intentionally left blank

CHAPTER 7 – DRAFT ENVIRONMENTAL IMPACT STATEMENT RECIPIENTS

Following is a list of the agencies, organizations, and persons who have received copies of the Draft EIS or notices of its availability with instructions on how to access the EIS on the Floating Houses Project webpage.

7.1 Federal Agencies

US Coast Guard, Marine Safety Detachment, Nashville, Tennessee

US Department of Army, Corps of Engineers
- Wilmington District, Asheville, North Carolina
- Nashville District, Nashville, Tennessee
- Mobile District, Mobile, Alabama
- Regulatory Office, Decatur, Alabama
- Regulatory Office, Lenoir City Tennessee

US Environmental Protection Agency, Southeast Region 4, Atlanta, Georgia

US Fish and Wildlife Service
- Southeast Region, Atlanta, Georgia
- Asheville, North Carolina
- Frankfort, Kentucky
- Decatur, Alabama
- Daphne, Alabama
- Athens, Georgia
- Jackson, Mississippi
- Cookeville, Tennessee
- Gloucester, Virginia
- Abingdon, Virginia

7.2 Federally Recognized Tribes

Absentee-Shawnee Tribe of Oklahoma

Alabama-Coushatta Tribe of Texas

Alabama Quassarte Tribal Town

Cherokee Nation

The Chickasaw Nation

Choctaw Nation of Oklahoma

Eastern Band of Cherokee Indians

Eastern Shawnee Tribe of Oklahoma

Jena Band of Choctaw Indians

Kialegee Tribal Town

Mississippi Band of Choctaw Indians

Muscogee (Creek) Nation of Oklahoma

Poarch Band of Creek Indians

Seminole Nation of Oklahoma

Shawnee Tribe

Thlopthlocco Tribal Town

United Keetoowah Band of Cherokee Indians in Oklahoma

7.3 State Agencies

Alabama

- Department of Conservation and Marine Resources, Montgomery
- Department of Conservation and Natural Resources, Montgomery
- Department of Economic and Community Affairs, Montgomery
- Department of Environmental Management, Montgomery
- Historical Commission, Montgomery
- North-Central Alabama Regional Council of Governments, Decatur
- Northwest Alabama Council of Local Governments, Muscle Shoals
- Top of Alabama Regional Council of Governments, Huntsville
- Decatur–Morgan County Port Authority, Decatur

Georgia

- Department of Natural Resources, Atlanta and Gainesville

Kentucky

- Energy and Environment Cabinet, Frankfort
- Department for Natural Resources, Frankfort
- Department for Environmental Protection, Frankfort
- Department of Fish and Wildlife, Frankfort
- State Clearinghouse, Frankfort
- Heritage Council and State Historic Preservation Officer, Frankfort

Mississippi

- Department of Archives and History, Jackson
- Department of Environmental Quality, Jackson
- Department of Wildlife, Fisheries, and Parks, Jackson
- NE Mississippi Planning and Development District, Booneville
- Tombigbee River Valley Water Management District, Tupelo

North Carolina

- Department of Environment and Natural Resources, Raleigh and Swannanoa offices
- North Carolina Wildlife Resources Commission, Raleigh
- North Carolina Department of Cultural Resources, Raleigh

Tennessee

- Department of Economic and Community Development, Nashville
- Department of Environment and Conservation, Nashville
- Historical Commission, Nashville
- Department of Transportation, Nashville
- East Tennessee Development District, Alcoa

First Tennessee Development District, Johnson City
Northwest Tennessee Development District, Martin
South Central Tennessee Development District, Columbia
Southeast Tennessee Development District, Chattanooga
Southwest Tennessee Development District, Jackson
Tennessee Wildlife Resources Agency, Nashville

Virginia
Department of Conservation and Recreation, Richmond
Department of Environmental Quality, Richmond and Abingdon
Department of Game and Inland Fisheries, Richmond
Department of Historic Resources, Richmond

7.4 Organizations

Alabama
Alred Marina, Guntersville
Brickyard Landing Marina, Decatur
Browns Creek Sailing Marina, Guntersville
Ditto Landing Marina, Huntsville
Emerald Beach Marina, Killen
Florence Harbor Marina and Restaurant, Florence
Goosepond Colony Resort, Scottsboro
Guntersville Boat Mart Inc., Guntersville
Guntersville Marina (Signal Point), Guntersville
Honeycomb Campground, Grant
Jackson County Park, Scottsboro
Jay Landing, Decatur
Lake Guntersville Resort, LLC, Gadsden
Lake Guntersville Yacht Club, Guntersville
Little Mountain Marina and Camping Resort (Wakefield Enterprises, Inc.), Langston
Lucy's Branch Marina, Athens
Marina Mar, Florence
Mountain Lakes Resort, Inc., Langston
Ossa-Win-Tha Resort, Guntersville
Powell Harbor, Guntersville
River Bend Marina Inc., Guntersville
Riverwalk Marina, Decatur
Rollison Marina, Florence
Seibold Creek Campground and Marina, Guntersville
South Sauty Creek - Davis Point, Langston
Spring Creek Marina (JD&L Enterprises, Inc.) West Long, Long Ventures, Guntersville
Steenson Hollow Marina, Muscle Shoals
Val Monte Lakeside Resort and Marina, Guntersville
Whitesburg Boat and Yacht Club, Huntsville
Joe Wheeler State Park, Rogersville

Florida
Harbor Lights Yacht Club, Ft. Myers

Georgia
- Blue Ridge Marina, Blue Ridge
- Boundary Waters Resort and Marina, Hiwassee
- CCL Associates, Roswell
- Eden Marina, Atlanta
- Nottely Marina, Blairsville
- Ridges Resort and Marina, Hiwassee
- Lower Bell RV Park, Hiawassee
- Salale Lodge, Hiawassee

Kentucky
- King Creek Resort and Marina (Blommaert Properties LLC)Mokena
- Bee Springs Lodge, Benton
- Big Bear Resort & Marina, Benton
- Cedar Knob Resort, Benton
- Cozy Cove Waterfront Resort, Benton
- Cypress Spring Resort, Inc., New Concord
- Fat Daddy's Resort and Marina, Murray
- Hester's Resort and Marina, LLC, Benton
- Hickory Hill Five Star Resort, Benton
- Hickory Star Resort & Marina, LLC, Middlesboro
- Irvin Cobb Resort, Murray
- Kenlake State Resort Park, Hardin
- Kentucky Beach Resort, Murray
- Kentucky Dam Village State Park, Gilbertville
- Lighthouse Landing, Grand Rivers
- Malcolm Creek Resort and Marina, Benton
- Missing Hill Resort, New Concord
- Moor's Resort, Gilbertville
- Owner's Association of Pirate's Cove, Inc. (Pirate's Cove Campground), Hardin
- Paradise Resort, Murray
- Shawnee Bay Resort, Inc., Benton
- Southern Komfort Campground and Marina (BCK, Inc.), Benton
- Spportsman's Anchor Resort/Marina, Wessinger Enterprises, Inc., Benton
- Sugar Creek Bay Marina (Alred Marina, Inc.), Murray
- Town and Country Marina, Benton
- Whispering Oaks Resort, Inc., Benton
- Lakeview Cottages and Marina, New Concord

Mississippi
- Aqua Yacht Harbor, Iuka
- Eastport Marina, Iuka
- J. P. Coleman State Park, Iuka
- Mill Creek Marina, LLC, Iuka

Missouri
- Water’s Edge RV Park and Marina

North Carolina
- Alarka Dock, Bryson City

Almond Boat and RV Park, Bryson City
Castaway Boat Dock, Robbinsville
Chatuge Cove Marina ,Hayesville
Crisp Boat Dock, Robbinsville
Dukes Hideaway Marina, Murphy
Greasy Boat Dock, Bryson City
Harbor Cove Marina, Murphy
Ho Hum Campground, Hayesville
Mountain View Marina & Boat Rental, Murphy
Penland Point Campground, Hayesville
Peppertree Fontana Village, Fontana Dam
Prince Boat Dock, Almond
Shook's Marina, Murphy

Tennessee
Anchor Harbor Marina, New Johnsonville
Arrowhead Resort, Spring City
B & B Marina, Charleston
B&B Straight Creek Boat Dock, Inc., New Tazewell, TN
Bass Bay Village and Marina, Big Sandy
Bayside Marina and Resort, Ten Mile
Bayview, Butler
Beach Island and Campground, Maynardville
Beaver Dam Creek Marina, Inc., Camden
Big Ridge Yacht Club,Hixson
Birdsong Resort, Camden
Black Oak Dock, Jefferson City
Blue Springs Boat Dock, Cumberland Gap
Blue Springs Marina, Ten Mile
Blue Water Campground, Dayton
Boone Lake Marina, Piney Flats
Britton Ford Campground, Springville
Browns Ferry Marina, Chattanooga
Buchanan Resort (Pine Point Boat Dock, LLC), Springville
Campground on the Lakeshore, Ten Mile
Cane Creek Dock, Stewart
Caney Creek Campground, Harriman
Caney Creek Marina, Harriman
Cardinal Cove Resort, Rutledge
Cedar Creek Boat Dock, Columbia
Cedar Grove Marina & Campground,New Tazewell
Cedar Hill Dock, Knoxville
Cherokee Heights Boat Dock, Sugar Tree
Cherokee Lake Campground, Mooresburg
Cherokee Marina
Chickamauga Marina
Choto Marina, Knoxville
Clifton Marina, Clifton
Concord Marina, Knoxville
Cottonport Fish'N Camp, Decatur
Country Junction Resort, Springville

Cove Ridge Marina, Bristol
Cowboy's Dock, Dandridge
Cuba Landing Marina, Waverly
Cypress Bay Resort, Buchanan
Davis Marina, Blountville
Dayton Boat Dock, Dayton
Deerfield Cove Marina, INC., LaFollette
Duncan Boat Dock, Knoxville
Eagle Bay Marina, LLC, Waverly
Eagle's Nest Marina, Inc., Buchanan
Erwin Marine Sales - Guntersville, Chattanooga
Euchee Marina and Campground, Ten Mile
Fall Creek Dock - Heron Point, Russellville
Fancher's Willow Branch Campground, Dandridge
Fish Springs Marina, Hampton
Flat Hollow Marina, LLC, Speedwell
Fort Loudoun Dam Marina, Lenoir City
Fox Road Marina, Knoxville
Fred's Bait and Tackle, Loudon
Friendship Resort & Marina, Bristol
Gator Point Marina, Sevierville
German Creek Resort, Bean Station
Gilmore Dock, Rutledge
Gold Point Marina, Chattanooga
Grand Harbor Marina, Counce
Greasy Hollow Boat Dock, LLC, Speedwell
Greenlee's May Springs, Rutledge
Greenlee's RV & Marine, Rutledge
Hales Bar Marina and Resort, Inc., Guild
Hamblen County Boat Dock, Morristown
Harbor Lights Marina, Soddy-Daisy
Harrison Bay State Park, Harrison
Hidden Cove Marina, Johnson City
Holiday Landing and Resort, Tullahoma
Hook, Line & Sinker, Linden
Hornsby Hollow, Kingston
Indian Creek Boat Dock, Dandridge
Indian River Marina, Inc., Jacksboro
International Harbor Marina, Friendsville
Island Cove Marina and Resort, Harrison
Jacobs Creek Recreation Area, Bristol
Jay's Dock, Gray
Lake Ocoee Inn and Marina, Benton
Lakeshore Marina,. Chattanooga
Lakeshore RV Park/Sportsman's Shop, Dandridge
Lakeside Marina, Bean Station
Lakeside Resort, Spring City
Lakeview Boat Dock, Sharps Chapel
Lakeview Dock, Bristol
Lakeview Marina, Kingsport
Laurel Marina and Yacht Club, Bristol

Leatherwood Resort (C/O Bradaniel, Inc.), Dover
Lighthouse Pointe, Dandridge
Linda's Lakeside Marine, Bean Station
Little Oak Mountain Recreation Area, Bristol
Lone Mountain Boat Dock, Tazewell
Lost Creek Dock, Decaturville
Lotterdale Cove Campground, Greenback
Louisville Landing Marina, Knoxville
Mallard Cove Marina, Butler
Mansard Island Resort and Marina, Springville
Mason's Dock, Reed A. Richardson, Waverly
Melton Hill Marina, Oak Ridge
Mermaid Marina, Decaturville
Misty Harbor Marina, Soddy-Daisy
Mountain Cove Marina/Sevier County Park, Kodak
Mountain Harbor Inn, Dandridge
Mountain Lake Marina and Campground, Lake City
Mountain Lake Resort @ Pappy's Marina, Butler
Norris Dam Marina, Norris
Norris Landing Marina LLC, Knoxville
Notchy Creek Campground, Vonore
Oak Haven Resort, Buchanan
Painter Creek Marina (Sade Corp. Inc), Bristol
Perryville Marina Campground LLC, Parsons
Pickwick Landing State Park, Counce
Pine Harbor Marina, Soddy-Daisy
Pine Point Resort (Pine Point Boat Dock LLC), Springville
Piney Point Resort, Spring City
Pioneer Landing, Butler
PJ's Landing Marina, Friendsville
PJ's Restaurant & Resort, Dover
Pleasant View Resort, LLC, Springville
Powell Valley Resort, LaFollette
Rarity Point
Rhea Harbor, Spring City
Rockingham Dock, Gray
Ross Landing Park, Chattanooga
Ross' Landing Park, Chattanooga
Sale Creek Marina, Soddy-Daisy
Sam's Boat Dock, Ten Mile
Sequoyah Birthplace Museum, Vonore
Sequoyah Marina LLC, Andersonville
Sequoyah Resort Marina, Andersonville
Shady Grove Harbor, Soddy-Daisy
Shanghai Resort, LaFollette
Shelton's Campground, Rockwood
Smithbilt Marinas, LLC (Waterside Marina), Knoxville
Sonny's Lakeside Marina, Gray
Southernaire Marina, Charlotte
Spring City Resort and Marina, Spring City
Springs Dock and Resort, LaFollette

Sugar Hollow Marina , LaFollette
Sullivan County Park, Bristol
Swann Harbor, Knoxville
Swann's Marina, Dandridge
Tellico Harbor Marina
Terrace View Marina Resorts, Spring City
The Breakers of Swan Bay, Paris
The Point Marina and Resort, Dandridge
Taylor's Lakeside Campground, Bean Station
Tims Ford Marina and Resort, Winchester
Tri-City Dock
Tri-County Sportsman's League Highway 58 Boat Dock, Decatur
Union County Boat Dock, Speedwell
Volunteer Landing, Knoxville
Wa-Ni Village, Rutledge
Warriors' Path State Park, Kingsport
Watauga Lakeshores Resort and Marina, Hampton
Watauga Yacht and Beach Club, Butler
Waterfront Investments LLC (Stardust Marina), Andersonville
Watts Bar Landing, Oak Ridge
Whitman Hollow Marina (Whitman Hollow Holdings LLC), LaFollette
Wildlife Cove Village and Marina (Wildlife Cove Corporation), Camden
Willow Point Marina, Knoxville

Texas
Twin Cove Marina, Houston

Virginia
Lakeshore Campgronud, Abingdon
Sportsman’s Marina, Abingdon
Washington County Park

7.5 Individuals

Alberton, Mary Ann and Tom	LaFollette, TN
Artley, Annette	Waynesville, NC
Ball, Billy	LaFollette, TN
Barnette, Guy	Parsons, TN
Birdsall, Brian	Jacksboro, TN
Black, Sandra	Whittier, NC
Blackburn, Jack	LaFollette, TN
Blevins, Phillip	Memphis, TN
Boatman, Mac	Clinton, TN
Brown, Jonathan	Bristol, TN
Broyles, Jerry and Laura	LaFollette, TN
Bundy, Matthew	Abingdon, VA
Burch, Henry A.	Trenton, TN
Cable, Greg	Robbinsville, NC

