Recreational Boating
Capacity Study

Tims Ford Reservoir

Supporting a
Thriving River System

TVA

Recreational Boating
Capacity Study

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Supporting a Thriving River System

February 2002

Tennessee Valley Authority

Park Studies, Inc.

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1: Introduction

Background: Increased Use and Development Pressure on Tims Ford Reservoir

Tims Ford Reservoir is managed by the Tennessee Valley Authority (TVA) to provide a multitude of benefits, including high quality recreation opportunities for nearby residents and visitors from the surrounding region. Over the past three years, the reservoir has experienced an increase in boating and water related accidents, as noted by Tennessee Wildlife Resources Agency (TWRA) and TVA Police reports. The question arises whether the number and diversity of recreational users present, along with associated local development, may threaten the safety and enjoyment of visitors and residents.

As recreational use increases, TVA managers and partnering peer agency staffs of TWRA and the Tennessee Department of Environment and Conservation (TDEC) find it difficult to know whether or not Tims Ford Reservoir is experiencing recreational boating use levels which could be considered overcrowded or unsafe. Along with increased recreational use, there have been requests for marina and public use area (PUA) expansions and new residential developments with associated private water-use facilities. With major cities, such as Nashville, Murfreesboro, and Columbia, Tennessee, and Huntsville, Alabama, experiencing crowding pressure at neighboring lakes and reservoirs, the recreation public is traveling greater distances to enjoy less crowded boating. Tims Ford Reservoir is experiencing the result of this regional trend.

To study this issue and explore ways to answer these questions, TVA has selected Tims Ford Reservoir as its initial pilot project for evaluating a methodology for assessing recreational boating capacity and obtaining useful data on recreational boating that relate to balancing and optimizing competing demands on the Tennessee River system. The notion of increased recreational impacts is further discussed in the Tims Ford Final Environmental Impact Statement (FEIS), Section 3.10, pages 3-46 through 3-51 (TVA, 2000).

TVA Reservoir Management Capability: Focusing on Recreational Boating

TVA reservoir managers recognize the opportunity they now have to take advantage of the limited lead time prior to executing the *Tims Ford Land Management and Disposal Plan (Land Plan)* implementation strategy to prepare for expected increased use of the reservoir and interest in shoreline development. Managers are also interested in improving their ability to address the increasing numbers of water-use permits and land use requests for new or expanding commercial and marina facilities while protecting the reservoir resources and preserving the quality and diversity of recreational opportunities that Tims Ford can provide.

The Challenge

TVA is challenged to maintain quality recreational experiences at Tims Ford Reservoir while acknowledging its increasing use and development potential. *Recreation quality* strongly equates with diversity of experiences. It is defined as the degree to which a range of boating opportunities (e.g. fishing, skiing, cruising, high performance boating, sailing, canoeing, pontoon boating, jet skiing, etc) are provided to meet the diversity of visitor needs and expectations rather than allowing one particular type of opportunity to dominate. There is no such thing as a typical visitor. Most visitors have many, sometimes conflicting, needs and interests. The goal is to achieve a balance among social conditions, resource conditions, and management conditions related to water base recreational opportunities.

The Problem

TVA decided to develop a systematic process to provide managers the data needed to make decisions about requests for the establishment of new and/or expansions of existing marina facilities on several reservoirs. This was in response to questions that were raised by citizen stakeholders regarding the ability of the reservoirs to accommodate additional boat traffic. TVA, like many other water resource management agencies, lacks a data-based, decision-making approach to:

- Identify and determine the extent of problems,
- Develop new management tools, and
- Plan for defensible responses based on clear rationale.

Furthermore, user groups who live nearby and recreate at Tims Ford are asking more questions about management actions and policies established by managing agencies, i.e., TVA, TWRA, and TDEC. Managers and staff find it increasingly difficult to defend complex decisions based upon individual professional judgment and perception of problems/issues. The public may often view such decisions as arbitrary and capricious. Consequently, managing authorities need systematic information gathered over time to answer questions, support management decisions, and to cope with changes in water surface and shoreline use. Providing for diverse tastes and needs requires collection of accurate data about user characteristics from the boating public—information about their preferences and the conditions they perceive to be detrimental to their enjoyment of the reservoir.

The Solution

Boating capacity studies are aimed at describing existing conditions and evaluating whether proposed changes will negatively impact current users. TVA initiated the Tims Ford Reservoir pilot project in October 2000 to evaluate various models and methodologies related to determining recreational boating capacity for reservoir settings. TVA elected to pilot a proactive approach which draws on the “Quality Upgrading and Learning Process” (QUAL) (Appendix 1) and the “Recreation Management Information System” (RMIS) (Appendix 2), both developed by Dr. Kenneth Chilman.

This hybrid process moves our thinking beyond the idea of boating capacity as a limit or "magic" number of boats that a reservoir system can support. Instead, it characterizes a reservoir setting in terms of resource conditions, social conditions, and managerial conditions for boating. A management compartment map displays four broad categories as part of an inventory process. This approach provides useful data for gaining a better understanding of future desired boating conditions and for offering reservoir managers choices for altering management strategies.

Pilot Project Purpose

The purpose of the pilot project is to develop a proactive approach for assessing boat crowding on TVA reservoirs. For the pilot, a modified QUAL/RMIS process (TVA Boating Capacity Model) was used to model and complete one boating capacity study in order to determine whether the methodology could be:

- Applied to land use requests and permitting on all TVA tributary and mainstream reservoirs,
- Easy to execute by all 12 Watershed Teams,
- Cost-effective in terms of dollars and human resources,
- Completed within a short period of time (< 12 months),
- Linked to the corporate goals of "stimulating economic growth" and "supporting a thriving river system", and
- Applied to one or more of TVA's Critical Success Factors, such as "balance and optimize competing demands on the river system."

The success of the pilot in addressing these concerns is discussed in Chapter 6.

Boating Capacity Study Objectives

The Tims Ford Reservoir Boating Capacity Study Team (Study Team) was formed to develop and execute this pilot project. The following specific study objectives are concerned with the application of the TVA Boating Capacity Model (Model) to the question of whether or not boating on Tims Ford Reservoir is getting overcrowded and unsafe. In meeting each of these objectives, the Study Team is addressing the management concerns stated above under "Pilot Project Purpose." The objectives are:

1. To test and apply the Model for gathering recreational boating information on Tims Ford Reservoir.
2. To document and estimate the amount of recreational boating activity on Tims Ford Reservoir.
3. To determine boaters' perceptions of the natural resource, social, and managerial conditions on the reservoir so that managers can better understand visitor desires and needs and gain a better understanding of changes and problems that occur.
4. To document the temporal and spatial use patterns of boaters, including locations of where specific activities occur.
5. To document the nature and magnitude of conflicts between boaters and the areas where conflicts occur.

Study Area

Tims Ford Reservoir is a 10,680-acre impoundment on the Elk River at mile 133.3 in Franklin and Moore Counties, Tennessee. For the purposes of the boating capacity study, approximately 120 acres were deducted from this total to account for the islands within the reservoir, resulting in a water surface area of 10,560 acres. Tims Ford Reservoir was completed in 1970 by TVA for the purposes of flood control, hydroelectric generation, recreation, and economic development. Tims Ford Dam was named from an early ford crossing the Elk River near Winchester. The ford, located on or near land owned by Abner Mansfield Tims, an early Franklin County settler, was used until about 1885 when the Tims Ford Bridge was constructed across the river.

The reservoir is 34 miles long at full pool and has 275 miles of shoreline. Water depth at the dam is 143 feet, and the average depth is about 50 feet. Although Tims Ford Reservoir is designed for a 30-foot drawdown ~~fr~~om 895 to 865 feet mean sea level—for flood protection, actual annual drawdowns average only 18 feet. Normal winter reservoir levels range from 865 to 873 feet, and normal summer levels are 888 to 883 feet. Maximum level is 895 feet. The hydroelectric plant has two units: a generating unit rated at 45,000 kilowatts (kW), and a minimum flow unit rated at 39 kW.

Projected Shoreline Build-Out Based on the Tims Ford Reservoir Land Management and Disposition Plan

TVA and TDEC jointly prepared a comprehensive *Land Management and Disposition Plan (Land Plan) for Tims Ford Reservoir, June 2000*. The Land Plan allocated 6,453 acres of land to specific uses. Of this, approximately 1,854 acres of land are currently owned and managed by TVA and 4,599 acres of land are currently owned and managed by TDEC. TDEC proposes to use the Land Plan to implement Tennessee Public Chapter 816 of the 1996 Acts of the Tennessee General Assembly, which charges TDEC with the responsibility to dispose of the remaining public land interests on Tims Ford Reservoir. TVA proposes to use the Land Plan to guide land use approvals, private water-use facility permitting, and resource management decisions on Tims Ford Reservoir.