Calvin, Tony	Candler, NC
Cantwell, L.	LaFollette, TN
Carter, Tim	Johnson City, TN
Caulder, Nancy	Tyrone, GA
Caxton, Brian	Clyde, NC
Childs, Charlie	Dunlap, TN
Cochran, Terry	Speedwell, TN
Collins, Harold and Theresa	Bryson City, NC
Collins, Orlin	Gray, TN
Combs, Phillip and Lisa	Speedwell, TN
Coulthard, Larry	LaFollette, TN
Coulthard, Patty	LaFollette, TN
Covert, Steven	Arden, NC
Crawford, Bernice M.	Kingsport, TN
Crisp, Ronnie	Graham, NC
Cross, C.E. and Barbara	Johnson City, TN
Crunkleton, Debbie	Franklin, NC
Culbert, Jim	Johnson City, TN
Danko, Don	Maineville, OH
Deal, Preston	Bristol, TN
Dean, Michael and Theresa	Pineville, KY
Dickman, Scott	Cincinnatti, OH
Dossett, Tony	LaFollette, TN
Douthit, James W.	Bryson City, NC
Driskell, Richard C.	Batavia, OH
Drumwright, Terry	Parsons, TN
Duncan, B.J.	New Tazewell, TN
Duncan, Lori	New Tazewell, TN
Duncan, William	Asheville, NC
Eberharter	Jacksboro, TN
Farwick, Gary	Speedwell, TN
Ferguson, David	Hamilton, OH
Figuerado, Jim	Guild, TN
Fletcher, Patrick	
Gaddy, Eric	Leicester, NC
Garlitz, Ryan	Alexandria, KY
Gaylon, Zenda	Kingsport, TN
Gaylord, Frank	Waynesville, NC
Giesleu, Don	Kingsport, TN
Gill, Tom and Brenda	Speedwell, TN
Godfrey, Mark and Bev	Humbolt, TN
Graham, Julie	Knoxville, TN
Green, Benny	Speedwell, TN

Green, Benny	Speedwell, TN
Greene, Teddy	Bryson City, NC
Gregory, Joseph	Bristol, TN
Grimes, Mike	Cincinnatti, OH
Gurley, Bob and Donna	Morganton, NC
Hale, Jim	Asheville, NC
Hamilton, Craig	
Hamlin, Harold	Cumberland Gap, TN
Harrison, Russ	Bluff City, TN
Hendric, Mary	Clyde, NC
Hensley, Robert	Franklin, NC
Henson, Gary	Millington, TN
Hickman, Logan	LaFollette, TN
Hidding, Rick	Atlanta, GA
Hodge, Brad	Andersonville, TN
Howell, Howard	Candler, NC
Howell, Ronald H.	Candler, NC
Hudson, Steve	New Tazewell, TN
Hudson, W.B. Jr	Kingsport, TN
Hughes, Robert	Middlesboro, KY
Hunter, Charlie	Asheville, NC
Hunter, Jason	Asheville, NC
Hunter, Jeff	Canton, NC
Ilgner, Berny	Knoxville, TN
Ishmael, Frank	Troy, OH
Ishmael, Lisa	Troy, OH
Jayne, Jesse Andrew	Fairview, NC
Jenkins, Arthur and Pamela	Speedwell, TN
Johns, Bryan and Joy	Lakeland, TN
Johnson, Brent and Rebecca	Middlesboro, KY
Johnson, Randall and Carla	LaFollette, TN
Jones, D. R.	LaFollette, TN
Jones, Jason	Canton, NC
Jones, Melvin Neil	Bryson City, NC
Jones, Shannon and James	Piney Flats, TN
Jowers, Paula	Lexington, TN
Kendall, Kenneth R.	Fontana Village, NC
Kluener, Mike	Cincinnatti, OH
Koserski, Chris	Bristol, TN
Krasner, Todd	Jackson, TN
Land, Tere	Bristol, VA
Landis, Pete	Robbinsville, NC
Lawrence, Tim	Waynesville, NC

Lawson, Keith	Lexington, TN
Lefker, Tom and Mary Ann	Williamsburg
Leopard, Mark	Waynesville, NC
Lewis, Lee	Pigeon Forge, TN
Light, Cindy	Gray, TN
Lizzie, Bill	Johnson City, TN
Loy, Ed	Lenoir City, TN
Lueck, Matt	Morristown, TN
Lyons, Howard and Sandy	New Carlisle, OH
Manis, Bill	Nashville, TN
Mathis, Jim and Jo	Bryson City, NC
Maurer, Tom	Fort Laramie, OH
Mays, Ken	Jacksboro, TN
McClure, Beth	Parsons, TN
Milan, J. Don	Sugar, TN
Mills, Sarah	Kingsport, TN
Mitchell, Joe and Sharon	Bryson City, NC
Moles, Jesse	Andersonville
Morris, Dale and Lora	Xenia, OH
Moss, Allen Jr	Maryville, TN
Moss, Tom	Maryville, TN
Mote, William	Crestview, FL
Mullins, Sean	Bristol, TN
Nation, Harrell and Janice	Jackson, TN
Nease, Harol	Lexington, KY
Newman, Brandon	Springsboro, OH
O'Neal, Doug and Lisa	Jackson, TN
Oros, John L.	Robbinsville, NC
Oros, Mike	Robbinsville, NC
Paine, David	Maryville, TN
Parker, Kym	Cherokee, NC
Pauley, Eddie and Sandra	Speedwell, TN
Pigman, Dwight and Suellen	Bryson City, NC
Prince, David	Almond, NC
Prince, Tony	Almond, NC
Punner, Frank	Kingsport, TN
Radford, George	Asheville, NC
Ray, Burton	Waynesville, NC
Reeves, Steve and Marcella	Conover, NC
Richardson, ken	LaFollette, TN
Rickard, Russ and Mary Anne	Caryville, TN
Riggs, Warren	Kingsport, TN
Robertson, Sam	Black Mountain, NC

Robertson, Samuel Jr	Black Mountain, NC
Roe, Sylvia	Abingdon, VA
Rogers, Andrea	Cincinnatti, OH
Rogers, Andrea	Cincinnatti, OH
Roland, Bill	Arden, NC
Rutherford, Bob	Kingsport, TN
Salava, Marc	De Pere, WI
Samples, Chuck	LaFollette, TN
Samples, Debbie	Jacksboro, TN
Samson, Amy	Almond, NC
Sanford, Paul and Tracy	Bells, TN
Schneider, Peter	Atlanta, GA
Schneider, Rachel	Boulder, CO
Seay, John	Bryson City, NC
Sellers, Brian	Franklin, NC
Sherrill, Tony	Bryson City, NC
Shipman, Bill	Candler, NC
Shope, Pete	Franklin, NC
Simpson, Sally A.	Middlesboro, KY
Slade, Barry T.	Knoxville, TN
Smith, Jeff	Clyde, NC
Sobocinski, Jennifer	Bryson City, NC
Soreano, Michael	Caryville, TN
Stewart, Jeannie	Fontana Dam, NC
Stoots, Mike	Flag Pond, TN
Stowers, Edward	Waynesville, NC
Szweda, Mark	Parsons, TN
Taylor, James	Cherokee, NC
Terry, Robert	Knoxville, TN
Tharpe, Carol	Kingsport, TN
Thomas, Brian and Rebecca	Bryson City, NC
Thomas, George	Cumberland, MD
Thornton, Dwyot	Nashville, TN
Tramel, Benjamin	Butler, TN
Trivette, Laura	Sylva, NC
Trivette, Todd	Sylva, NC
Turner, Glen	Parsons, TN
Vann, John M.	Bristol, TN
Webb, James T.	Waynesville, NC
Webb, Mark H.	Bristol, TN
Whitaker, Perry and Donna	Blountville, TN
Whitwell, Tommy	Lexington, TN
Wilks, Michael	Tipp City, OH

Williams, Timothy D.	Gray, TN
Wilson, Richard P.	Maryville, TN
Womack, Paul	Knoxville, TN
Wormsley, David and Callie	Jacksboro, TN
Yeary, Curtis Buddy	Middlesboro, KY

This page intentionally left blank

Appendix A

TVA 26a Regulations Pertinent to Nonnavigable Houseboats and Floating Houses

This page left intentionally blank.

Code of Federal Regulations

Title 18 – Conservation of Water and Power Resources

Part 1304: Approval of Construction in the Tennessee River System and Regulations of Structures and Other Alterations

Subpart B: Regulation of Nonnavigable Houseboats

[Available at http://www.tva.gov/river/26apermits/regs_index.htm**]**

§ 1304.100 Scope and intent

This subpart prescribes regulations governing existing nonnavigable houseboats that are moored, anchored, or installed in TVA reservoirs. No new nonnavigable houseboats shall be moored, anchored, or installed in any TVA reservoir.

§ 1304.101 Nonnavigable houseboats

(a) Any houseboat failing to comply with the following criteria shall be deemed a nonnavigable houseboat and may not be moored, anchored, installed, or operated in any TVA reservoir except as provided in paragraph (b) of this section:
(1) Built on a boat hull or on two or more pontoons;
(2) Equipped with a motor and rudder controls located at a point on the houseboat from which there is forward visibility over a 180-degree range;
(3) Compliant with all applicable state and federal requirements relating to vessels;
(4) Registered as a vessel in the state of principal use; and
(5) State registration numbers clearly displayed on the vessel.

(b) Nonnavigable houseboats approved by TVA prior to February 15, 1978, shall be deemed existing houseboats and may remain on TVA reservoirs provided they remain in compliance with the rules contained in this part. Such houseboats shall be moored to mooring facilities contained within the designated and approved harbor limits of a commercial marina. Alternatively, provided the owner has obtained written approval from TVA pursuant to subpart A of this part authorizing mooring at such location, nonnavigable houseboats may be moored to the bank of the reservoir at locations where the owner of the houseboat is the owner or lessee (or the licensee of such owner or lessee) of the proposed mooring location, and at locations described by §1304.201(a)(1), (2), and (3).

All nonnavigable houseboats must be moored in such a manner as to:
(1) Avoid obstruction of or interference with navigation, flood control, public lands or reservations;
(2) Avoid adverse effects on public lands or reservations;
(3) Prevent the preemption of public waters when moored in permanent locations outside of the approved harbor limits of commercial marinas;

(4) Protect land and landrights owned by the United States alongside and subjacent to TVA reservoirs from trespass and other unlawful and unreasonable uses; and
(5) Maintain, protect, and enhance the quality of the human environment.

(c) All approved nonnavigable houseboats with toilets must be equipped as follows with a properly installed and operating Marine Sanitation Device (MSD) or Sewage Holding Tank and pump-out capability:
(1) Nonnavigable houseboats moored on “Discharge Lakes” must be equipped with a Type I or Type II MSD.
(2) Nonnavigable houseboats moored in: “No Discharge Lakes” must be equipped with holding tanks and pump-out capability. If a nonnavigable houseboat moored in a “No Discharge Lake” is equipped with a Type I or Type II MSD, it must be secured to prevent discharge into the lake.

(d) Approved nonnavigable houseboats shall be maintained in a good state of repair. Such houseboats may be structurally repaired or rebuilt without additional approval from TVA, but any expansion in length, width, or height is prohibited except as approved in writing by TVA.

(e) All nonnavigable houseboats shall comply with the requirements for flotation devices contained in §1304.400.

(f) Applications for mooring of a nonnavigable houseboat outside of designated harbor limits will be disapproved if TVA determines that the proposed mooring location would be contrary to the intent of this subpart.

§ 1304.102 Numbering of nonnavigable houseboats and transfer of ownership
(a) All approved nonnavigable houseboats shall display a number assigned by TVA. The owner of the nonnavigable houseboat shall paint or attach a facsimile of the number on a readily visible part of the outside of the facility in letters at least 3 inches high.

(b) The transferee of any nonnavigable houseboat approved pursuant to the regulations in this subpart shall, within thirty (30) days of the transfer transaction, report the transfer to TVA.

(c) A nonnavigable houseboat moored at a location approved pursuant to the regulations in this subpart shall not be relocated and moored at a different location without prior approval by TVA, except for movement to a new location within the designated harbor limits of a commercial dock or marina.

§ 1304.103 Approval of plans for structural modifications or rebuilding of approved nonnavigable houseboats
Plans for the structural modification, or rebuilding of an approved nonnavigable houseboat shall be submitted to TVA for review and approval in advance of any structural modification which would increase the length, width, height, or flotation of the structure.

Subpart E: Miscellaneous

§ 1304.400 Flotation devices and material, all floating structures

(a) All flotation for docks, boat mooring buoys, and other water-use structures and facilities, shall be of materials commercially manufactured for marine use. Flotation materials shall be fabricated so as not to become water-logged, crack, peel, fragment, or be subject to loss of beads. Flotation materials shall be resistant to puncture, penetration, damage by animals, and fire. Any flotation within 40 feet of a line carrying fuel shall be 100 percent impervious to water and fuel. Styrofoam floatation must be fully encased. Reuse of plastic, metal, or other previously used drums or containers for encasement or flotation purpose is prohibited, except as provided in paragraph (c) of this section for certain metal drums already in use. Existing flotation (secured in place prior to September 8, 2003) in compliance with previous rules is authorized until in TVA's judgment the flotation is no longer serviceable, at which time it shall be replaced with approved flotation upon notification from TVA. For any float installed after September 8, 2003, repair or replacement is required when it no longer performs its designated function or exhibits any of the conditions prohibited by this subpart.

(b) Because of the possible release of toxic or polluting substances, and the hazard to navigation from metal drums that become partially filled with water and escape from docks, boathouses, houseboats, floats, and other water-use structures and facilities for which they are used for flotation, the use of metal drums in any form, except as authorized in paragraph (c) of this section, for flotation of any facilities is prohibited.

(c) Only metal drums which have been filled with plastic foam or other solid flotation materials and welded, strapped, or otherwise firmly secured in place prior to July 1, 1972, on existing facilities are permitted. Replacement of any metal drum flotation permitted to be used by this paragraph must be with a commercially manufactured flotation device or material specifically designed for marine applications (for example, pontoons, boat hulls, or other buoyancy devices made of steel, aluminum, fiberglass, or plastic foam, as provided for in paragraph (a) of this section).

(d) Every flotation device employed in the Tennessee River system must be firmly and securely affixed to the structure it supports with materials capable of withstanding prolonged exposure to wave wash and weather conditions.

§ 1304.401 Marine sanitation devices

No person operating a commercial boat dock permitted under this part shall allow the mooring at such permitted facility of any watercraft or floating structure equipped with a marine sanitation device (MSD) unless such MSD is in compliance with all applicable statutes and regulations, including the FWPCA and regulations issued thereunder, and, where applicable, statutes and regulations governing "no discharge" zones.

§ 1304.402 Wastewater outfalls

Applicants for a wastewater outfall shall provide copies of all federal, state, and local permits, licenses, and approvals required for the facility prior to applying for TVA approval, or shall concurrently with the TVA application apply for such approvals. A section 26a permit shall not be issued until other required water quality approvals are obtained, and TVA reserves the right to impose additional requirements.

§ 1304.403 Marina sewage pump-out stations and holding tanks
All pump-out facilities constructed after September 8, 2003, shall meet the following minimum design and operating requirements:

(a) Spill-proof connection with shipboard holding tanks;

(b) Suction controls or vacuum breaker capable of limiting suction to such levels as will avoid collapse of rigid holding tanks;

(c) Available fresh water facilities for tank flushing;

(d) Check valve and positive cut-off or other device to preclude spillage when breaking connection with vessel being severed;

(e) Adequate interim storage where storage is necessary before transfer to approved treatment facilities;

(f) No overflow outlet capable of discharging effluent into the reservoir;

(g) Alarm system adequate to notify the operator when the holding tank is full;

(h) Convenient access to holding tanks and piping system for purposes of inspection;

(i) Spill-proof features adequate for transfer of sewage from all movable floating pump-out facilities to shore-based treatment plants or intermediate transfer facilities;

(j) A reliable disposal method consisting of:
(1) An approved upland septic system that meets TVA, State, and local requirements; or
(2) Proof of a contract with a sewage disposal contractor; and

(k) A written statement to TVA certifying that the system shall be operated and maintained in such a way as to prevent any discharge or seepage of wastewater or sewage into the reservoir.

§ 1304.404 Commercial marina harbor limits
The landward limits of commercial marina harbor areas are determined by the extent of land rights held by the dock operator. The lakeward limits of harbors at commercial marinas will be designated by TVA on the basis of the size and extent of facilities at the dock, navigation and flood control requirements, optimum use of lands and land rights owned by the United States, carrying capacity of the reservoir area in the vicinity of the marina, and on the basis of the environmental effects associated with the use of the harbor. Mooring buoys, slips, breakwaters, and permanent anchoring are prohibited beyond the lakeward extent of harbor limits. TVA may, at its discretion, reconfigure harbor limits based

on changes in circumstances, including but not limited to, changes in the ownership of the land base supporting the marina.

§ 1304.405 Fuel storage tanks and handling facilities
Fuel storage tanks and handling facilities are generally either underground (UST) or aboveground (AST) storage tank systems. An UST is any one or combination of tanks or tank systems defined in applicable federal or state regulations as an UST. Typically (unless otherwise provided by applicable federal or state rules), an UST is used to contain a regulated substance (such as a petroleum product) and has 10 percent or more of its total volume beneath the surface of the ground. The total volume includes any piping used in the system. An UST may be a buried tank, or an aboveground tank with buried piping if the piping holds 10 percent or more of the total system volume including the tank. For purposes of this part, an aboveground storage tank (AST) is any storage tank whose total volume (piping and tank) is less than 10 percent underground or any storage tank defined by applicable law or regulation as an AST.

(a) TVA requires the following to be included in all applications submitted after September 8, 2003, to install an UST or any part of an UST system below the 500-year flood elevation on a TVA reservoir, or regulated tailwater:
(1) A copy of the state approval for the UST along with a copy of the application sent to the state and any plans or drawings that were submitted for the state's review;
(2) Evidence of secondary containment for all piping or other systems associated with the UST;
(3) Evidence of secondary containment to contain leaks from gas pumps(s);
(4) Calculations certified by a licensed, professional engineer in the relevant state showing how the tank will be anchored so that it does not float during flooding; and
(5) Evidence, where applicable, that the applicant has complied with all spill prevention, control and countermeasures (SPCC) requirements.

(b) The applicant must accept and sign a document stating that the applicant shall at all times be the owner of the UST system, that TVA shall have the right (but no duty) to prevent or remedy pollution or violations of law, including removal of the UST system, with costs charged to the applicant, that the applicant shall at all times maintain and operate the UST system in full compliance with applicable federal, state, and local UST regulations, and that the applicant shall maintain eligibility in any applicable state trust fund.

(c) An application to install an AST or any part of an AST system below the 500-year elevation on a TVA reservoir or a regulated tailwater is subject to all of the requirements of §1304.405 (a) and (b) except that paragraph (a)(1) shall not apply in states that do not require application or approval for installation of an AST. Eligibility must be maintained for any applicable AST trust fund, and the system must be maintained and operated in accordance with any applicable AST regulations. The applicant must notify and obtain any required documents or permission from the state fire marshal's office prior to installation of the AST. The applicant must also follow the National Fire Protection Association Codes 30 and 30A for installation and maintenance of flammable and combustible liquids storage tanks at marine service stations.

(d) Fuel handling on private, non-commercial docks and piers. TVA will not approve the installation, operation, or maintenance of fuel handling facilities on any private, non-commercial dock or pier.

(e) Floating fuel handling facilities. TVA will not approve the installation of any floating fuel handling facility or fuel storage tank.

(f) Demonstration of financial responsibility. Applicants for a fuel handling facility to be located in whole or in part on TVA land shall be required to provide TVA, in a form and amount acceptable to TVA, a surety bond, irrevocable letter of credit, pollution liability insurance, or other evidence of financial responsibility in the event of a release.

§ 1304.406 Removal of unauthorized, unsafe, and derelict structures or facilities
If, at any time, any dock, wharf, boathouse (fixed or floating), nonnavigable houseboat, outfall, aerial cable, or other fixed or floating structure or facility (including any navigable boat or vessel that has become deteriorated and is a potential navigation hazard or impediment to flood control) is anchored, installed, constructed, or moored in a manner inconsistent with this part, or is not constructed in accordance with plans approved by TVA, or is not maintained or operated so as to remain in accordance with this part and such plans, or is not kept in a good state of repair and in good, safe, and substantial condition, and the owner or operator thereof fails to repair or remove such structure (or operate or maintain it in accordance with such plans) within ninety (90) days after written notice from TVA to do so, TVA may cancel any license, permit, or approval and remove such structure, and/or cause it to be removed, from the Tennessee River system and/or lands in the custody or control of TVA.

Such written notice may be given by mailing a copy thereof to the owner's address as listed on the license, permit, or approval or by posting a copy on the structure or facility. TVA may remove or cause to be removed any such structure or facility anchored, installed, constructed, or moored without such license, permit, or approval, whether such license or approval has once been obtained and subsequently canceled, or whether it has never been obtained. TVA's removal costs shall be charged to the owner of the structure, and payment of such costs shall be a condition of approval for any future facility proposed to serve the tract of land at issue or any tract derived therefrom whether or not the current owner caused such charges to be incurred.

In addition, any applicant with an outstanding removal charge payable to TVA shall, until such time as the charge be paid in full, be ineligible to receive a permit or approval from TVA for any facility located anywhere along or in the Tennessee River or its tributaries. TVA shall not be responsible for the loss of property associated with the removal of any such structure or facility including, without limitation, the loss of any navigable boat or vessel moored at such a facility. Any costs voluntarily incurred by TVA to protect and store such property shall be removal costs within the meaning of this section, and TVA may sell such property and apply the proceeds toward any and all of its removal costs. Small businesses seeking expedited consideration of the economic impact of actions under this section may contact TVA's Supplier and Diverse Business Relations staff, TVA Procurement, 1101 Market Street, Chattanooga, Tennessee 37402-2801.

§ 1304.407 Development within flood control storage zones of TVA reservoirs

(a) Activities involving development within the flood control storage zone on TVA reservoirs will be reviewed to determine if the proposed activity qualifies as a repetitive action. Under TVA's implementation of EO 11988, Floodplain Management, repetitive actions are projects within a class of actions TVA has determined to be approvable without further review and documentation related to flood control storage, provided the loss of flood control storage caused by the project does not exceed one acre-foot. A partial list of repetitive actions includes:

(1) Private and public water-use facilities;
(2) Commercial recreation boat dock and water-use facilities;
(3) Water intake structures;
(4) Outfalls;
(5) Mooring and loading facilities for barge terminals;
(6) Minor grading and fills; and
(7) Bridges and culverts for pedestrian, highway, and railroad crossings.

(b) Projects resulting in flood storage loss in excess of one acre-foot will not be considered repetitive actions.

(c) For projects not qualifying as repetitive actions, the applicant shall be required, as appropriate, to evaluate alternatives to the placement of fill or the construction of a project within the flood control storage zone that would result in lost flood control storage. The alternative evaluation would either identify a better option or support and document that there is no reasonable alternative to the loss of flood control storage. If this determination can be made, the applicant must then demonstrate how the loss of flood control storage will be minimized.

(1) In addition, documentation shall be provided regarding

(i) The amount of anticipated flood control storage loss;
(ii) The cost of compensation of the displaced flood control storage (how much it would cost to excavate material from the flood control storage zone, haul it to an upland site and dispose of it);
(iii) The cost of mitigation of the displaced flood control storage (how much it would cost to excavate material from another site within the flood control storage zone, haul it to the project site and use as the fill material);
(iv) The cost of the project; and
(v) The nature and significance of any economic and/or natural resource benefits that would be realized as a result of the project.

(2) TVA may, in its discretion, decline to permit any project that would result in the loss of flood control storage.

(d) Recreational vehicles parked or placed within flood control storage zones of TVA reservoirs shall be deemed an obstruction affecting navigation, flood control, or public lands or reservations within the meaning of section 26a of the Act unless they:
(1) Remain truly mobile and ready for highway use. The unit must be on its wheels or a jacking system and be attached to its site by only quick disconnect type utilities;
(2) Have no permanently attached additions, connections, foundations, porches, or similar structures; and
(3) Have an electrical cutoff switch that is located above the flood control zone and fully accessible during flood events.

§ 1304.408 Variances
The Vice President or the designee thereof is authorized, following consideration whether a proposed structure or other regulated activity would adversely impact navigation, flood control, public lands or reservations, power generation, the environment, or sensitive environmental resources, or would be incompatible with surrounding uses or inconsistent with an approved TVA reservoir land management plan, to approve a structure or activity that varies from the requirements of this part in minor aspects.

§ 1304.409 Indefinite or temporary moorage of recreational vessels
(a) Recreational vessels' moorage at unpermitted locations along the water's edge of any TVA reservoir may not exceed 14 consecutive days at any one place or at any place within one mile thereof.

(b) Recreational vessels may not establish temporary moorage within the limits of primary or secondary navigation channels.

(c) Moorage lines of recreational vessels may not be placed in such a way as to block or hinder boating access to any part of the reservoir.

(d) Permanent or extended moorage of a recreational vessel along the shoreline of any TVA reservoir without approval under section 26a of the TVA Act is prohibited.

§ 1304.410 Navigation restrictions
(a) Except for the placement of riprap along the shoreline, structures, land based or water use, shall not be located within the limits of safety harbors and landings established for commercial navigation.

(b) Structures shall not be located in such a way as to block the visibility of navigation aids. Examples of navigation aids are lights, dayboards, and directional signs.

(c) The establishment of "no-wake" zones outside approved harbor limits is prohibited at marinas or community dock facilities that are adjacent to or near a commercial navigation channel. In such circumstances, facility owners may, upon approval from TVA, install a floating breakwater along the harbor limit to reduce wave and wash action.

§ 1304.411 Fish attractors

Fish attractors constitute potential obstructions and require TVA approval.

(a) Fish attractors may be constructed of anchored brush piles, log cribs, and/or spawning benches, stake beds, vegetation, or rock piles, provided they meet "TVA Guidelines for Fish Attractor Placement in TVA Reservoirs" (TVA 1997).

(b) When established in connection with an approved dock, fish attractors shall not project more than 30 feet out from any portion of the dock.

(c) Any floatable materials must be permanently anchored.

This page intentionally left blank

Appendix B

TVA Land Management Zones

This page intentionally left blank

The following definitions of TVA land management zones and current land zone allocations by reservoir are taken directly from the *Natural Resource Plan* (TVA 2011a).

TVA Land Management Zones – Definitions

Zone	Definition
1 Non-TVA Shoreland	Shoreland that TVA does not own in fee. This land may be privately owned or owned by a governmental entity other than TVA. Uses of this non-TVA land may include residential, industrial, commercial, and/or agricultural. In many instances, TVA may have purchased the right to flood and/or limit structures on this non-TVA land (i.e., flowage easement). TVA's permitting authority under Section 26a of the TVA Act applies to construction of structures on non-TVA shoreland. Non-TVA shoreland allocations are based on deeded rights and, therefore, will not change as a result of the lands planning process. This category is provided to assist in comprehensive evaluation of potential environmental impacts of TVA's allocation decision.
2 Project Operations	Land currently used, or planned for future use, for TVA operations and public works projects, including: • **Land adjacent to established navigation operations —** Locks, lock operations and maintenance facilities, and the navigation work boat dock and bases. • **Land used for TVA power projects operations —** Generation facilities, switchyards, and transmission facilities and rights-of-way. • **Dam reservation land —** Areas acquired and managed for the primary purpose of supporting the operation and maintenance of TVA dams and associated infrastructure; secondary uses may also include developed and dispersed recreation, maintenance facilities, miscellaneous TVA field offices, research areas, and visitor centers. • **Navigation safety harbors/landings —** Areas used for tying off commercial barge tows and recreational boats during adverse weather conditions or equipment malfunctions. • **Navigation dayboards and beacons —** Areas with structures placed on the shoreline to facilitate navigation. • **Public works projects —** Includes rights-of-way for public utility infrastructure, such as sewer lines, water lines, transmission lines, and major highway projects.
3 Sensitive Resource Management	Land managed for protection and enhancement of sensitive resources. Sensitive resources, as defined by TVA, include resources protected by state or federal law or executive order and other land features/natural resources TVA considers important to the area viewscape or natural environment. Recreational natural resource activities, such as hunting, wildlife observation, and camping on undeveloped sites, may occur in this zone, but the overriding focus is protecting and enhancing the sensitive resource the site supports. Areas included are: • TVA-designated sites with potentially **significant archaeological resources.** • TVA public land with **sites/structures listed in or eligible for listing in the National Register of Historic Places.** • **Wetlands —** Aquatic bed, emergent, forested, and scrub-shrub wetlands as defined by TVA.

Zone	Definition
3 Sensitive Resource Management (continued)	• **TVA public land under easement, lease, or license to other agencies/individuals** for resource protection purposes. • **TVA public land fronting land owned by other agencies/individuals** for resource protection purposes. • **Habitat protection areas —** These TVA natural areas are managed to protect populations of species identified as threatened or endangered by the U.S. Fish and Wildlife Service, state-listed species, and any unusual or exemplary biological communities/geological features. • **Ecological study areas —** These TVA natural areas are designated as suitable for ecological research and environmental education by a recognized authority or agency. They typically contain plant or animal populations of scientific interest or are of interest to an educational institution that would utilize the area. • **Small wild areas —** These TVA natural areas are managed by TVA or in cooperation with other public agencies or private conservation organizations to protect exceptional natural, scenic, or aesthetic qualities that can also support dispersed, low-impact types of outdoor recreation. • **River corridor with sensitive resources present —** A river corridor is a segment of a river and the adjacent land along the banks. River corridors often consist of a linear green space of TVA land serving as a buffer to tributary rivers entering a reservoir. These areas will be included in Zone 3 when identified sensitive resources are present. • **Significant scenic areas —** Areas designated for visual protection because of their unique vistas or particularly scenic qualities. • **Champion tree site —** Areas designated by TVA as sites that contain the largest known individual tree of its species in that state. The state forestry agency “Champion Tree Program” designates the tree, while TVA designates the area of the sites for those located on TVA public land. • **Other sensitive ecological areas —** Examples of these areas include heron rookeries, uncommon plant and animal communities, and unique cave or karst formations.
4 Natural Resource Conservation	Land managed for the enhancement of natural resources for human use and appreciation. Management of resources is the primary focus of this zone. Appropriate activities in this zone include hunting, timber management to promote forest health, wildlife observation, and camping on undeveloped sites. Areas included are: • **TVA public land** managed for wildlife or forest management projects. • **TVA public land under easement, lease, or license to other agencies** for wildlife or forest management purposes. • **TVA public land fronting land owned by other agencies** for wildlife or forest management purposes. • **Dispersed recreation areas** maintained for passive, dispersed recreation activities, such as hunting, hiking, bird-watching, photography, primitive camping, bank fishing, and picnicking. • **Shoreline conservation areas —** Narrow riparian strips of vegetation between the water’s edge and TVA’s back-lying property that are managed for wildlife, water quality, or visual qualities. • **Wildlife observation areas —** TVA natural areas with unique concentrations of easily observed wildlife that are managed as public wildlife observation areas. • **River corridor without sensitive resources present —** A river corridor is a linear green space along both stream banks of selected tributaries entering a reservoir managed for light boat access at specific sites, riverside trails, and interpretive activities. River corridors will be included in Zone 4 unless sensitive resources are present (see Zone 3). • **Islands** without sensitive resources or existing development.

Zone	Definition
5 Industrial	Land currently used, or planned for future use, for economic development, including businesses in distribution/processing/assembly and manufacturing. Preference will be given for businesses requiring water access. There are two primary types of uses for TVA land allocated for Industrial: **(1) access for water supply or structures associated with navigation such as barge terminals, mooring cells, etc., or (2) land-based development potential.** Areas included are: • **TVA public land under easement, lease, or license to other agencies/individuals/ entities** for industrial purposes. • **TVA public land fronting land owned by other agencies/individuals/entities** for industrial purposes. In some cases, TVA land allocated to industrial use would be declared surplus and sold at public auction. Types of development that can occur on this land are: • **Industry —** Manufacturing, fabrication, and distribution/processing/assembly involving chemical, electronics, metalworking, plastics, telecommunications, transportation, and other industries. Industry does not include retail or service-based businesses. • **Industrial access —** Access to the waterfront by back-lying property owners across TVA property for water intakes, wastewater discharge, or conveyance of commodities (i.e., pipelines, rail, or road). Barge terminals are associated with industrial access corridors. • **Barge terminal sites —** Public or private facilities used for the transfer, loading, and unloading of commodities between barges and trucks, trains, storage areas, or industrial plants. • **Fleeting areas —** Sites used by the towing industry to switch barges between tows or barge terminals that have both offshore and onshore facilities. • **Minor commercial landing —** A temporary or intermittent activity that takes place without permanent improvements to the property. These sites can be used for transferring pulpwood, sand, gravel, and other natural resource commodities between barges and trucks.
6 Developed Recreation	Land currently used, or planned for future use, for concentrated, active recreational activities that require capital improvement and maintenance of developed infrastructure, including: • **TVA public land** developed for recreational purposes, such as campgrounds, day-use areas, etc. • **TVA public land under easement, lease, or license to other agencies/individuals/ entities** for developed recreational purposes. • **TVA public land fronting land owned by other agencies/individuals/entities** for developed recreational purposes.