The Land Plan allocates land into seven broad land use zones, including TVA project operations, sensitive resource management, natural resource conservation, industrial/commercial development, developed recreation, residential development/access and conservation partnership. The plan includes approximately 2,215 acres of land currently committed to a specific use through previous land transfers, leases, and contracts that are allocated to that current use. In total, the Land Plan allocates 37 percent of Tims Ford Reservoir land to Natural Resource Conservation, 25 percent to recreation, 24 percent to residential, and 9 percent to Sensitive Resource Protection. The Land Plan also provides opportunities for enhanced reservoir access through establishment of a Conservation Partnership Zone. This zone is intended to help establish a wider shoreline buffer zone by fostering shoreline protection partnerships with the adjacent property owners. In return for conservation partnership easements granted by adjacent private property owners, TVA would consider requests for limited community water-use facilities.

Tims Ford Reservoir has a total of 275 miles of shoreline at summer pool elevation 888 feet above sea level. The Study Team has mapped Tims Ford Reservoir at total shoreline build-out based on the Land Plan (Exhibit A). The Land Plan identifies approximately 73 miles of shoreline (Zone 7 and Zone 8) that could be developed for residential access and conservation partnership, respectively. Of these 73 miles, approximately 52 miles or 19 percent of the total shoreline is currently used for residential access. Another 17 miles of shoreline could be developed for new industrial or commercial/recreational development as outlined in the TVA Board-approved Final Environmental Impact Statement/Land Plan. Of these 17 miles, 7.7 miles (.03 percent of the total Tims Ford Reservoir Shoreline) are currently in commercial/recreation use. Only part (11 miles) of the existing 38.2 miles of state park shoreline has been included as developable recreational shoreline. This is because most of the state park shoreline will likely not be developed in a fashion that will impact boating capacity activities; most of the state park shoreline will fall into a conservation or nonconsumptive recreational category. For example, the large peninsula near the area known as "The Narrows" has been developed as a golf course. None of the shoreline adjacent to the golf course will likely be planned to support waterfront recreation like camping, picnicking, swimming beaches, or other water related activities. In all likelihood, it will remain as a protective vegetated shoreline buffer for the golf course. Therefore, it is estimated by the Study Team that at build-out, 37.5 percent of Tims Ford Reservoir shoreline would be impacted by development from water-use facilitates or water-related activities.

Tims Ford Reservoir
Shoreline Development Forecast At Build Out
Exhibit A

N

- Project Operations (Zone 2) - 1.3 Miles (.5 Percent)
- Industrial/Commercial and Recreation (Zone 5 and 6) - 17.2 Miles (6 Percent)
- Potential and Existing Residential Development and Access (Zone 7 and 8) - 72.9 Miles (27 Percent)
- State Park Shoreline with Proposed Recreational Use - 11.0 Miles (4 Percent)
- State Park and Remote Sites - 30.5 Miles
- Public/Community Boat Ramps

TVA

Total Shoreline Is 275 Miles At Elevation 888.

5000 0 5000 Feet

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Lost Creek Road
Turkey Creek
Fall Lick Creek
Mansford Road
Lost Creek
Cooper Branch
Anderton Branch
Rey Branch
The Narrows
Wiseman Bend
Kitchens Creek
Hurricane Creek
Little Hurricane Creek
Fanning Bend
Maple Bend
Owl Creek Hollow
Eastbrook Road
Taylor Creek
Elk River
Old Estill Springs Road
Hwy. 41
Hwy. 130
Hwy. 64
Hwy. 50
Boiling Fork Creek

2: Process Methodology

Recreational Boating Capacity

Boating capacity is a concept borrowed from other resource management fields such as range or wildlife management. The notion of providing a broad range of boating opportunities and recreational experiences in a particular location can also be applied to water-based recreation. This concept, known as Recreation Opportunity Spectrum (ROS), describes a prescribed range of experiences associated with place-specific locations in undeveloped to developed settings (Driver and Brown, 1978). The concept implies that specific land or water areas have certain "capacities" for use and that these capacities can be determined and then managed.

Ideally, the determination of boating capacity would be accomplished by applying a simple formula for calculating a manageable limit or specific number of watercraft for an entire body of water. However, given the sheer diversity of boats on the water [from houseboats to personal watercraft (PWC) use] and the variability in horespower (from 10 to 600), an acres per boat calculation can only provide a crude estimate of capacity conditions. But the concept of evaluating recreational boating capacity on rivers, lakes, and reservoirs is more complex. To obtain an accurate picture, estimation of boating capacity must include learning about current boating conditions, discovering what managing agencies and our visitors might like future conditions to be, and developing a strategy to get there.

The definition for boating capacity used in this study is:

> *The reservoir condition in which a high-quality, safe, and enjoyable recreation experience can be maintained while protecting the natural resources where recreational activities occur.*

Specifically, **boating capacity is the prescribed number of people/boats** (demand) **that a reservoir area will accommodate** (supply), **given the desired biophysical/cultural resources** (resource conditions), **visitor experiences** (social conditions), **and management program** (managerial conditions) (Hass, 2001). The understanding of boating capacity depends upon knowledge of user preferences and perceptions, resource capabilities, the reservoir existing conditions, agencies management objectives, policies, regulations, budget, and personnel—conditions which change with some frequency.

In 1982 R. F. Washburne proposed recreational carrying capacity as a <u>set of conditions</u>—physical-biological, social, and managerial—to be managed in a particular area, rather than as a calculation of limits on visitor numbers. During the past two decades various processes have been developed and used by major land managing agencies, including ***Limits of Acceptable Change*** used by the U.S. Forest Service, ***Visitor Experience and Resource Protection*** or ***Visitor Impact Management*** used

by the National Park Service (U.S. Department of the Interior, 1997), ***Carrying Capacity Assessment Process*** used by the National Oceanic and Atmospheric Administration Coastal Service Center, and ***Quality Upgrading and Learning*** (QUAL) used by the U.S. Army Corps of Engineers. All of these processes integrate various kinds of information and recommendations for a desired set of conditions. However, with the exception of QUAL, most of these models are expensive and time consuming, taking two or more years to complete.

The TVA Boating Capacity Model

The Model is a five-step systematic process, as shown in Figure 1. Each step of the process results in a product that can be distributed or accessed via the Internet, enhancing communication and the credibility of decision-makers with the public and agency partners.

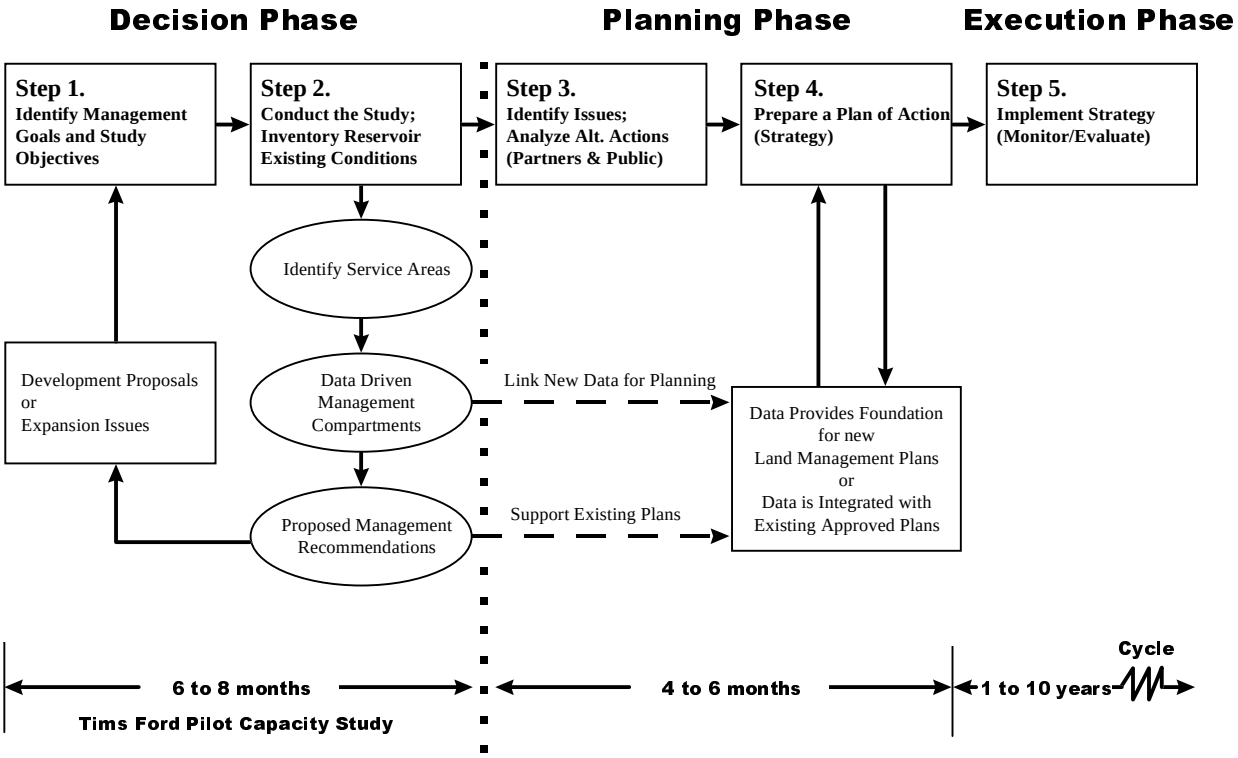


Figure 1: TVA Boating Capacity Model

Step 1: Identify Management Goals and Study Objectives

The process begins with the definition of desired future conditions of a reservoir setting. Considerations in developing these scenarios include:

- Providing a diverse range of quality recreation opportunities,
- Zoning different activities to specific locations of the reservoir,

- Linking management practices to the various activity zones,
- Educating visitors or providing user information about the different conditions within the various zones, and
- Surveying recreation end-users concerning desired and current conditions.