Zone	Definition
6 Developed Recreation (continued)	Residential use, long-term accommodations, and/or individually owned units are not permitted on land allocated for developed recreation. Types of development that can occur on this land are: • **Public recreation —** Recreation amenities developed and owned by a public agency that are open to the public. Public recreation areas may have varying levels of development, ranging from a water access site (e.g., launching ramp) to a marina facility. Facilities at public recreation areas could include playgrounds/play structures, picnic facilities, tennis courts, horseshoe areas, play courts, recreation centers, trails, greenways, natural areas, amphitheaters, food concessions (vending, snack bar), access to water for fishing and boating, swimming areas and swimming pools, launching ramps, courtesy piers, canoe access, marina facilities owned by the public entity, parking, and campgrounds. Cabins or other overnight accommodations (other than campgrounds) are only permitted if the public recreation area is operated by a state or state agency as a component of a state park system. Public recreation areas and facilities are typically owned and operated by the federal, state, county, or local government. However, private entities may operate recreation facilities on public recreation land as concessionaires under agreement with the public entity controlling the property. The use of the facilities may be offered free or for a fee. Time-forward, public-private partnerships where facilities are owned by private investors will not be approved on public recreation land. All structures and facilities should be owned by the public entity. • **Commercial recreation —** Recreation amenities that are provided for a fee to the public intending to produce a profit for the private owner/operator. These primarily water-based facilities typically include marinas and affiliated support facilities such as stores, restaurants, campgrounds, and cabins and lodges. Where applicable, TVA will require appropriate compensation for the commercial use of the property.
7 Shoreline Access	TVA-owned land where Section 26a applications and other land use approvals for residential shoreline alterations are considered in accordance with TVA's Shoreline Management Policy. Types of development/management that may be permitted on this land are: • **Residential water use facilities**, e.g., docks, piers, launching ramps/driveways, marine railways, boathouses, enclosed storage space, and non-potable water intakes. • **Shoreline access corridors**, e.g., pathways, wooden steps, walkways, or mulched paths that can include portable picnic tables and utility lines. • **Shoreline stabilization**, e.g., bioengineering, riprap, gabions, and retaining walls. • **Shoreline vegetation management.**

Current Land Zone Allocations by Reservoir

Note: Zone 1 – Non-TVA Shoreland is not represented because the parcels are private land (on which TVA owns flowage rights). The figures in the following table (1) have been rounded to the nearest whole number; (2) are an estimate based on the RLA; (3) are subject to change pending additional verification; and (4) contain a slight margin of error.

	Current Land Zone Allocation					
Reservoir	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Apalachia Reservoir	91	0	*	0	9	0
Beaver Creek Reservoir	11	0	0	0	86	0
Beech River Projects Reservoirs	6	0	51	0	43	0
Big Bear Creek Reservoir	7	82	0	0	10	0
Blue Ridge Reservoir	62	3	6	0	3	26
Boone Reservoir	24	17	51	0	9	<1
Cedar Creek Reservoir	10	66	10	0	8	5
Chatuge Reservoir	22	1	49	0	24	4
Cherokee Reservoir	7	12	68	0	9	3
Chickamauga Reservoir	9	34	40	1	7	10
Clear Creek Reservoir	100	0	0	0	0	0
Douglas Reservoir	50	3	40	0	6	1
Fontana Reservoir	43	0	5	0	47	4
Fort Loudoun Reservoir	33	3	18	<1	2	44
Fort Patrick Henry Reservoir	27	7	41	0	14	10
Great Falls Reservoir	100	0	0	0	0	0
Guntersville Reservoir	6	27	60	1	5	2
Hiwassee Reservoir	36	11	44	0	4	4
Kentucky Reservoir	1	2	84	2	5	6
Little Bear Creek Reservoir	18	69	2	1	6	4
Melton Hill Reservoir	11	49	24	1	8	6
Nickajack Reservoir	20	25	51	3	3	0
Nolichucky Reservoir	5	57	13	<1	25	0
Normandy Reservoir	13	15	67	0	4	<1
Norris Reservoir	3	18	67	0	7	5
Nottely Reservoir	53	0	33	0	11	2
Ocoee Reservoirs	100	0	0	0	0	0
Pickwick Reservoir	7	8	69	3	8	6
South Holston Reservoir	28	<1	46	6	19	1
Tellico Reservoir	5	17	56	2	15	4
Tims Ford Reservoir**	9	15	58	1	6	10
Upper Bear Creek Reservoir	6	81	8	0	3	2
Watauga Reservoir	46	9	38	0	8	<1
Watts Bar Reservoir***	13	28	28	3	12	17
Wheeler Reservoir	4	24	65	2	8	<1
Wilbur Reservoir	83	0	17	0	0	0
Wilson Reservoir	0	0	7	0	63	30

* *Includes narrow strip of TVA-retained land along shoreline; acreage not calculated*

** *Tims Ford Reservoir contains an additional 64 acres allocated to Zone 8, or a conservation partnership. The allocation of public lands to Zone 8 has been discontinued. However, TVA will continue to manage lands allocated to Zone 8 per agency policy*

*** *TVA is currently reviewing eight parcels of land impacted by the Kingston ash spill. The percentage of land allocated to Zones 2 and 7 may change slightly if these parcels are placed under these zones.*

This page intentionally left blank

Appendix C

County-Level Socioeconomic Data

This page intentionally left blank

Table C-1. County Population Data

State/County	Population (2010)	Population (2013)	Percent Change in Population from 2010 to 2013	Population Density (2010)	Population Density (2013)	Persons per Household
Alabama	*4,779,736*	*4,833,722*	*1.13%*	*94.38*	*95.44*	*2.55*
Colbert	54,428	54,520	0.17%	91.84	92.00	2.42
Franklin	31,704	31,532	-0.54%	50.02	49.75	2.52
Jackson	53,227	52,951	-0.52%	49.38	49.13	2.53
Lauderdale	92,709	92,797	0.09%	138.85	138.98	2.36
Lawrence	34,339	33,587	-2.19%	49.72	48.63	2.52
Limestone	82,782	88,845	7.32%	147.84	158.67	2.56
Madison	334,811	346,892	3.61%	417.68	432.75	2.5
Marion	30,776	30,334	-1.44%	41.46	40.87	2.34
Marshall	93,019	94,760	1.87%	164.39	167.47	2.7
Morgan	119,490	119,787	0.25%	206.25	206.76	2.55
Winston	24,484	24,146	-1.38%	39.94	39.39	2.52
Georgia	*9,687,653*	*9,992,167*	*3.14%*	*168.44*	*173.74*	*2.71*
Fannin	23,682	23,760	0.33%	61.24	61.44	2.36
Towns	10,471	10,771	2.87%	62.87	64.67	2.29
Union	21,356	21,566	0.98%	66.34	66.99	2.3
Kentucky	*4,339,367*	*4,395,295*	*1.29%*	*109.90*	*111.31*	*2.5*
Calloway	37,191	37,657	1.25%	96.59	97.81	2.28
Livingston	9,519	9,359	-1.68%	30.40	29.89	2.62
Lyon	8,314	8,451	1.65%	38.88	39.52	2.12
Marshall	31,448	31,107	-1.08%	104.39	103.26	2.57
Mississippi	*2,967,297*	*2,991,207*	*0.81%*	*63.24*	*63.75*	*2.65*
Tishomingo	19,593	19,529	-0.33%	46.18	46.03	2.52
North Carolina	*9,535,483*	*9,848,060*	*3.28%*	*196.13*	*202.56*	*2.53*
Cherokee	27,444	27,218	-0.82%	60.26	59.76	2.5
Clay	10,587	10,584	-0.03%	49.30	49.29	2.37
Graham	8,861	8,736	-1.41%	30.34	29.91	2.49
Swain	13,981	14,058	0.55%	26.48	26.63	2.56
Tennessee	*6,346,105*	*6,495,978*	*2.36%*	*153.90*	*157.54*	*2.52*
Anderson	75,129	75,542	0.55%	222.83	224.05	2.43
Benton	16,489	16,290	-1.21%	41.84	41.33	2.35
Blount	123,010	125,099	1.70%	220.17	223.91	2.5
Bradley	98,963	101,848	2.92%	301.02	309.79	2.59
Campbell	40,716	40,238	-1.17%	84.79	83.80	2.51
Carter	57,424	57,338	-0.15%	168.30	168.05	2.32
Claiborne	32,213	31,560	-2.03%	74.12	72.62	2.46
Cocke	35,662	35,479	-0.51%	82.06	81.64	2.36

State/County	Population (2010)	Population (2013)	Percent Change in Population from 2010 to 2013	Population Density (2010)	Population Density (2013)	Persons per Household
Decatur	11,757	11,661	-0.82%	35.22	34.93	2.26
Franklin	41,052	41,129	0.19%	74.03	74.17	2.42
Grainger	22,657	22,702	0.20%	80.74	80.91	2.5
Greene	68,831	68,267	-0.82%	110.63	109.72	2.33
Hamblen	62,544	63,074	0.85%	388.04	391.33	2.55
Hamilton	336,463	348,673	3.63%	620.29	642.80	2.45
Hardin	26,026	26,034	0.03%	45.08	45.09	2.58
Hawkins	56,833	56,800	-0.06%	116.70	116.64	2.41
Henry	32,330	32,210	-0.37%	57.52	57.30	2.35
Houston	8,426	8,292	-1.59%	42.07	41.40	2.39
Humphreys	18,538	18,243	-1.59%	34.91	34.36	2.46
Jefferson	51,407	52,123	1.39%	187.56	190.17	2.53
Johnson	18,244	17,977	-1.46%	61.12	60.23	2.36
Knox	432,226	444,622	2.87%	850.47	874.86	2.35
Loudon	48,556	50,448	3.90%	211.83	220.09	2.49
Marion	28,237	28,374	0.49%	56.68	56.96	2.49
McMinn	52,266	52,341	0.14%	121.51	121.69	2.53
Meigs	11,753	11,649	-0.88%	60.23	59.70	2.42
Monroe	44,519	45,265	1.68%	70.05	71.22	2.52
Moore	6,362	6,301	-0.96%	49.23	48.76	2.58
Perry	7,915	7,869	-0.58%	19.08	18.97	2.42
Polk	16,825	16,690	-0.80%	38.71	38.40	2.44
Rhea	31,809	32,513	2.21%	100.86	103.09	2.58
Roane	54,181	53,047	-2.09%	150.21	147.06	2.4
Sevier	89,889	93,570	4.10%	151.71	157.92	2.45
Stewart	13,324	13,362	0.29%	29.01	29.09	2.49
Sullivan	156,823	156,595	-0.15%	379.39	378.83	2.32
Union	19,109	19,102	-0.04%	85.48	85.45	2.57
Van Buren	5,548	5,583	0.63%	20.29	20.42	2.61
Warren	39,839	39,965	0.32%	92.07	92.37	2.55
Washington	122,979	125,546	2.09%	376.69	384.56	2.3
Wayne	17,021	16,939	-0.48%	23.19	23.07	2.43
White	25,841	26,244	1.56%	68.60	69.67	2.63
Virginia	*8,001,024*	*8,260,405*	*3.24%*	*202.61*	*209.18*	*2.60*
Washington	54,876	54,907	0.06%	97.82	97.88	2.34
Total	**3,688,828**	**3,744,458**	**1.51%**	**125.74**	**127.44**	**2.45**

Table C-2. County Income and Employment Data

State[1]/County	Civilian labor force[2]	Unemployment Rate (%)[2]	Per capita income (2009-2013)[3]	Median household income (2009-2013)[3]	Largest Industry (2009-2013)[3]
Alabama	***2,129,341***	***5.80***	***$23,680***	***$43,253***	***Educ, health, and social***
Colbert	24,791	6.90	$21,572	$39,077	Educ, health, and social
Franklin	12,736	7.00	$18,888	$36,415	Manufacturing
Jackson	25,294	5.60	$20,486	$37,634	Manufacturing
Lauderdale	44,006	6.10	$23,510	$42,844	Educ, health, and social
Lawrence	14,694	7.00	$20,181	$38,551	Educ, health, and social
Limestone	40,582	5.00	$25,020	$48,619	Educ, health, and social
Madison	171,440	5.10	$31,933	$58,434	Educ, health, and social
Marshall	39,201	5.80	$20,382	$39,526	Manufacturing
Morgan	55,154	5.50	$23,764	$44,800	Manufacturing
Georgia	***4,767,101***	***7.20***	***$25,182***	***$49,179***	***Educ, health, and social***
Fannin	10,366	7.30	$19,164	$34,239	Educ, health, and social
Towns	5,734	6.10	$20,419	$36,570	Educ, health, and social
Union	11,037	5.40	$22,156	$40,009	Educ, health, and social
Kentucky	***1,993,973***	***5.30***	***$23,462***	***$43,036***	***Educ, health, and social***
Calloway	15,869	5.50	$21,490	$39,677	Educ, health, and social
Livingston	4,367	5.30	$19,795	$40,313	Educ, health, and social
Lyon	3,427	5.30	$22,123	$40,112	Manufacturing
Marshall	14,099	5.90	$22,381	$43,907	Educ, health, and social
Trigg	6,088	5.20	$25,527	$45,629	Educ, health, and social
Mississippi	***1,255,969***	***7.30***	***$20,618***	***$39,031***	***Educ, health, and social***
Tishomingo	7,414	7.40	$18,338	$32,592	Manufacturing
North Carolina	***4,680,350***	***5.50***	***$25,284***	***$46,334***	***Educ, health, and social***
Cherokee	9,444	7.30	$18,340	$34,432	Educ, health, and social
Clay	4,477	5.00	$22,081	$38,828	Educ, health, and social
Graham	3,789	11.20	$19,780	$33,903	Educ, health, and social
Swain	6,838	6.60	$19,626	$36,094	Educ, health, and social
Tennessee	***3,020,443***	***6.30***	***$24,409***	***$44,298***	***Educ, health, and social***
Anderson	35,231	6.20	$24,561	$43,620	Educ, health, and social
Bedford	22,289	5.90	$19,303	$40,759	Manufacturing
Benton	6,791	8.30	$18,456	$33,033	Educ, health, and social
Blount	61,926	5.30	$23,788	$45,991	Educ, health, and social
Bradley	49,231	5.80	$21,649	$41,083	Educ, health, and social
Campbell	16,146	8.00	$16,812	$31,943	Educ, health, and social
Carter	25,841	6.10	$19,018	$31,842	Educ, health, and social
Claiborne	12,296	8.10	$18,583	$33,229	Educ, health, and social
Cocke	14,878	8.00	$17,476	$30,573	Manufacturing
Coffee	26,269	5.60	$20,357	$37,618	Manufacturing

State[1]/County	Civilian labor force[2]	Unemployment Rate (%)[2]	Per capita income (2009-2013)[3]	Median household income (2009-2013)[3]	Largest Industry (2009-2013)[3]
Decatur	5,289	8.10	$25,368	$36,258	Educ, health, and social
Franklin	19,561	5.30	$22,398	$42,904	Educ, health, and social
Grainger	9,318	7.60	$17,933	$32,364	Manufacturing
Hamblen	27,875	6.90	$21,261	$39,596	Manufacturing
Hamilton	161,660	6.20	$27,229	$46,702	Educ, health, and social
Hardin	11,006	7.40	$20,127	$33,622	Educ, health, and social
Hawkins	24,612	6.60	$20,662	$37,357	Manufacturing
Henry	13,210	7.90	$22,239	$36,950	Educ, health, and social
Houston	3,830	7.70	$18,539	$35,271	Educ, health, and social
Humphreys	9,056	6.40	$22,183	$42,846	Educ, health, and social
Jefferson	22,841	6.50	$20,619	$39,745	Educ, health, and social
Johnson	7,154	6.70	$16,470	$29,609	Educ, health, and social
Knox	227,981	5.10	$28,136	$47,694	Educ, health, and social
Loudon	24,336	5.60	$27,045	$51,074	Educ, health, and social
Marion	12,006	7.40	$21,399	$41,268	Manufacturing
McMinn	23,114	7.00	$19,744	$39,410	Manufacturing
Meigs	5,128	7.70	$19,403	$35,150	Manufacturing
Monroe	18,035	7.20	$19,643	$37,595	Manufacturing
Moore	3,242	5.00	$23,307	$46,170	Manufacturing
Morgan	8,381	8.60	$17,747	$37,631	Educ, health, and social
Perry	2,682	8.60	$17,214	$32,845	Educ, health, and social
Polk	7,351	6.80	$20,274	$39,074	Manufacturing
Rhea	12,997	7.80	$18,952	$36,741	Manufacturing
Roane	25,819	6.10	$23,936	$42,223	Educ, health, and social
Sevier	47,815	5.80	$22,242	$43,649	Arts, ent, rec, and accom
Stewart	5,460	7.30	$21,701	$39,781	Educ, health, and social
Sullivan	71,089	6.10	$23,850	$39,479	Educ, health, and social
Union	8,519	6.00	$17,426	$34,399	Manufacturing
Washington	59,634	5.90	$25,355	$42,075	Educ, health, and social
Wayne	6,104	9.20	$17,706	$33,198	Educ, health, and social
Virginia	***4,269,389***	***4.80***	***$33,493***	***$63,907***	***Educ, health, and social***
Washington	27,889	5.30	$25,109	$41,897	Educ, health, and social
County Totals	**1,714,739**	**5.97**	**NA**	**NA**	**NA**

[1] State numbers are only listed for reference and are not counted in the totals for the study area.
[2] Bureau of Labor and Statistics. 2014a and 2014b. Data from October 2014.
[3] US Census Bureau. 2013b. 20092013 American Community Survey.