These parameters help in the formulation of specific goals and objectives for conducting the boating capacity study.

Step 2: Conduct the Study

Once the project scope is defined, an inventory of existing reservoir conditions is conducted. Data collection for a boating capacity study has two primary components: a **boater survey** and on-water **boat counts**. Typically, the survey process includes both face-to-face exit interviews with boaters at the boat ramps and mail-back questionnaires sent to shoreline property owners and marina users. Data are collected within defined subunits of the reservoir called Service Areas. The data are coded and entered into a computer database as the data are being collected so that progress can be closely tracked. The boat count data are entered into a Geographic Information System (GIS) database for retrieval and spatial analysis with accompanying map products. Management Compartments are created by conducting a visual analysis of the boat survey spatial responses and weekend boat count composite maps to identify logical breaks in user patterns. Boat density is integrated with boater conflict information using a Management Compartment Classification Criteria Matrix. The matrix ranks Management Compartments into different classes (I-IV) from the highest density/conflict to the least.

The process can end with Step 2—as did the Tims Ford Boating Capacity pilot study (Figure 1). The data and report findings would provide enough information to support good management decisions related to reservoir shoreline development; marina expansions; or the ability to address other recreational boating capacity issues and concerns within a reservoir setting without proceeding on to the development of a formal Action Plan and Implementation Strategy (Steps 3-5). A more detailed discussion of Step 2 follows under the section “Tims Ford Boating Capacity Study Design.”

Step 3: Address Key Issues

Steps 3 through 5 involve partnering with stakeholders and obtaining public input for the development of an Action Plan and an Implementation Strategy. Step 3 focuses on identifying solutions to recreational reservoir users’ key issues and concerns. First, an interagency workshop is held with agency partners using a modified nominal group technique to generate ideas for alternative actions addressing each issue. The list of possible actions are prioritized and become a basis for discussions with other stakeholder groups and the public.

An open house public forum provides an opportunity for public input. Large posters and maps exhibiting the results of the interagency workshop are used to stimulate discussion. Public opinion on the proposed actions and new ideas are recorded and

analyzed in terms of how they support or do not support the proposed actions. For discussion purposes, issues to be addressed can be grouped into two categories: reservoir wide or specific to a Management Compartment. Based on private consultant reports from past workshops, the most commonly raised reservoir-wide issues are:

- PWC numbers and behavior (e.g., operator age too young and require a license to operate).
- Protection of the shoreline and natural or scenic qualities of the reservoir, including water quality and "quiet coves" (e.g., low developed areas).
- Potential improvements to existing public facilities.
- Ability to provide responsive and reliable law enforcement, including a greater presence at public boat ramp sites.
- The need for requiring boating safety education before issuance of a license for operating any type of powered watercraft.

Compartment-specific issues typically include concerns about crowding and conflict behavior in particular locations.

Step 4: Prepare a Plan of Action

After external review of the proposed actions is completed, a facilitated workshop, including all agency partners, is held to develop an Action Plan for managing the boating capacity of the study reservoir. During the workshop, participants develop specific tasks or strategies to address each of the issues identified and prioritized in Step 3 and identify key indicators to be used in monitoring implementation of the Action Plan. Implications of proposed management actions or strategies must be thoroughly discussed with all parties involved. Factors, such as ease of implementation; costs; effects on boater freedom; user safety; sustaining a quality recreation experience; diversity of recreation opportunities; and legal or regulatory ramifications, should be considered for each task. Each proposed action should be considered feasible **only** if it helps **accomplish desired future conditions** for the reservoir.

During Step 4, additional consideration should be given to linking the new boating capacity data findings to the development of new TVA Land Management Plans, or to integrating proposed recommendations as support for existing TVA Board approved plans.

Step 5: Implement Strategy

Implementation takes place in day-to-day management of a reservoir, according to the approved Action Plan. After strategies and management techniques have been implemented to achieve defined objectives, evaluation or monitoring programs should be initiated to measure and report successful accomplishment of the plan of action. Periodic re-measurement of key indicators identified in Step 4 is an important and tangible indication that agreed-upon work is being done and progress toward accomplishing the goal of desired future conditions is responsive to the Action Plan. If monitoring reveals that significant changes are occurring on the reservoir, it may be

necessary to begin a process of adjusting the implemented strategy to accommodate the changes.

Process improvements and opportunities to increase the quality of the boating experience should be continually looked for during Step 5.

Tims Ford Boating Capacity Study Design

The following provides an overview of the major components of Step 2 used by the Study Team to inventory the existing conditions of Tims Ford Reservoir. Tasks 12 through 21 in Figure 2 summarize the major tasks in this step.