Table C-3. County Housing Data

State[1]/County	Housing Units (2013)[2]	Vacant Housing Units (2000)[3]	Vacant Housing Units (2010)[4]	Vacant - For Rent (2000)[3]	Vacant - For Rent (2010)[4]	Vacant - For Seasonal, Recreational, or Occasional Use (2000)[3]	Vacant - For Seasonal, Recreational, or Occasional Use (2010)[4]
Alabama	***2,189,938***	***226,631***	***288,062***	***64,091***	***79,265***	***47,205***	***63,890***
Colbert	25,957	2,519	2,985	673	696	444	542
Franklin	13,956	1,490	1,736	488	449	229	303
Jackson	24,599	2,553	3,273	620	614	553	691
Lauderdale	44,075	4,336	5,111	1,336	1,209	863	1,163
Lawrence	15,083	1,471	1,575	296	221	212	216
Limestone	35,196	2,209	3,531	621	938	245	657
Madison	152,226	10,333	11,747	4,761	4,809	713	752
Marshall	40,147	3,784	4,532	1,078	994	700	1,126
Morgan	51,226	3,786	4,163	1,577	1,171	181	267
Georgia	***4,109,896***	***275,368***	***503,226***	***86,905***	***174,416***	***50,064***	***81,511***
Fannin	16,396	2,765	6,020	177	555	1,938	4,061
Towns	7,796	2,284	3,221	97	239	1,712	2,373
Union	14,139	2,842	4,936	173	304	2,040	3,504
Kentucky	***1,936,565***	***207,199***	***207,199***	***56,960***	***56,960***	***38,616***	***38,616***
Calloway	18,091	2,207	2,535	467	633	935	794
Livingston	4,783	776	839	60	81	242	322
Lyon	4,775	1,291	1,504	77	45	954	1,135
Marshall	15,808	2,318	2,675	296	337	1,276	1,376
Trigg	7,789	1,483	1,927	73	164	1,007	1,298
Mississippi	***1,283,165***	***115,519***	***158,951***	***29,486***	***44,735***	***21,845***	***28,867***
Tishomingo	10,259	1,636	2,147	249	258	527	1,033
North Carolina	***4,394,261***	***391,931***	***582,373***	***92,893***	***156,587***	***134,870***	***191,508***
Cherokee	17,563	3,163	5,762	198	368	1,910	3,669
Clay	7,161	1,578	2,480	53	206	1,186	1,568
Graham	5,900	1,730	2,229	87	192	1,350	1,524
Swain	8,732	1,968	3,051	158	441	1,281	1,948
Tennessee	***2,840,914***	***206,538***	***318,581***	***64,476***	***93,370***	***36,712***	***60,778***
Anderson	34,591	2,671	3,464	1,207	1,087	197	297
Bedford	18,435	1,085	1,830	229	510	240	328
Benton	8,922	1,732	1,912	216	151	801	977
Blount	55,427	4,392	6,001	1,153	1,638	1,115	1,557
Bradley	42,043	2,539	3,448	1,141	1,306	162	263
Campbell	20,126	2,402	3,612	446	650	1,024	1,457
Carter	27,650	2,434	3,549	650	647	471	900
Claiborne	14,876	1,463	2,006	281	417	252	362
Cocke	17,264	2,082	2,671	424	434	546	746

State[1]/County	Housing Units (2013)[2]	Vacant Housing Units (2000)[3]	Vacant Housing Units (2010)[4]	Vacant - For Rent (2000)[3]	Vacant - For Rent (2010)[4]	Vacant - For Seasonal, Recreational, or Occasional Use (2000)[3]	Vacant - For Seasonal, Recreational, or Occasional Use (2010)[4]
Coffee	23,408	1,861	2,508	537	821	422	427
Decatur	6,804	1,540	1,946	102	140	957	1,139
Franklin	18,827	1,810	2,686	321	468	650	1,029
Grainger	10,760	1,462	1,865	145	193	598	792
Hamblen	26,931	1,482	2,403	541	759	89	169
Hamilton	152,989	10,248	14,425	4,002	5,273	707	1,080
Hardin	13,924	2,381	3,303	303	358	1,161	1,886
Hawkins	26,673	2,480	3,527	570	885	319	551
Henry	16,904	2,764	3,450	323	365	1,433	1,782
Houston	4,146	685	839	99	119	385	390
Humphreys	8,833	1,244	1,411	242	206	526	613
Jefferson	23,437	2,164	3,635	460	605	636	1,349
Johnson	8,863	1,052	1,761	130	155	368	603
Knox	197,288	13,567	17,700	5,829	6,777	586	1,048
Loudon	22,016	1,333	1,899	331	360	199	373
Marion	12,929	1,103	1,551	278	395	231	355
McMinn	23,158	1,905	2,476	572	568	120	220
Meigs	5,611	884	942	66	103	497	476
Monroe	20,692	1,958	3,076	367	568	655	849
Moore	2,937	304	423	29	28	77	179
Morgan	8,838	724	1,228	129	171	149	252
Perry	4,546	1,092	1,439	56	60	677	887
Polk	8,206	921	1,338	121	207	290	481
Rhea	14,290	1,381	2,089	279	441	411	593
Roane	25,496	2,169	3,340	717	760	433	611
Sevier	56,047	8,785	20,575	1,574	1,932	5,639	15,624
Stewart	6,719	1,047	1,392	109	133	520	661
Sullivan	73,704	5,496	7,462	2,046	2,174	497	906
Union	8,997	1,174	1,567	179	246	458	634
Washington	58,076	3,584	5,932	1,371	1,793	261	457
Wayne	7,208	765	1,151	130	164	94	289
Virginia	***3,412,460***	***205,019***	***308,881***	***47,563***	***82,493***	***54,696***	***80,468***
Washington	25,591	1,929	2,758	382	577	502	691
County Totals	**1,705,839**	**160,616**	**228,569**	**41,702**	**49,568**	**45,853**	**74,605**

1 State numbers are only listed for reference and are not counted in the totals for the study area.
2 US Census Bureau. 2013b. 2013 American Community Survey.
3 US Census Bureau. 2000. 2000 US Census.
4 US Census Bureau. 2010. 2010 US Census.

Table C-4. County Government Services

State[1]/County	Fire Departments[2]	Police Departments[3]	School Districts[4]	Students[4]	Hospitals[5]	Hospital Beds[5]
Alabama	***1,277***	***309***	***173***	***744,621***	***93***	***16,023***
Colbert	17	7	4	8,317	2	369
Franklin	12	5	2	5,778	1	92
Jackson	25	6	2	8,421	1	220
Lauderdale	24	6	2	13,055	1	358
Lawrence	5	5	2	5,179	1	43
Limestone	12	3	2	12,122	1	101
Madison	47	5	6	52,028	3	1,019
Marshall	24	9	5	16,688	2	294
Morgan	36	6	3	19,483	2	365
Georgia	***1,576***	***366***	***218***	***1,685,016***	***115***	***22,684***
Fannin	0	4	1	3,028	1	50
Towns	7	3	1	1,124	0	0
Union	12	2	2	3,689	1	195
Kentucky	***1,035***	***243***	***194***	***681,987***	***78***	***14,491***
Calloway	14	3	4	4,870	1	378
Livingston	8	1	1	1,337	0	0
Lyon	15	2	1	878	0	0
Marshall	15	3	1	4,756	0	0
Trigg	9	3	1	2,143	0	0
Mississippi	***761***	***220***	***162***	***490,079***	***73***	***10,841***
Tishomingo	7	5	1	3,177	1	48
North Carolina	***1,670***	***350***	***244***	***1,507,750***	***106***	***22,731***
Cherokee	17	3	2	3,716	1	191
Clay	7	1	1	1,412	0	0
Graham	5	1	1	1,222	0	0
Swain	5	2	3	2,238	1	20
Tennessee	***1,402***	***251***	***141***	***999,693***	***119***	***20,365***
Anderson	13	5	3	12,598	1	210
Bedford	13	3	1	8,085	1	60
Benton	10	2	1	2,841	0	0
Blount	18	4	3	18,374	1	308
Bradley	18	2	2	15,755	2	194
Campbell	14	5	1	5,972	2	218
Carter	13	2	2	8,199	1	121
Claiborne	14	3	1	4,784	1	176
Cocke	13	2	2	5,692	1	92
Coffee	13	3	3	9,411	2	187
Decatur	6	4	1	1,719	1	40

Franklin	19	7	1	5,950	2	198
Grainger	6	2	1	3,658	0	0
Hamblen	10	2	1	10,323	2	271
Hamilton	51	8	1	43,296	8	1,508
Hardin	16	2	1	3,721	1	122
Hawkins	20	5	2	8,265	1	39
Henry	14	2	2	4,949	1	114
Houston	6	2	1	1,419	0	0
Humphreys	12	4	1	3,172	0	0
Jefferson	9	5	1	7,568	1	58
Johnson	8	2	1	2,330	0	0
Knox	41	3	2	58,815	6	2,100
Loudon	14	3	2	7,369	1	40
Marion	15	7	2	4,734	1	70
McMinn	11	6	3	8,199	2	266
Meigs	8	2	1	1,849	0	0
Monroe	19	5	2	7,155	1	59
Moore	1	1	1	1,039	0	0
Morgan	8	1	1	3,318	0	0
Perry	7	2	1	1,204	1	33
Polk	13	2	1	2,704	0	0
Rhea	18	4	2	5,237	0	0
Roane	27	7	1	7,413	1	61
Sevier	24	4	1	14,523	1	123
Stewart	13	2	1	2,278	0	0
Sullivan	21	6	3	22,192	3	902
Union	6	2	1	4,464	0	0
Washington	16	4	2	16,804	3	663
Wayne	7	3	1	2,532	1	32
Virginia	***1,111***	***171***	***227***	***1,257,883***	***92***	***18,994***
Washington	12	4	2	7,383	1	116
County Totals	**920**	**229**	**111**	**541,954**	**71**	**12,124**

[1] State numbers are only listed for reference and are not counted in the totals for the study area.
[2] US Fire Administration 2015.
[3] USA Cops 2015.
[4] National Center for Education Statistics 2015.
[5] American Hospital Directory 2015.

Table C-5. County Minority and Low-Income Populations

State[1]/County	White alone, not hispanic[2]	Black or African American[2]	American Indian[2]	Asian[2]	Native Hawaiian / Pacific Islander[2]	Two or more Races[2]	Hispanic or Latino[2]	Persons below poverty level (%)[3]
Alabama	***66.4***	***26.6***	***0.7***	***1.3***	***0.1***	***1.5***	***4.1***	***18.6***
Colbert	78.8	16.4	0.6	0.5	Z	1.6	2.5	17.9
Franklin	78.7	4.3	1.5	0.3	0.1	1.5	15.4	21.9
Jackson	89.8	3.4	1.6	0.5	0.1	2.6	2.8	16
Lauderdale	85	10.2	0.5	0.8	0.1	1.4	2.4	17.2
Lawrence	76.5	11.4	5.8	0.2	Z	4.4	2.1	17.5
Limestone	77.7	13.2	0.8	1.4	0.2	2	5.8	14.7
Madison	65.7	24.5	0.8	2.5	0.1	2.4	4.7	12.8
Marshall	82.6	2.3	1.1	0.7	0.3	1.6	12.9	19.5
Morgan	76.9	12.4	1.1	0.7	0.1	1.9	7.8	15.7
Georgia	***54.8***	***31.4***	***0.5***	***3.7***	***0.1***	***1.9***	***9.2***	***18.2***
Fannin	95.5	0.7	0.4	0.4	Z	1.2	1.9	23
Towns	95.1	1.1	0.3	0.6	Z	0.6	2.5	16.3
Union	94.6	0.8	0.4	0.4	Z	1.3	2.8	17.7
Kentucky	***85.6***	***8.2***	***0.3***	***1.3***	***0.1***	***1.7***	***3.3***	***18.8***
Calloway	90.1	3.9	0.3	2	Z	1.5	2.5	20.1
Livingston	96.3	0.6	0.5	0.3	0.1	1.2	1.4	16.9
Lyon	91.3	5.7	0.2	0.3	Z	1.1	1.4	16.8
Marshall	97.1	0.4	0.2	0.3	Z	0.8	1.3	11.6
Trigg	88.2	7.8	0.3	0.4	Z	1.8	1.7	16.1
Mississippi	***57.5***	***37.4***	***0.6***	***1***	***0.1***	***1.1***	***2.9***	***22.7***
Tishomingo	93.3	2.9	0.4	0.2	Z	0.9	2.6	17.6
North Carolina	***64.4***	***22***	***1.6***	***2.6***	***0.1***	***2***	***8.9***	***17.5***
Cherokee	91.6	1.5	1.5	0.7	0.1	2.4	2.8	17.9
Clay	94.1	1	0.4	0.2	Z	1.4	3.1	24.3
Graham	88.3	0.4	7	0.4	0.1	1.9	2.7	21.1
Swain	63.9	1.1	27.9	0.6	Z	4.4	4.4	27.2
Tennessee	***74.9***	***17***	***0.4***	***1.6***	***0.1***	***1.7***	***4.9***	***17.6***
Anderson	90.1	4.2	0.4	1.2	Z	1.9	2.4	18.2
Bedford	77.9	8.2	1	1.2	0.2	1.8	11.7	20
Benton	93.3	2.4	0.5	0.5	Z	1.4	2.1	22.1
Blount	91.6	2.9	0.4	0.9	Z	1.5	3	13.7
Bradley	87.4	4.7	0.6	1.1	0.1	1.7	5.4	19.8
Campbell	96.6	0.5	0.3	0.3	0.1	1.1	1.3	23.8
Carter	95.3	1.5	0.2	0.4	Z	1.2	1.6	22.9