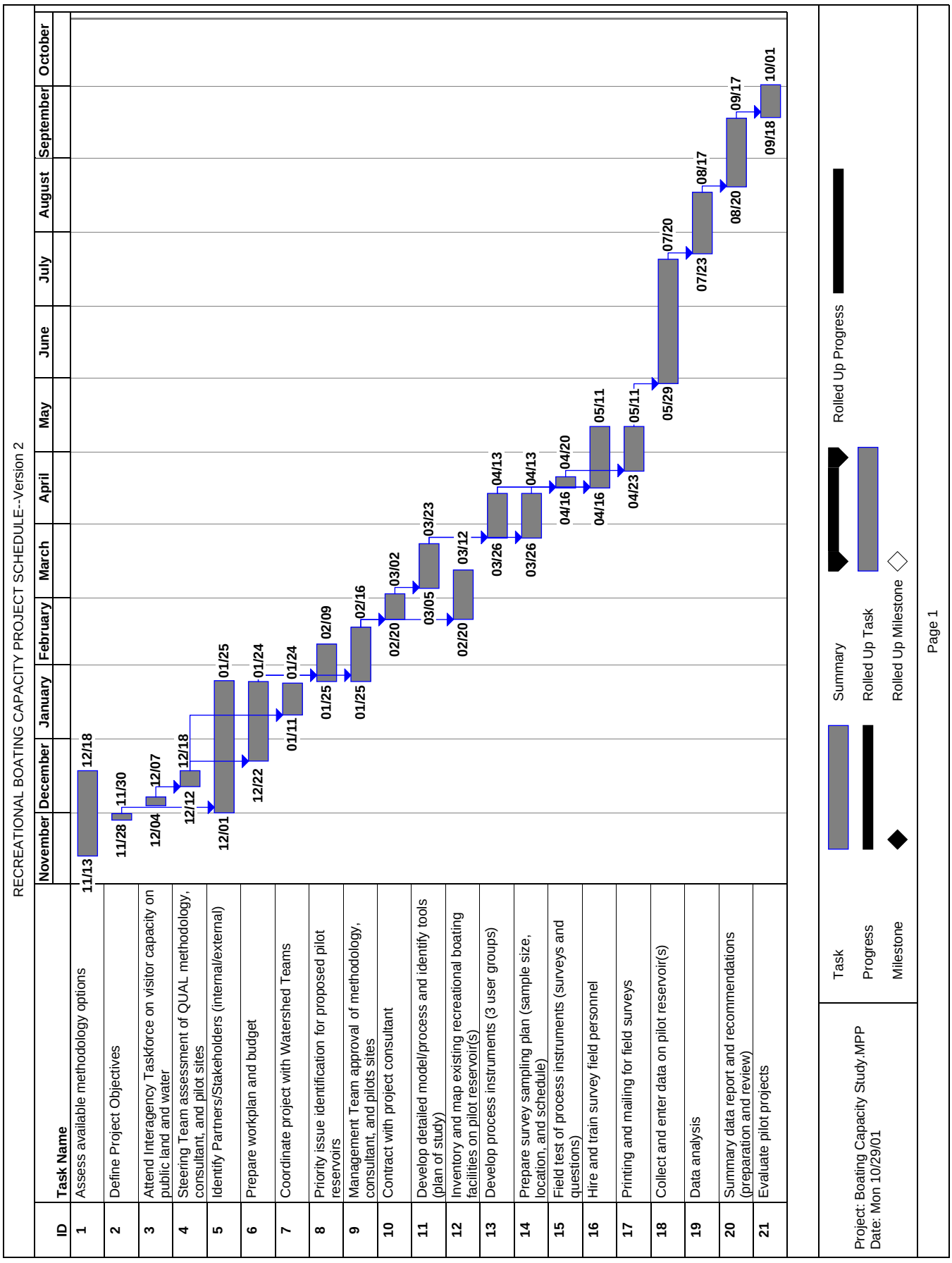
Defining the Service Areas

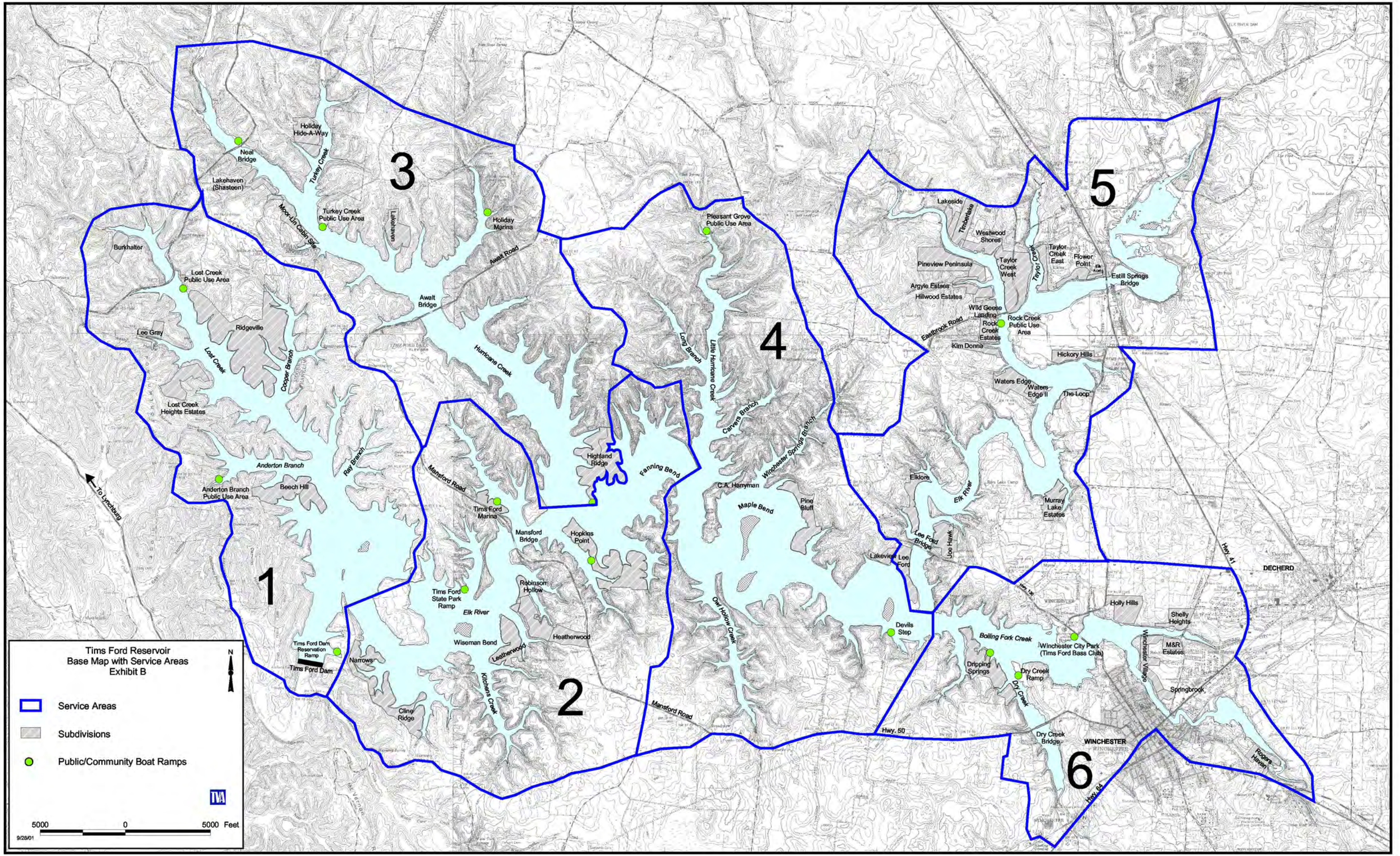
Service Areas are large divisions of a reservoir and adjacent shoreland. They can be described as "lakes within a lake" in that each area has unique attributes which represent a somewhat distinct character from that of an adjoining Service Area (Titre, et al., 1995). For the Study Team, Service Areas provide practical study area boundaries where boat counts and observation of boat types can be conducted. Although the boundaries are artificial, they are intended to define the area within which a boater is expected to spend most of his/her time. This rule of thumb is based on the assumption, supported by other boating capacity studies, that boaters generally do not want to cruise more than 20 minutes from their point of reservoir access (e.g., ramp or boat slip).

To define the Tims Ford Reservoir Service Areas, the Study and Watershed Teams worked together to create a base map locating all public and community boat ramps on the reservoir (Exhibit B). Using the following criteria, the Watershed Team divided Tims Ford Reservoir into six Service Areas:

- From observation and collaboration with partnering agencies, each ramp site was assigned a use rating of high, medium, or low. The objective was to provide, if possible, at least one high- to medium-use ramp and one low-use ramp within each Service Area.
- Commercial marina ramps, community ramps, and PUA ramps should be relatively evenly distributed.
- The Service Area size should be limited to an area that can be navigated by the Study Team within a two-hour time period.
- Depending on the configuration of the shoreline (convoluted versus smooth), water surface area was divided into more or less equal shoreline segments.
- The density and distribution of private or public shoreline development were considered.
- Physical features or natural conditions, such as bridges, old road beds used as informal access areas, channel depth (deep versus shallow water areas), wave or wind conditions, coves versus open-water areas, etc., that could influence boating traffic patterns were considered.

Figure 2: Recreational Boating Capacity Project Schedule — 2000 to 2001




3
4
5
1
2
6
Holiday Hide-A-Way
Neal Bridge
Turkey Creek
Lakehaven (Shasteen)
Moor-Un Cabin Site
Turkey Creek Public Use Area
Lakehaven
Holiday Marina
Awalt Road
Awalt Bridge
Burkhalter
Lost Creek Public Use Area
Lee Gray
Ridgeville
Lost Creek
Cooper Branch
Lost Creek Heights Estates
Hurricane Creek
Pleasant Grove Public Use Area
Long Branch
Little Hurricane Creek
Carvers Branch
Winchester Springs Branch
Highland Ridge
Fanning Bend
C.A. Harryman
Maple Bend
Ping Bluff
Lakeside
Timberlake
Westwood Shores
Pineview Peninsula
Taylor Creek West
Taylor Creek
Taylor Creek East
Flower Point
Estill Springs Bridge
Argyle Estates
Hillwood Estates
Wild Geese Landing
Rock Creek Estates
Rock Creek Public Use Area
Eastbrook Road
Kim Donna
Hickory Hills
Waters Edge
Waters Edge II
The Loop
Elklore
Elk River
Murray Lake Estates
Lakeview Lee Ford
Lee Ford Bridge
Joe Hawk
Hwy. 41
DECHERD
Holly Hills
Shelly Heights
M&R Estates
Springbrook
Winchester Village
Boiling Fork Creek
Winchester City Park (Tims Ford Bass Club)
Dripping Springs
Dry Creek Ramp
Dry Creek
Dry Creek Bridge
WINCHESTER
Hwy. 64
Rogers Haven
Devils Step
Owl Hollow Creek
Hwy. 50
Mansford Road
Anderton Branch
Anderton Branch Public Use Area
Beech Hill
Ray Branch
To Lynchburg
Tims Ford Marina
Mansford Bridge
Hopkins Point
Tims Ford State Park Ramp
Elk River
Robinson Hollow
Wiseman Bend
Heatherwood
Leatherwood
Kitchens Creek
Tims Ford Dam Reservation Ramp
Tims Ford Dam
Narrows
Cline Ridge
Tims Ford Reservoir
Base Map with Service Areas
Exhibit B
N
Service Areas
Subdivisions
Public/Community Boat Ramps
TVA
5000 0 5000 Feet
9/28/01

- Areas of the reservoir that provide land-based recreational facilities, offering goods and services that would reflect existing boater use patterns (i.e., collaborative knowledge among partners concerning the location of favorite versus avoided areas of the reservoir) were considered.
- Existing roads or other mapped geographic features that can easily be recognized by those who will be working with Service Area data were selected or incorporated.

Preparing the Sampling Plan

A good sampling plan provides the best opportunity for selecting defensible samples (e.g. samples that adequately represent diverse user groups and the variety of locations to which they are attracted) of adequate size. Trade-offs are frequently necessary between target sample sizes, staffing levels, and cost constraints. A rule of thumb is to attempt to achieve a sample size of 300 to 400 participants. For this study, the following parameters were used to create the sampling plan:

- Sample populations were defined as ramp users; marina users; shoreline property owners.
- Since there were fewer than 400 total marina slip users on Tims Ford, all 357 persons in this population were sent a mail survey (if there had been more, a random sample of no more than 400 marina slip users would have been selected). Ramp users were interviewed on-site. A total of 428 exit interviews were conducted with boaters as they were leaving the boat ramp.
- A sampling schedule for boat counts (Appendix 3) and surveys (Appendix 4) was developed. Weekdays and weekends for exit interviews were randomly selected.
- The boat count schedule was modified to ensure that what is being measured is a representative weekday and weekend. For example, extremely rainy weather and/or thunderstorm events would not be considered typical.
- Boats were categorized into easily identifiable types. Boat count maps were developed by GIS to record observations for both weekday and weekend counts.

Designing the Survey Instruments

The approach to information collection and analysis that was followed in this study stressed a detailed inventory of the resource and its use. Inventories are basic to decision-making in that they reveal "where we are" as a foundation for "where we are going." Furthermore, inventory information provides a factual basis for discussing options that lead to the formulation of specific management objectives for maintaining quality user experiences.

The exit interview (Appendix 5) and mail survey (Appendix 6) differed slightly, because the exit interview emphasized the boaters' experience from the perspective of the present outing, while the mail survey asked respondents questions regarding their most recent previous outing. Both surveys did, however, focus on gathering information on

use patterns, and on the perceptions and preferences of boaters using Tims Ford Reservoir.

Both survey instruments were constructed using the Total Design Method (TDM) developed by Donald Dillman (1978). TDM has three components:

- Identify each aspect of the survey that may affect the quality (complete and accurate) or quantity (high rates) of responses.
- Shape the questions to achieve the best possible responses.
- Use an iterative mail-out process (i.e., reminder cards and follow-up surveys sent at critical schedule intervals) designed to achieve a high rate of response.

Considerable effort was taken in designing the survey procedures to maximize the representativeness of the survey sample to ensure that the survey results would provide data relevant to the overall boating population at Tims Ford Reservoir. The goal of the TDM is to achieve a response rate of 60 to 70 percent. As Figure 3 illustrates, the response rate to the iterative mailing process used during the Tims Ford Study was 70 percent.

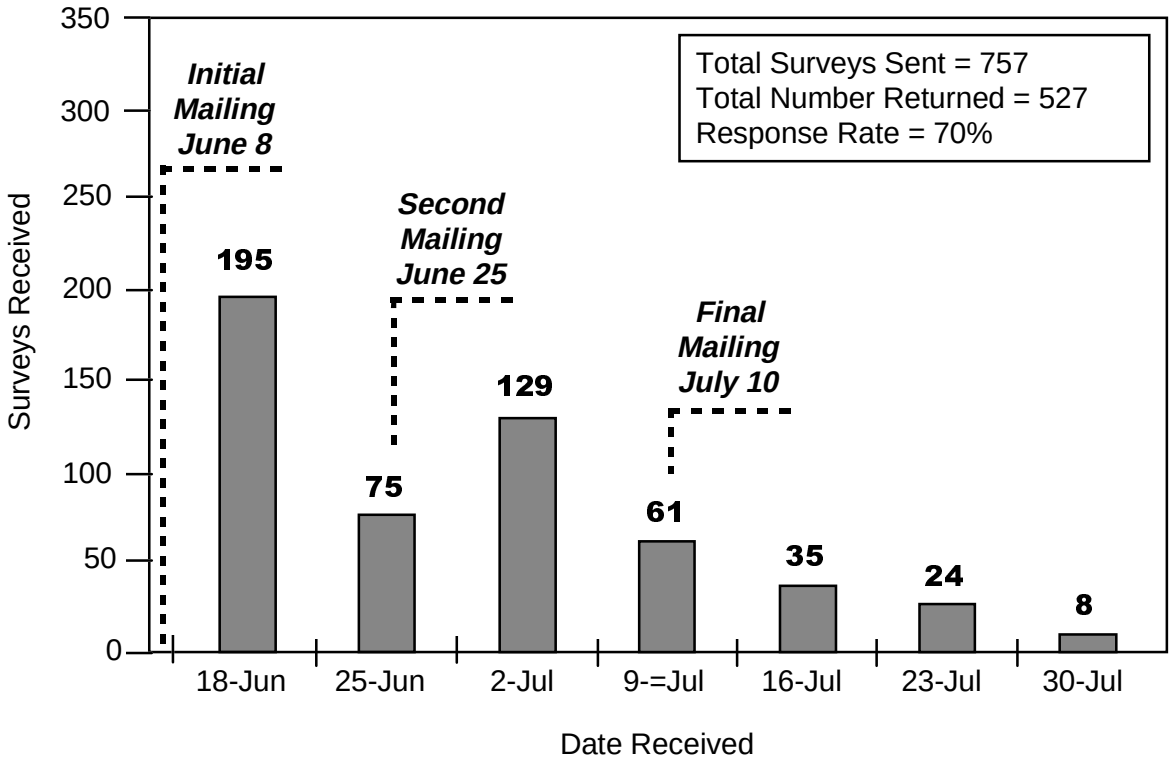


Figure 3: Response rate of mail-in surveys are a result of the iterative mailing process used in the Tims Ford Study

Training Interviewers and Boat Counters

External contractors were hired to augment TVA staff for the purpose of conducting the interviews and boat counts. Local citizens were chosen to conduct the exit interviews at boat ramp sampling sites. This proved to be beneficial because of their knowledge of the area and because ramp users quickly trusted the interviewers. Both Watershed Team members and contractors were used to conduct boat counts. The interviewees and boat counters attended one training workshop, conducted by the consultant, Park Studies, Inc., where their roles and responsibilities were clearly outlined. Workshop participants were engaged in role playing and scenarios to equip them with strategies for coping with varying situations. Perspective boat counters were taken out on the water to practice identifying boat types and correctly placing symbols on the map. They also attended a mandatory boating safety course.

Conducting Surveys and Boat Counts

Over a seven-week period (May 30 through July 18), exit interviewers were assigned to specific ramp locations to conduct interviews according to the sampling plan. Boat counters observed and recorded boat types on specified weekdays and weekends between June 2 and July 18. Mail surveys were mailed to shoreline property owners and marina slip users on June 8 (see "Preparing the Sampling Plan," above). Responses were accepted through July 30.

The survey procedure for boaters using public launch ramps was designed so that the full range of boaters using the ramps would have an opportunity to be included in the survey sample. The launch ramp exit interview schedule provided for interviewers to talk to boaters using moderate- to high-use ramp sites, as well as those using more remote and lower-use ramp sites. Exit interviews were conducted over two 4-hour periods (10 a.m. to 2 p.m. and 4 p.m. to 8 p.m.) per sampling day, in order to ensure that a diversity of boat users were encountered.

Both weekend and weekday users were sampled. To capture peak user periods, all weekends were included in the samples, but weekdays (which typically are less crowded) were randomly selected.

Data Management

All quantitative survey data (i.e., multiple-choice question responses) were entered into SPSS™, a statistical software package. Qualitative survey data (open-ended question responses) were entered into Ethnograph™ software. Spatial data for boat counts and boat types were entered into TVA's GIS.

Following data entry, statistical analyses were conducted to help make data understandable. The Study Team used the data to describe resource, social, and managerial conditions.

Creating Management Compartments

Management Compartments are a reconfiguration of the Service Areas, based on analysis of the survey and boat count data. The purpose of establishing Management

Compartments is to facilitate the formation of management strategies designed to maintain the desired conditions for specific recreation experiences (Figure 4). Existing conditions can easily be described in terms of Management Compartments. Based on existing conditions and study data, managers can decide whether the public interest is best served by attempting to maintain the existing physical, social, or managerial conditions in specific locations or by allowing them to change. Some control can be exerted over reservoir conditions by allowing or prohibiting additional boat access; shoreline development; closing, upgrading, or expanding existing facilities; designation of no-wake areas; definition of speed limits; or requiring boat operators to participate in educational programs. Such changes in managerial conditions would likely impact social conditions for reservoir users.