State[1]/County	White alone, not hispanic[2]	Black or African American[2]	American Indian[2]	Asian[2]	Native Hawaiian / Pacific Islander[2]	Two or more Races[2]	Hispanic or Latino[2]	Persons below poverty level (%)[3]
Claiborne	95.9	1.1	0.3	0.6	Z	1.2	1	22.9
Cocke	93.7	2	0.5	0.4	0.1	1.6	2.1	26.1
Coffee	89.5	3.7	0.4	1	0.1	1.9	3.9	20.9
Decatur	92.1	3.1	0.3	0.6	0.1	1.2	3	22.6
Franklin	89.3	5.2	0.4	0.9	0.1	1.7	2.7	15.1
Grainger	95.4	0.7	0.3	0.2	0.1	1	2.7	20.4
Hamblen	82.4	4.5	0.8	0.9	0.2	1.8	11	19.2
Hamilton	71.7	19.9	0.6	2.1	0.2	1.6	4.9	16.6
Hardin	92.3	3.7	0.4	0.5	Z	1.5	1.9	22.6
Hawkins	95.5	1.5	0.3	0.5	Z	1.1	1.3	16.2
Henry	87.5	8.2	0.3	0.4	Z	1.6	2.2	19.2
Houston	92.4	3	0.3	0.4	Z	1.9	2.2	23.5
Humphreys	93.3	2.8	0.6	0.4	Z	1.3	2	13.9
Jefferson	92.4	2.4	0.4	0.4	Z	1.2	3.5	18.3
Johnson	94.6	2.3	0.2	0.2	Z	1	1.7	26.4
Knox	83.3	9.1	0.4	2.1	0.1	1.9	3.7	14.6
Loudon	88.8	1.5	0.4	0.7	0.2	1.1	7.8	16.1
Marion	92.4	4	0.5	0.5	Z	1.4	1.5	18.2
McMinn	90.1	4.1	0.4	0.8	Z	1.9	3.1	18.3
Meigs	94.8	1.5	0.9	0.3	Z	1.2	1.8	20.7
Monroe	91.7	2.3	0.6	0.5	0.1	1.6	3.7	19.6
Moore	94.1	2.5	0.3	0.6	Z	1.1	1.6	13.2
Morgan	93.2	3.9	0.4	0.2	Z	1.3	1.1	20.8
Perry	93	2.2	0.8	0.3	0	1.8	2.2	21.1
Polk	95.8	0.6	0.5	0.3	0.1	1.4	1.7	17.3
Rhea	91.5	2.2	0.5	0.5	Z	1.6	4.2	22.6
Roane	93.2	2.7	0.4	0.6	Z	1.7	1.6	15
Sevier	91	1.2	0.5	1.1	Z	1.2	5.5	14.5
Stewart	92.4	2	0.7	1.1	Z	1.7	2.3	20
Sullivan	93.9	2.3	0.4	0.7	Z	1.3	1.7	18.3
Union	96.8	0.2	0.4	0.2	0.1	1.2	1.4	23.6
Washington	89.7	4.3	0.4	1.3	Z	1.7	3.1	18.3
Wayne	90.8	6	0.4	0.2	Z	1	1.7	20.2
Virginia	***63.6***	***19.7***	***0.5***	***6.1***	***0.1***	***2.7***	***8.6***	***11.3***
Washington	95.8	1.5	0.2	0.5	Z	0.8	1.4	12.1

[1] State numbers are only listed for reference and are not considered part of the study area.
[2] US Census Bureau. 2013a. 2013 Annual Population Estimates.
[3] US Census Bureau. 2013b. 2013 American Community Survey.

Appendix D

Projected Number of Floating Houses and Nonnavigable Houseboats by Reservoir for Years 2021 and 2045

This page intentionally left blank

Reservoir	Current	Projected Number of Floating Houses for Each Reservoir by Year and Alternative											
		2021						2045					
		No Action	A	B1	B2	C	D	No Action	A	B1	B2	C	D
Bear Creek	0	6	5	0	0	0	6	9	8	0	0	0	9
Blue Ridge	12	15	12	9	9	6	5	23	20	9	0	6	13
Boone	133	167	134	100	100	67	152	260	227	100	0	67	246
Cedar Creek	0	3	2	0	0	0	3	5	4	0	0	0	5
Chatuge	0	16	13	0	0	0	16	26	22	0	0	0	26
Cherokee	2	3	2	2	2	1	2	4	3	2	0	1	4
Chickamauga	20	25	20	15	15	10	23	39	34	15	0	10	37
Douglas	0	3	3	0	0	0	3	5	5	0	0	0	5
Fontana	357	448	358	268	268	179	309	699	610	268	0	179	561
Fort Loudoun	100	125	100	75	75	50	78	196	171	75	0	50	148
Fort Patrick Henry	6	8	6	5	5	3	7	12	10	5	0	3	11
Guntersville	12	15	12	9	9	6	14	23	20	9	0	6	22
Hiwassee	30	38	30	23	23	15	34	59	51	23	0	15	56
Kentucky	55	69	55	41	41	28	39	108	94	41	0	28	78
Little Bear	0	5	4	0	0	0	5	8	7	0	0	0	8
Melton Hill	0	4	3	0	0	0	4	6	5	0	0	0	6
Nickajack	30	38	30	23	23	15	12	59	51	23	0	15	34
Normandy	0	4	3	0	0	0	4	5	5	0	0	0	5
Norris	921	1,155	925	691	691	461	417	1,803	1,573	691	0	461	417
Nottely	0	5	4	0	0	0	5	7	7	0	0	0	7
Parksville (Ocoee 1)	0	8	6	0	0	0	8	12	11	0	0	0	12
Pickwick	2	3	2	2	2	1	2	4	3	2	0	1	4
South Holston	117	147	117	88	88	59	134	229	200	88	0	59	216
Tellico	0	4	3	0	0	0	4	7	6	0	0	0	7
Tims Ford	0	2	1	0	0	0	2	3	3	0	0	0	3
Watauga	37	46	37	28	28	19	42	72	63	28	0	19	68
Watts Bar	2	3	2	2	2	1	2	4	3	2	0	1	4
Wheeler	0	0	0	0	0	0	0	0	0	0	0	0	0
Wilson	0	3	2	0	0	0	3	5	4	0	0	0	5
Total	**1,836**	**2,365**	**1,894**	**1,377**	**1,377**	**918**	**1,337**	**3,692**	**3,220**	**1,377**	**0**	**918**	**2,016**

This page intentionally left blank

Appendix E

Analysis of Marina Harbor Limit Maps and Aerial Photography for Selected Marinas

This page intentionally left blank

Appendix E – Analysis of Marina Harbor Limit Maps and Aerial Photography for Selected Marinas

TVA reviewed and compared GIS data and aerial imagery of marina harbor limits and facilities at commercial marinas wherein FHs/NNs are moored, on reservoirs with more than five FHs/NNs.

Total acreage figures by reservoir are provided in the Table E-1. This analysis was used to support TVA's assumptions under Alternative D regarding the capacity of marinas to accommodate structures that are used primarily for residential use and not for navigation.

Table E-1. Percent of Marina Area wherein Facilities are Moored Exceeding the Approved Harbor Limits

Reservoir	Number of Marinas Reviewed	Approved Harbor Limit Acreage (Total)	Acreage Exceeded Outside Harbor Limit	Percent over Approved (%)
Boone	5	41	5	9.7
Chickamauga	1	5	1	20
Fontana	6	1,011	0.4	0.03
Fort Loudon	3	15	3	20
Fort Patrick Henry	1	5	0	0
Guntersville	1	6	1	16
Hiwassee	2	26	0.8	3
Kentucky	2	16	6	31
Nickajack	1	39	0	0
Norris	23	618	255	41
South Holston	5	133	9	7
Watauga	3	58	5	3

The following images illustrate harbor limits and facilities for selected commercial marinas where FHs/NNs are moored.

This page intentionally left blank

Boone Reservoir
Lakeview Marina

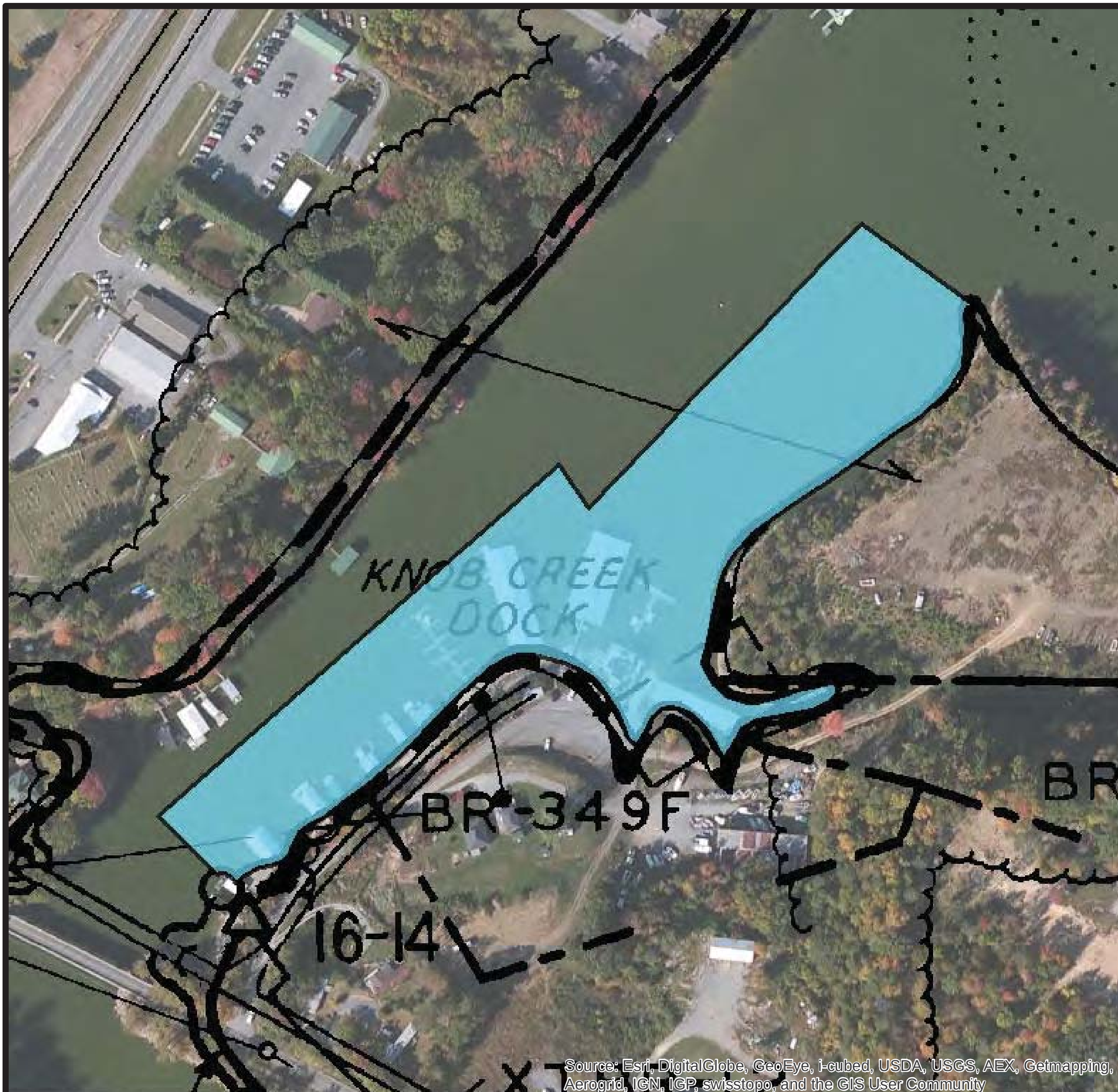
Legend

- Harbor Limits (approx. 10 acres)
- Outside Harbor Limits (approx. 2 acres)

200 0 200 Feet

N

Map Reference: Boone 5D



Boone Reservoir

Serenity Cove Marina

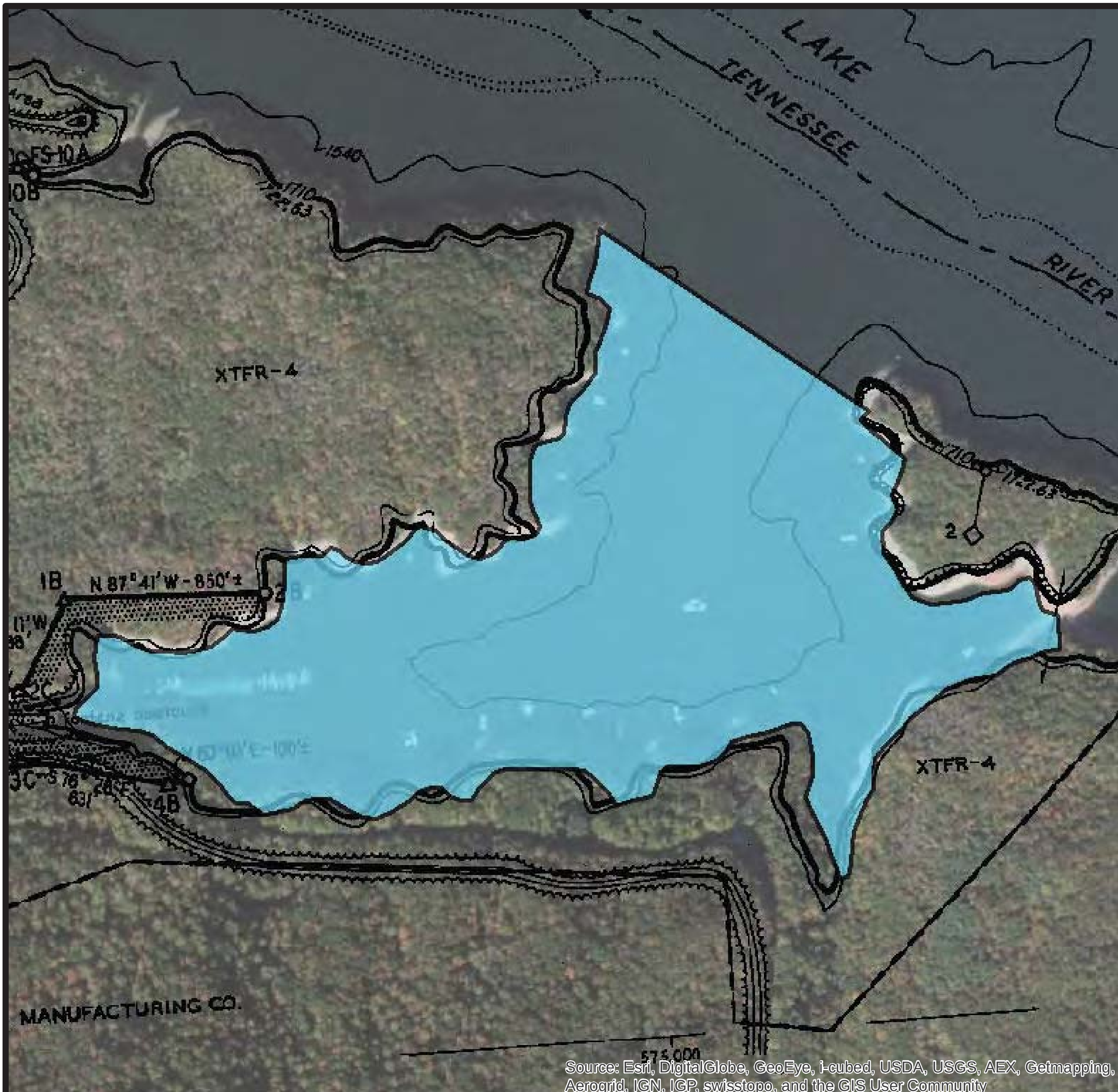
Legend

Harbor Limits (approx. 7 acres)