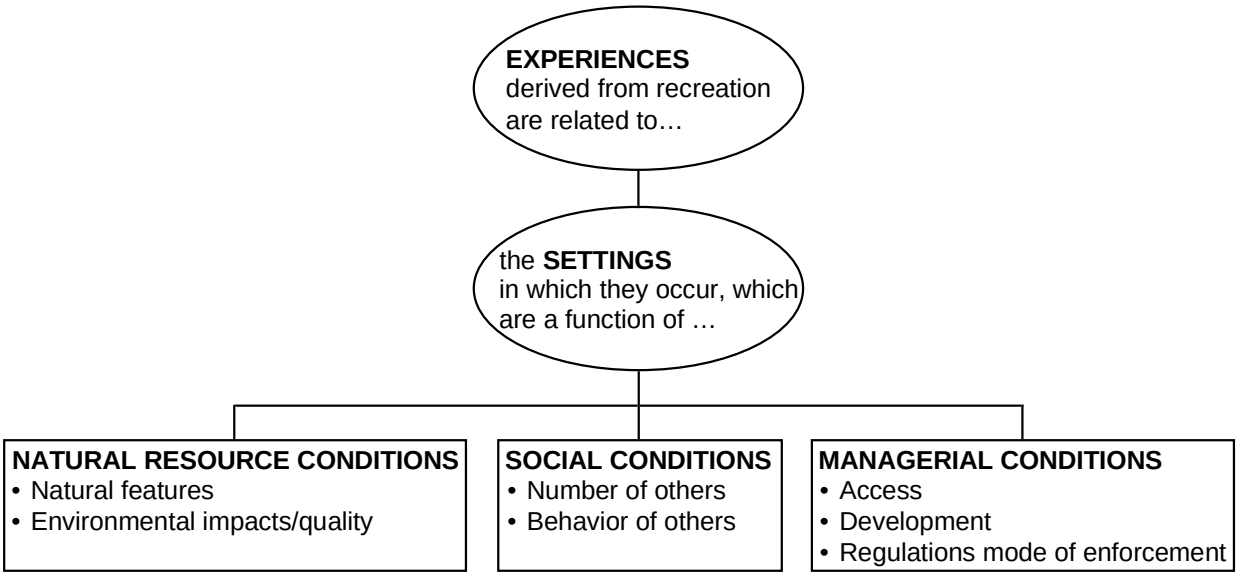


Figure 4: Managing Water Recreation Opportunities

Compartments on Tims Ford Reservoir were created by conducting a visual analysis of composite data maps showing two key social variables:

- The relative frequency of conflicts between boaters (Exhibit C)
- The number of boats observed on weekends (Exhibit D)

The Study Team looked for logical breaks in reservoir usage—places where user patterns began to show a distinctive difference from one area of the reservoir to another. These patterns tend to emerge as a result of boaters finding the conditions they desire or the recreation experiences they are seeking. From the six original Service Areas, 23 Management Compartments were delineated.

Tims Ford Reservoir
Boater Survey Spatial Responses
Exhibit C

- Favorite Areas
- Areas Avoided
- Unsafe Areas
- Public/Community Boat Ramps
- (1) Mgmt. Compartment ID Number (Color Represents Classification)
- Mgmt. Compartment Delineations

N

5000 0 5000 Feet

9/28/01

Lost Creek Road
Mansford Road
Awalt Road
Eastbrook Road
Old Estill Springs Road
Hwy. 130
Hwy. 41
Hwy. 64
Hwy. 50
Mansford Road
WINCHESTER

Tims Ford Reservoir
Boating Density Weekend Counts
Exhibit D

- Fishing Boat/Bass Boat - (208)
- PWC (Jet Ski) - (325)
- Pontoon Boat - (372)
- Runabout/Deck Boat/Speedboat/Ski Boat - (706)
- Other - (44)
- Public/Community Boat Ramps
- 1 Mgmt. Compartment ID Number (Color Represents Classification)
- Mgmt. Compartment Delineations

N

5000 0 5000 Feet

9/28/01

Lost Creek Road
Mansford Road
Awalt Road
Eastbrook Road
Old Estill Springs Road
Hwy. 130
Hwy. 41
Hwy. 64
Hwy. 50
Mansford Road
Estill Springs
WINCHESTER
Declard

Management Compartment Classification

For each of the 23 Management Compartments, information from the survey (Chapter 3) and boat counts (Chapter 4) was analyzed using the Management Compartment Classification Criteria Matrix (Table 1). This matrix correlates the incident of conflicts with boat density (surface acres/number of boats) using a four-level classification system.

Table 1: Management Compartment Classification Criteria Matrix

	Incidence of Conflicts (avoid and unsafe locations)		
Use Level (density)	**High**	**Moderate**	**Low**
Very High	Class I*	Class I	Class III
High	Class I	Class I	C II / C III
Moderate	Class I	Class II	Class II
Low	Class II	Class II	Class IV
Very Low	Class II	Class II	Class IV

*See Table 3 for class definitions

Data on boater conflict are derived from responses to the "avoid" and "unsafe" questions in the exit ramp and mail surveys (Appendices 5 and 6). In general, the majority of boaters seek to avoid (1) high amounts of boat traffic and/or (2) feel unsafe with incompatible boat types, activities, and unsafe or discourteous boat operation. "Avoid" and "unsafe" spatial data are combined to formulate a conflict scale, because the data for both are often located in close proximity on the reservoir (Titre, et al, 1995), demonstrating a close relationship between the two responses. As shown in Table 2, a compartment is rated low, moderate, or high depending on the percent of total avoided and/or conflict locations on Tims Ford Reservoir that occurred in the compartment.

Table 2. Density and Conflict Criteria

Conflict Scale (Percent of Avoided/ Unsafe Locations)	**Category**	**Density Scale (Surface Water per Boat)**	**Use Level Category**
		<25.0 acres	Very Low Use (VL)
<6.0%	Low (**L**)	20.1 - 25.0 acres	Low Use (L)
6 -12.0%	Moderate (**M**)	15.1 - 20.0 acres	Moderate Use (M)
>12.0%	High (**H**)	10.0 - 15.0 acres	High Use (H)
		>10.0 acres	Very High (VH)

Density refers to the number of boats observed from boat counts. The boat traffic density data (discussed in Chapter 4) are used as the best means of comparison of use

levels between the different-sized Management Compartments. The five use-level categories in the Density Scale in Table 2 represent relative differences between observed use levels at peak weekend use times. The number “10 acres-per-boat”—a density figure used by reservoir managers as a threshold beyond which a body of water is considered "overcrowded"—is used as the dividing line between the most heavily used and less heavily used compartments (Titre, et al, 1995).

Placement of compartments into the Management Compartment Classification Criteria Matrix, at the intersection of their conflict (H, M, L) and density ratings (VH, H, M, L, VL), reveals their classification (see Table 1). Parcels with high conflict and high density or moderate density with high conflict fall into the Class I range. At the other extreme, compartments with low density and low incidence of conflicts fall into the Class IV range. Table 3 provides definitions for each of the four classes.

Table 3: Class Definitions

Class I:	High to very high boat traffic density at peak use times and moderately high or high incidence of conflicts *or* Moderate density of boat traffic and high incidence of conflicts
Class II:	Moderate or high boat traffic density at peak use times but low incidence of conflicts *- or -* Low to very low boat traffic density and moderate incidence of conflicts
Class III:	High to very high boat traffic density at peak use times but low or moderate incidence of conflicts
Class IV:	Low boat traffic density, even at peak use times, and low incidence of conflicts

Table 4 (following Exhibit E) shows the final classification of the 23 Management Compartments on Tims Ford Reservoir. The data showing how the conflict and density ratings were derived are included. The Management Compartment classifications were mapped, using a color coding system to show the four classes (Exhibit E). The original service areas are overlaid on this map to provide a picture of where the data were collected.

Table 5 gives a composite picture of the reservoir surface area by class. On Tims Ford Reservoir, the class which resulted in the highest percent of surface area (35 percent) is Class IV, closely followed by Class II which includes 34 percent of the total surface acres. The class with the lowest total acreage (970) is Class III with 9 percent of the total.