200 0 200 Feet

N

Map Reference: Boone 5D



Fontana Reservoir

Peppertree Fontana Village

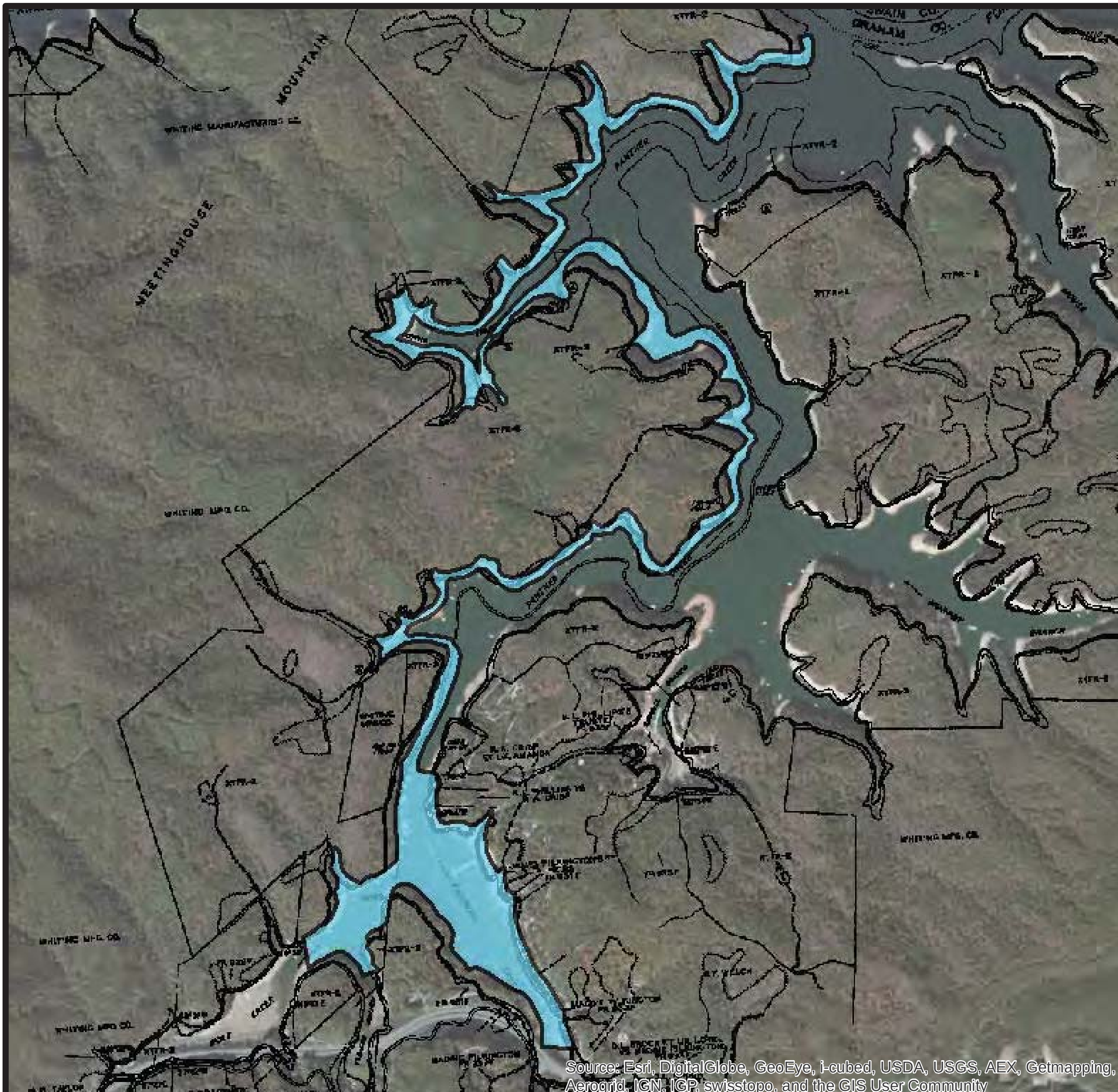
Legend

Harbor Limits (approx. 105 acres)

600 0 600 Feet

N

Map Reference: Fontana 2D



Fontana Reservoir

Prince Boat Dock

Legend

Harbor Limits (approx. 130 acres)

1,500 0 1,500 Feet

N

Map Reference:
Fontana 10D & 11D

Kentucky Reservoir

Perryville Marina

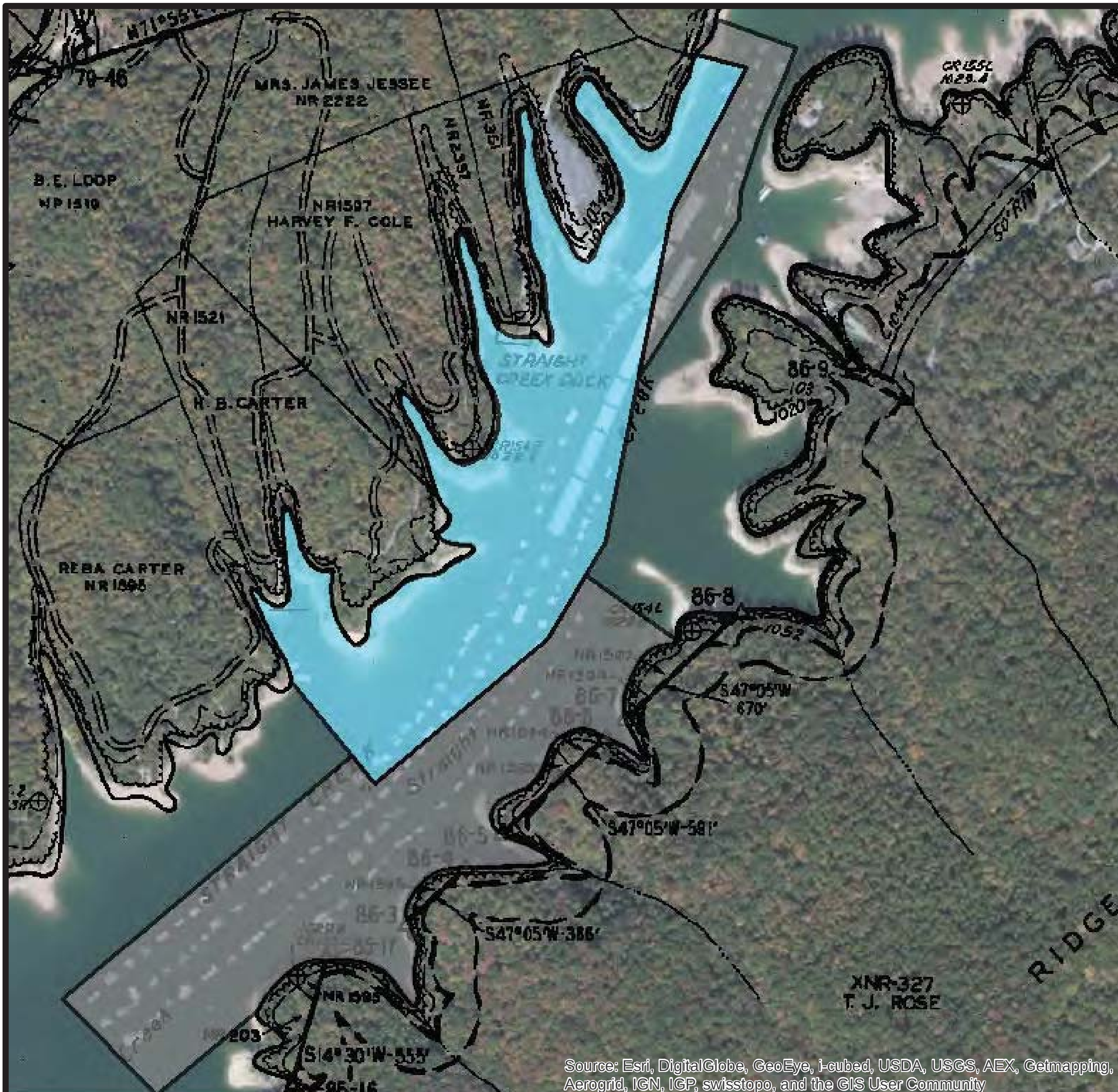
Legend

- Harbor Limits (approx. 15 acres)
- Outside Harbor Limits (approx. 1 acre)

200 0 200 Feet

N

Map Reference: Kentucky 208D



Norris Reservoir

B&B Straight Creek Marina

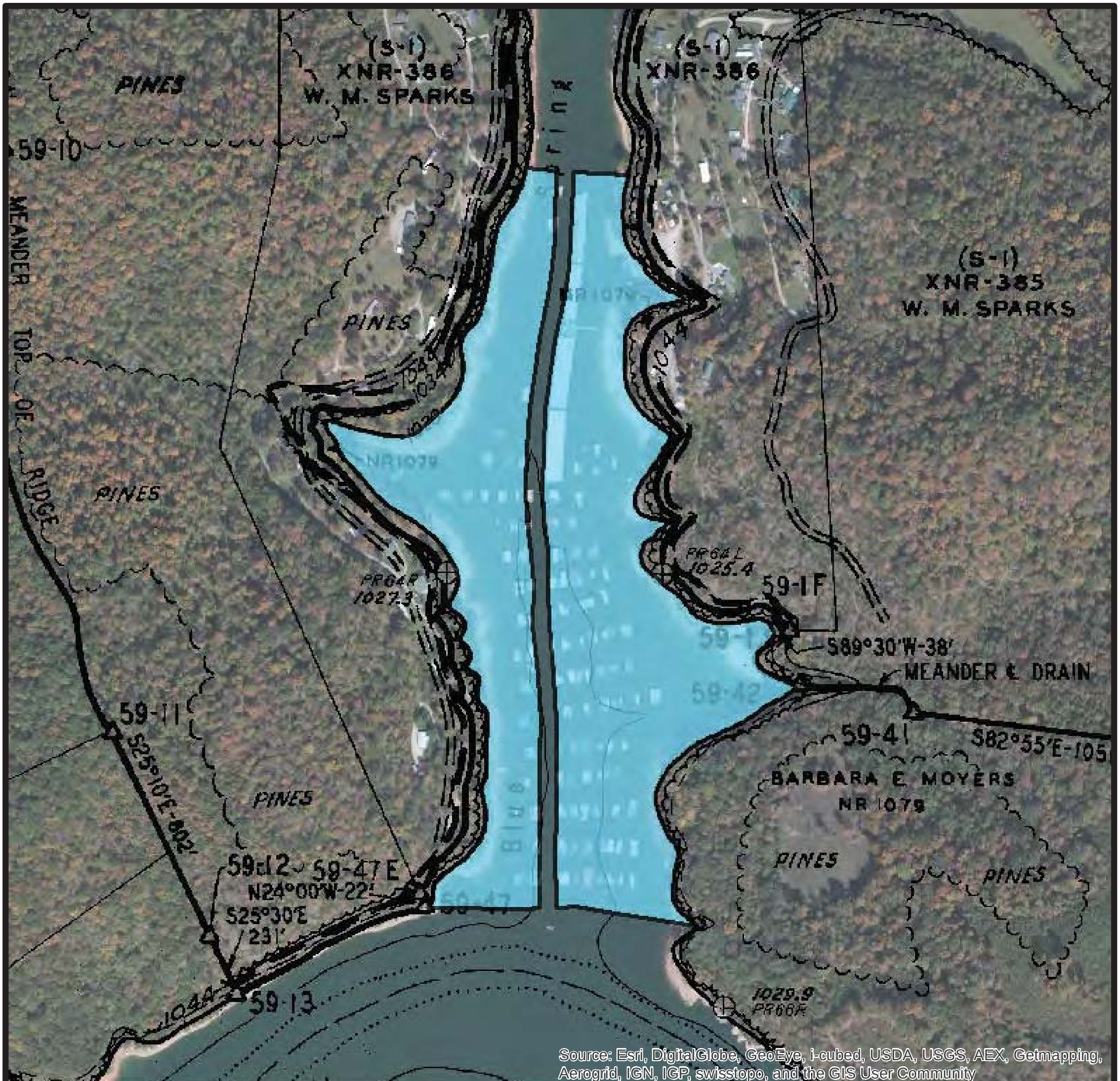
Legend

- Harbor Limits (approx. 42 acres)
- Outside Harbor Limits (approx. 43 acres)

600 0 600 Feet

N

Map Reference:
Norris 79D & 86D



Norris Reservoir

Blue Springs Boat Dock

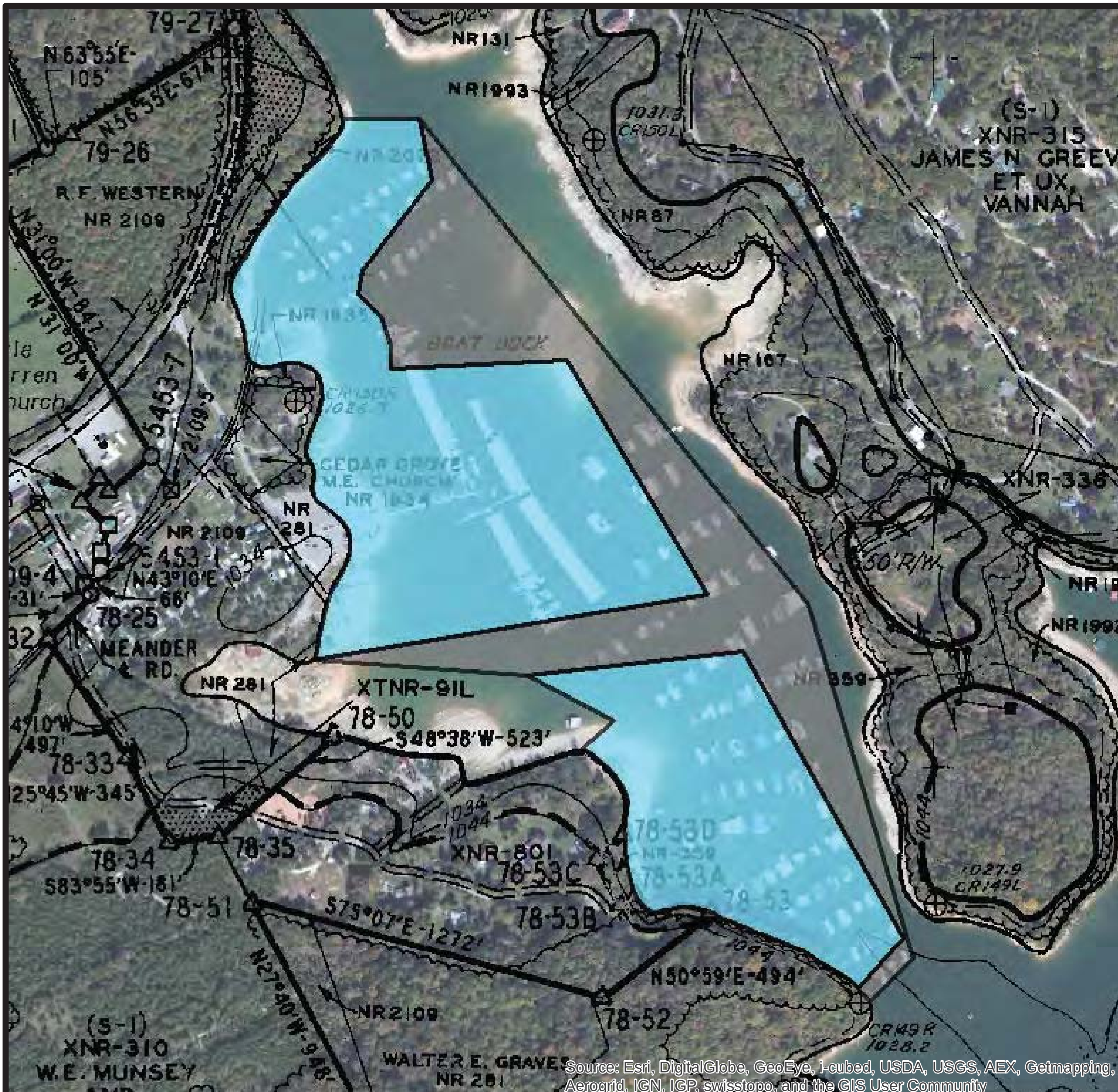
Legend

Harbor Limits (approx. 42 acres)

500 0 500 Feet

N

Map Reference: Norris 59D



Norris Reservoir

Cedar Grove Boat Dock

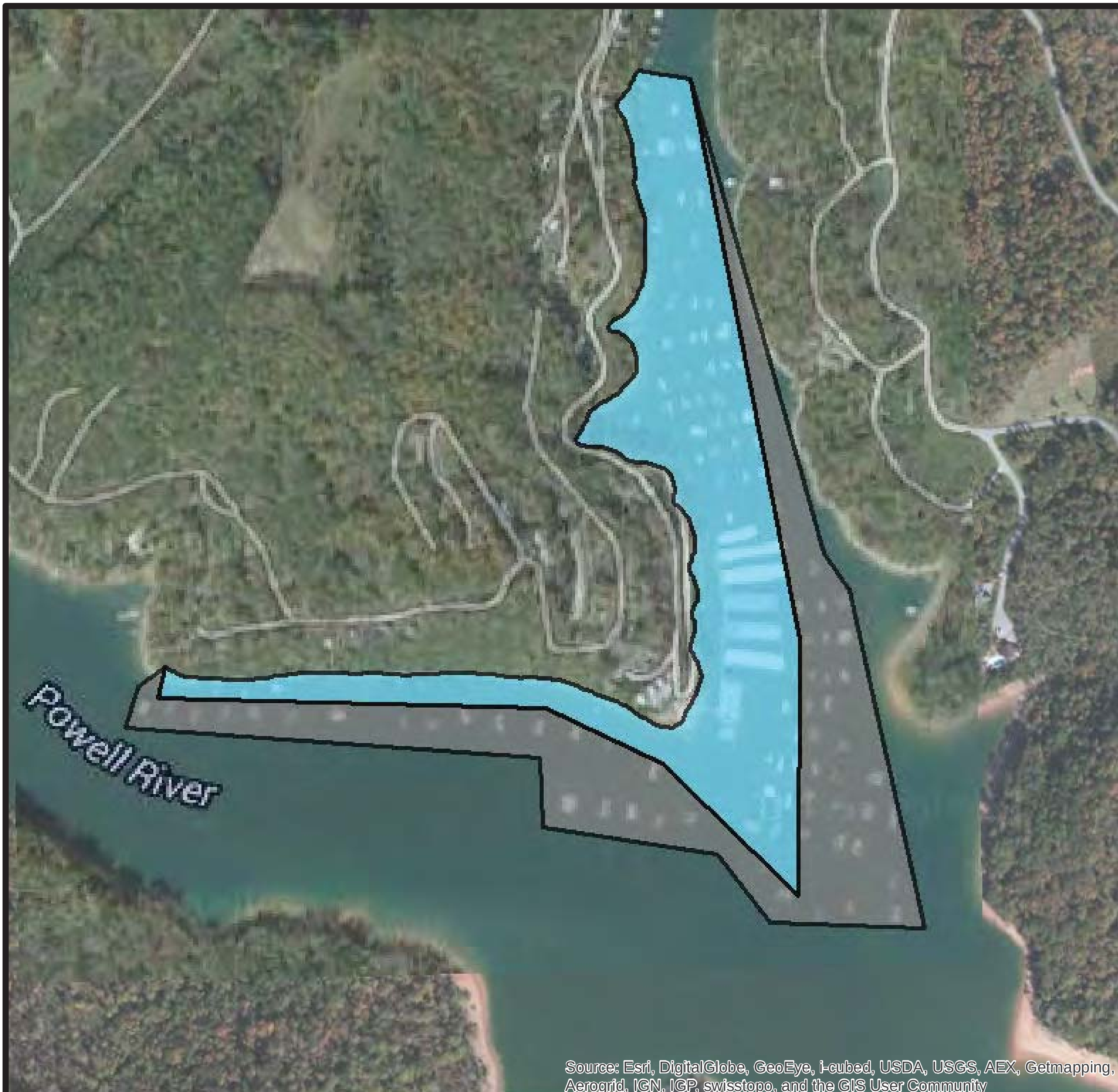
Legend

- Harbor Limits (approx. 42 acres)
- Outside Harbor Limits (approx. 23 acres)

500 0 500 Feet

N

Map Reference:
Norris 78D & 79D



Norris Reservoir

Flat Hollow Marina

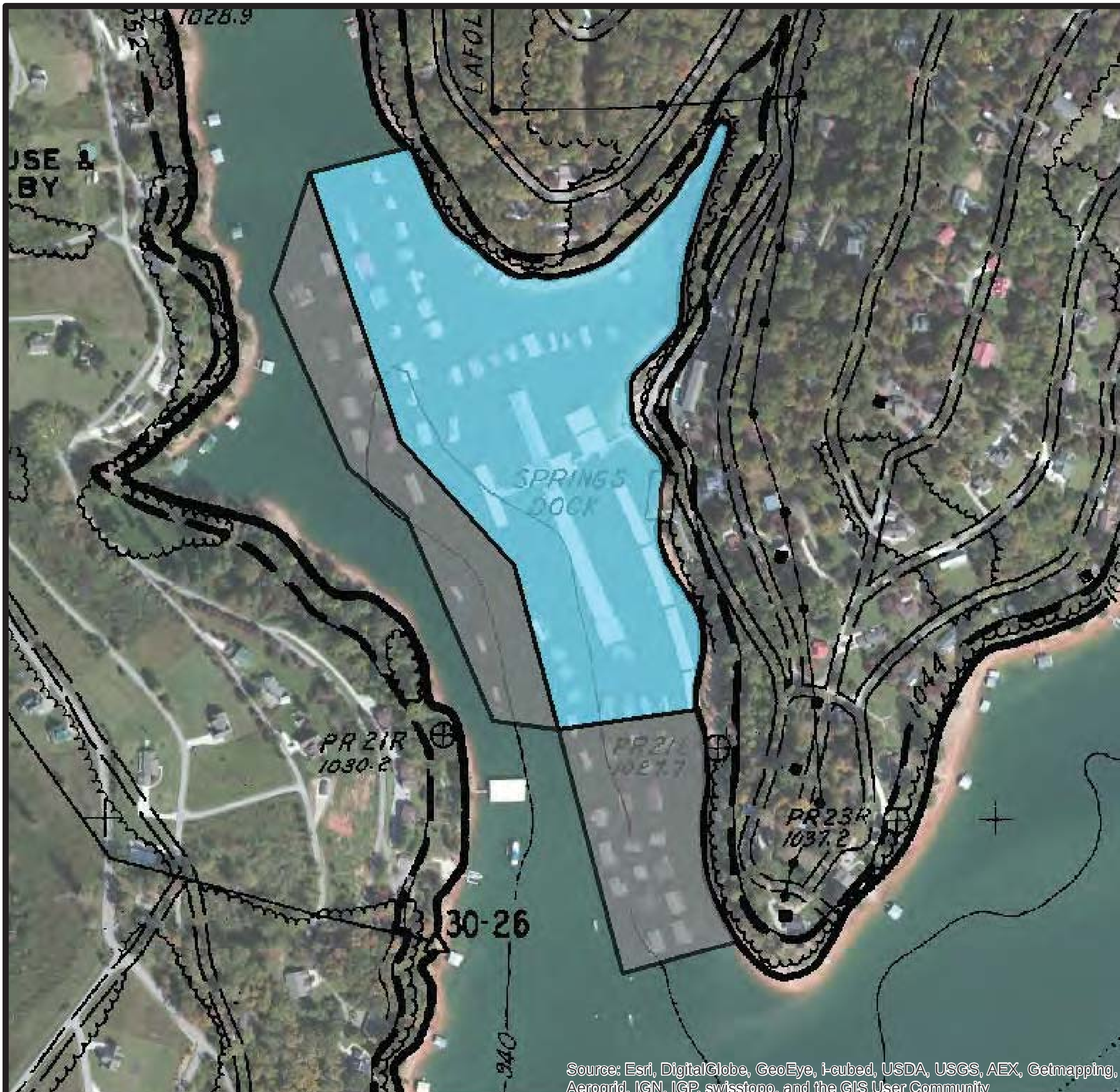
Legend

- Harbor Limits (approx. 39 acres)
- Outside Harbor Limits (approx. 32 acres)

600 0 600 Feet

N

Map Reference: Norris 30D



Norris Reservoir

Springs Dock

Legend

- Harbor Limits (approx. 21 acres)
- Outside Harbor Limits (approx. 12 acres)

400 0 400
Feet

N

Map Reference:
Norris 30D

South Holston Reservoir
Lakeview Dock

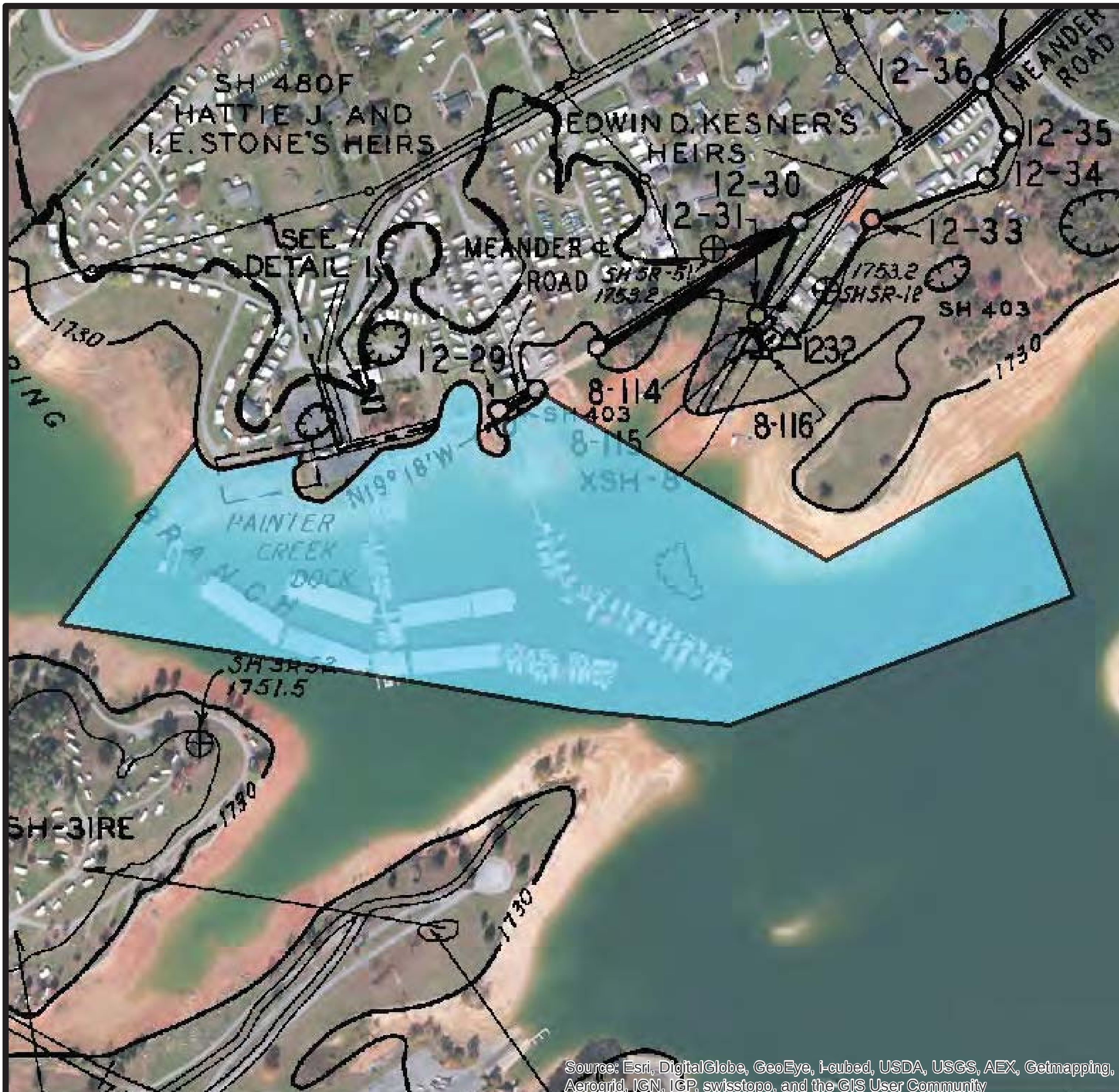
Legend

- Harbor Limits (approx. 17 acres)
- Outside Harbor Limits (approx. 3 acres)

300 0 300 Feet

N

Map Reference:
South Holston 2D, 3D, & 4D



South Holston Reservoir
Painter Creek Dock

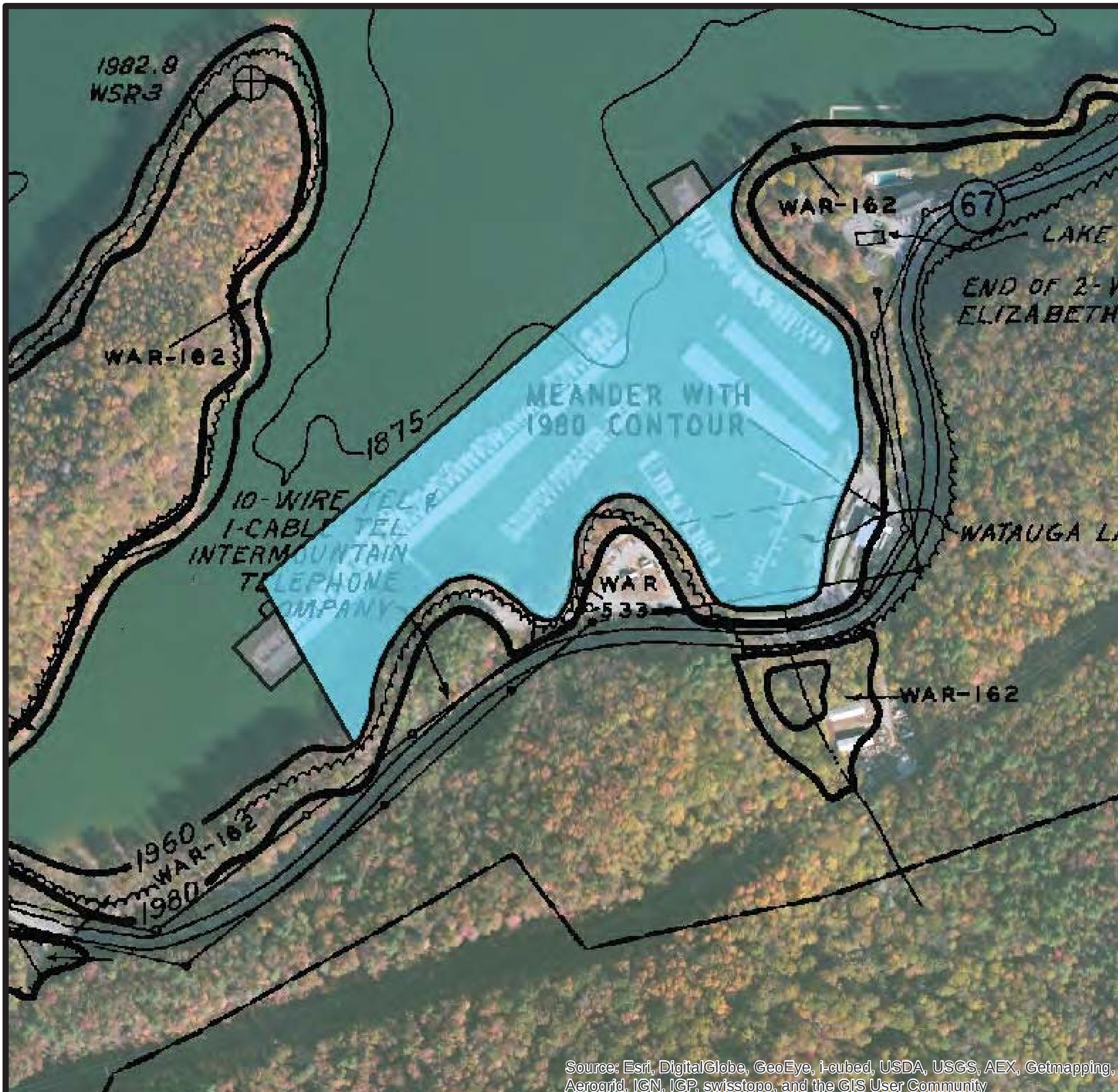
Legend

Harbor Limits (approx. 35 acres)

400 0 400 Feet

N

Map Reference:
South Holston 8D



Watauga Reservoir
Watauga Lakeshores

Legend

Harbor Limits (approx. 25 acres)

Outside Harbor Limits (approx. 1 acre)

400 0 400 Feet

N

Map Reference:
Watauga 4D

This page intentionally left blank