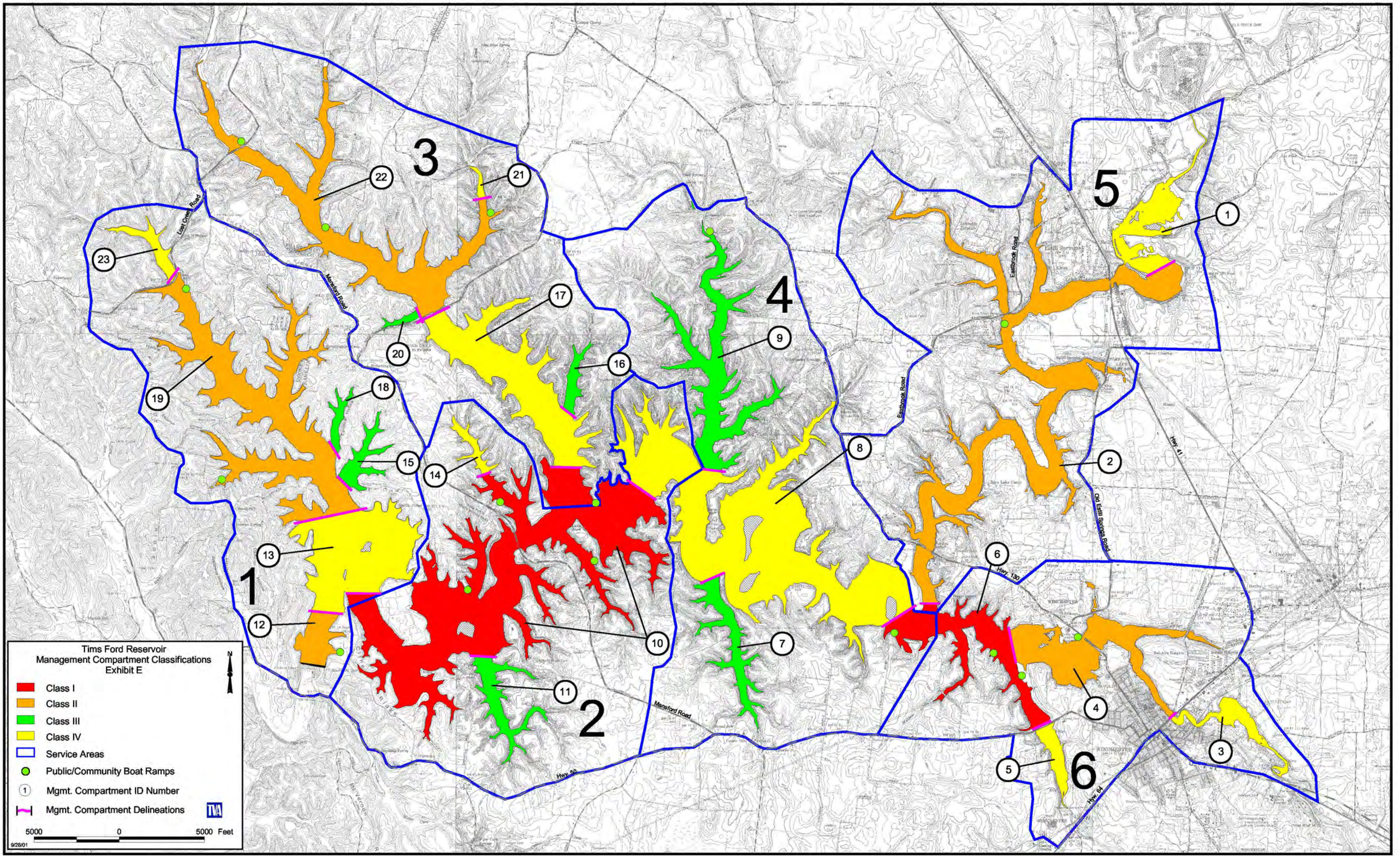

3
4
5
1
2
6
Tims Ford Reservoir
Management Compartment Classifications
Exhibit E
Class I
Class II
Class III
Class IV
Service Areas
Public/Community Boat Ramps
Mgmt. Compartment ID Number
Mgmt. Compartment Delineations
5000 0 5000 Feet
9/28/01
Lost Creek Road
Moreland Road
Eastbrook Road
Old Estill Springs Road
Hwy. 41
Hwy. 130
Hwy. 64
Hwy. 50
Mansford Road
WINCHESTER

Table 4: Management Compartment Classification Analysis

Compartment Number	Incidence of Conflicts (Avoid/Unsafe)			Density (Acre/Boat)		Classification
	% Conflict	Total Responses	Conflict Rating	Acre/Boat	Density Rating	Overall Rating
1	<1	4	L	249	VL	IV
2	7	44	M	20	M	II
3	0	0	L	113	L	IV
4	8	52	M	36	VL	II
5	0	0	L	39	VL	IV
6	17	103	H	15	H	I
7	<1	2	L	15	H	III
8	5	33	L	29	VL	IV
9	4	27	L	14	H	III
10	38	233	H	13	H	I
11	0	0	L	14	H	III
12	3	18	L	19	M	II
13	2	10	L	34	VL	IV
14	<1	1	L	48	VL	IV
15	<1	1	L	18	M	III
16	<1	2	L	9	VH	III
17	1	5	L	29	VL	IV
18	0	0	L	11	H	III
19	3	20	L	16	M	II
20	0	0	L	17	M	III
21	0	0	L	15	M	IV
22	10	63	M	17	M	II
23	0	0	L	69	VL	IV
Total	**100**	**618**				

Table 5: Reservoir Surface Area by Class

Classification	# of Compartments	Total Surface Acres	% of Surface Area
Class I	2	2,343	22%
Class II	5	3,552	34%
Class III	7	970	9%
Class IV	9	3,695	35%
Total	**23**	**10,560**	**100%**

Use of Compartments in Managing a Reservoir

In many instances, management strategies are applicable to all compartments within a classification. For example, strategies may be adopted to discourage additional boat traffic and reduce conflicts in compartments with both high use and frequent occurrence of conflicts (placed in Class I). Class II compartments, comprising 34 percent of Tims Ford Lake, often represent the "negotiated ground" for additional development. To maximize diverse boating opportunities, managers may also discourage additional boat traffic and development in Class IV compartments where use conflicts are low. Similar considerations could be afforded Class III compartments where use is high but conflicts are low. It seems logical to discuss strategies for those areas, and potential management actions to meet those goals, within this classification framework. In some instances, management strategies will differ within a classification, especially where both use and conflicts are moderate or low (this includes Class IV and some Class II compartments). There is more latitude in deciding what goals are most appropriate for compartments with moderate to low use and conflicts.

3: Boater Survey Results

Introduction

This section of the report presents the results of the exit interviews conducted with boaters using public launch ramps and the mail-back survey of marina boaters and lakefront property owners. The two questionnaires are presented in Appendices 5 and 6.

Although a nearly inexhaustible series of analyses can be done on the descriptive and qualitative perception data from the surveys, we have chosen to present data in this report in the form of averages and grouped responses. We believe this allows the most immediate and accessible presentation of the data and is sufficient to expand understanding of current conditions. This presentation of the data can best support discussions among Tims Ford Reservoir managers and the public about management directions and options. The survey data, available in the form of SPSS database files, can be used for any further analysis and reporting which may be desired. The data collected by this type of survey are valuable because they provide a baseline of information on which to draw conclusions about current conditions and to use as a basis for comparison in the future.

The boater survey results are presented in three parts. First are the descriptive data that explain who the boaters are in each survey group and that allow comparison among groups. The second part investigates boaters' perceptions about the quality of the recreational experience, primarily safety and crowding issues. Third, the open-ended questions are presented. These reveal boaters' perceptions and preferences regarding natural resource, social, and managerial conditions, including their perceptions of conflicts that may be occurring.

Description of Boater Groups

Most of the descriptive questions were asked uniformly of all three user groups because the ability to compare among groups is useful when seeking to answer such questions as:

- Are there differences among boater groups that might affect how the boaters perceive conditions on the reservoir?
- Are there differences among those groups that could influence which boater groups are most affected by certain changes?

The boater survey describes boaters through seven types of information:

1. Length of experience on the reservoir
2. Frequency of visits to the reservoir

3. Length of visits to the reservoir
4. Distance traveled to the reservoir
5. Size of group visiting the reservoir
6. Type, size, and horsepower of boat used
7. Activities participated in on the reservoir and the proportion of boaters time per outing devoted to each activity

The reason for collecting each type of information and its potential usefulness to managers is described in Chapter 2. The intent is for managers to be able to paint a picture in their minds of the boater population on Tims Ford Reservoir as they review these data in order to help in the development of a more complete understanding of the makeup and primary activities of the various boater groups for whom they are managing the reservoir.

The descriptive data are used to connect boaters' statements about conditions to specific types or groups of boaters. Knowing such things as the extent of boaters experience at Tims Ford Reservoir, how much they use the reservoir, the types of watercraft they use, and the water-based activities they participate in helps explain boaters' preferences. These types of information are necessary to reach an understanding of what boaters are looking for at Tims Ford Reservoir and how those recreation opportunities may be protected and experiences improved.

Length of Experience on Tims Ford Reservoir

In the visitor perception portion of the survey, respondents were asked about present conditions and changes that have occurred at Tims Ford Reservoir. The amount of knowledge boaters have about these topics (presented later in this report) depends in part on their length of boating experience on the reservoir. Boaters length of experience also determines the time frame in which they have had the opportunity to observe changes. Previous studies at other reservoirs (Titre, et al, 1995) have shown that long-time visitors often develop a sense of ownership of a reservoir, and they tend to have a greater sensitivity to and concern about changes in the conditions they have become accustomed to than visitors with less experience at that reservoir.

According to our survey, a large majority of Tims Ford Reservoir boaters have more than one year of experience with the reservoir. According to the survey, ramp users are more likely to be new users as compared to the other two user groups. On the average, ramp users have 2.7 years of experience boating on Tims Ford Reservoir, while marina slip users and shoreline property owners have considerably greater experience (10.2 and 14.3 years, respectively) (Table 6).

The study showed that among the three boater groups, the ramp users tended to be less affected by changes occurring at Tims Ford Reservoir because they have limited basis for comparison, that is, they are less attached to past conditions. Conversely, the longer-term lake users among the marina renters

and lakefront property owners may be more acutely aware of changes and therefore expected to express the greatest attachment to or desire for a return to past conditions (e.g., less boat traffic).

Table 6: Descriptive Statistics for Boater Populations

	Ramp Users n=428	Marina Slip Users n=196	Shoreline Property Owners n=235
	Average number of years, days, and hours (Greatest values are shown in bold type)		
Number of years of boating experience on Tims Ford	2.7 years	10.2 years	**14.3 years**
Frequency of visits to Tims Ford last year	37 days	41 days	**43 days**
Amount of time spent on water during last visit to Tims Ford	5.0 hours	**5.5 hours**	4.5 hours

Frequency of Use of Tims Ford Reservoir

Boaters who are frequent users of Tims Ford Reservoir have more knowledge of current conditions than boaters who visit less frequently. Frequent visits also result in more opportunities to notice and a greater probability of being affected by changes that are detrimental to the experiences those boaters are seeking over other reservoirs. Given that the average visit frequency for each user group exceeds 30 days, it appears that the reservoir is a primary destination for boaters that use Tims Ford Reservoir (Table 6). This concentration of boating activity at Tims Ford Reservoir means that undesirable changes there will be of greater concern to these boaters than if their activity were more broadly distributed over several reservoirs.

Question 1 on both the exit interview and mailed surveys (Appendices 5 and 6) asked respondents to report their number of years of boating experience on Tims Ford Reservoir. Only 7 percent of respondents indicated that this was their first year boating on Tims Ford Reservoir. Ramp users comprised the greatest percentage (10 percent) of first-year users. In contrast, marina users only had 3 percent new users.

As Table 7 shows, there is a difference in use patterns on the weekdays versus the weekends between the three user groups studied. While weekday use was evenly reported, lakefront property owners reported slightly more weekend than

weekday use of the reservoir, as compared to the other two user groups. It is interesting to note that the most frequent users on weekends were the shoreline property owners, who might have been expected to use the reservoir the most on uncrowded weekdays.

Table 7: Comparison of Weekday and Weekend Use for Three Boating Groups

	Ramp Users n=428	Marina Slip Users n=196	Shoreline Property Owners n=235
	Average number of user days in year 2000		
Weekdays	19	19	19
Weekend days	18	22	24
Total days[1]	37	41	43

[1]The term "day," as used within the questions concerning visits to Tims Ford Reservoir in 2000, does not imply 24 hours of use but rather indicates any period of use on any individual day. The term "visits" was not used because boaters may visit the reservoir more than once or may make several boat excursions on the same day, or may engage in multiple-day visits.

Length of Time on the Water per Visit

The length of boaters' outings at Tims Ford Reservoir was fairly consistent among the three user groups (Table 6). The overall average amount of time boaters spent on the reservoir during their last visit was five hours. Almost 39 percent of lakefront property owners averaged stays on the water between one to three hours. In comparison, approximately half of all ramp users (51 percent) spent between six to nine hours on the water during their last visit. Forty-five percent of the marina slip renters fall into this category.

Previous studies (Titre 1995; Titre, et al, 1996 - Beaver Lake) have shown that the length of visits are related to the frequency of visits and the distance boaters live from the reservoir. These studies also indicate that boaters who travel greater distances to a reservoir typically visit less often, but those less frequent visits are longer in duration.

State of Residence and Distance Traveled to Tims Ford Reservoir

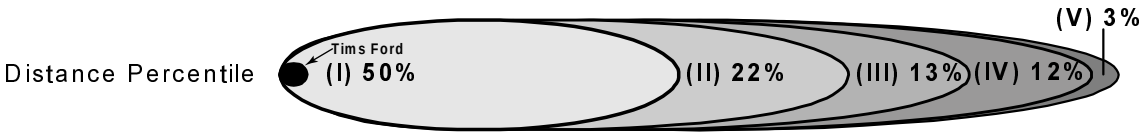
Generally, the distance boaters live from a reservoir affects how much they use the reservoir. It is also a factor in how boaters may be reached for boater education efforts (e.g., local newspapers and radio may not reach distant boaters) and whether they are likely to attend local public meetings to provide their input on reservoir management issues. Boaters were asked the location (city and state) of their residence. Actual distances were calculated from that information.

Nine out every ten (90 percent) respondents were Tennessee residents. Alabama residents accounted for 8.5 percent, and only 1.5 percent were from states other than Tennessee and Alabama. Most respondents were from counties and cities that border the reservoir. This finding shows that visitors to Tims Ford Reservoir are mostly regional.

Nearly 50 percent of all users reported living 25 miles or less from the reservoir (Figure 5). These respondents can be considered "local residents." Those who indicated traveling between 26 and 100 miles (49 percent) are "regional users." Only 3 percent reported traveling 101 miles or more.

Almost three quarters of recreational boaters (72 percent) that use Tims Ford travel no more than 50 miles from their home (Figure 5). However, one-quarter (25 percent) of those boaters surveyed drive up to two hours or 100 miles to enjoy a recreational boating experience on Tims Ford.

	MARKET SECTORS				
	Primary Sector (1-50 miles)		Target-Growth Sector (51-100 miles)		Future Sector (>101 miles)
Distance Categories	I	II	III	IV	V
Miles Driven	1-12	26-50	51-75	76-100	>101
Reservoir Users	378	171	102	96	25



Selected Cities representing the spectrum of Boating Markets for Tims Ford by distance category.

I (1-12 miles)
Tullahoma, TN
Winchester, TN
Monteagle, TN
Estill Springs, TN

II (26-50 miles)
McMinnville, TN
Shelbyville, TN
Lynchburg, TN
Fayetteville, TN

III (51-75 miles)
Lewisburg, TN
Madison, AL
Murfreesboro, TN
Huntsville, AL

IV (76-100 miles)
Dalton, GA
Nashville, TN
Columbia, TN
Franklin, TN

V (101 or more miles)
Columbus, MS
Cincinnati, OH
Louisville, KY
Knoxville, TN
Savanna, GA

Figure 5: Boating Markets for Tims Ford Reservoir

Group Size Visiting Tims Ford Reservoir

Ramp users were asked how many people were in their group. Most parties (38 percent) consisted of one to two people (Figure 6.). The second highest range (37 percent) was between three and four per party. Large groups, over five people, made up 21 percent of the sample.

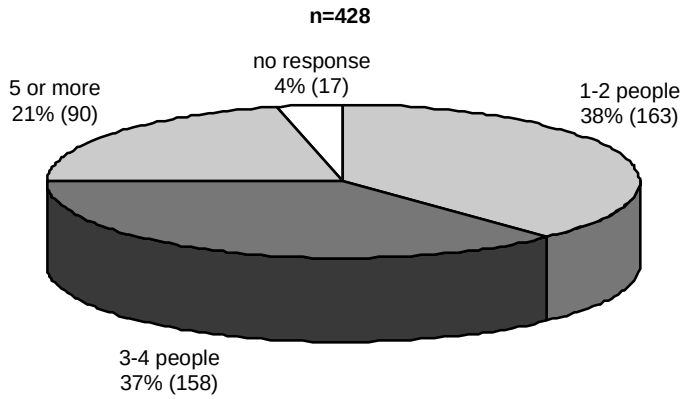


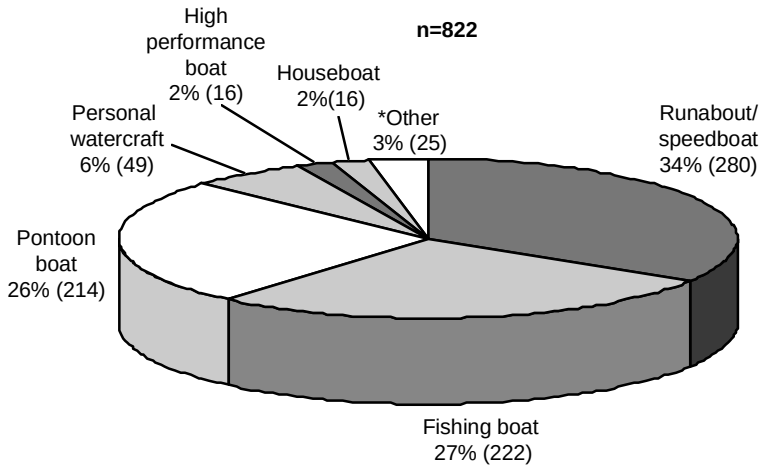
Figure 6: Size of Groups Visiting Tims Ford Reservoir

Type, Size, and Horsepower of Boats Used on Tims Ford Reservoir

Boaters were asked to report the type of boat they were using on the day of the interview. Knowing the types of boats being used provides some indication of the nature of their boating activity. Boaters using runabouts, pontoon boats, and PWC can each be expected to use the reservoir differently. For example, there may be differences in how far and how fast they travel, the areas they prefer to use, and the activities they participate in on the water. Also, some conflicts between boaters appear to be closely related to the types of watercraft being used; for example, recent similar studies revealed frequent conflicts between PWC and other pleasure boats. Tracking changes in the types, sizes, and power of boats being used on a particular reservoir allows managers to anticipate changes in use patterns and potential increases in conflicts among boater types.

Runabouts/speedboats are the predominant boat type used on Tims Ford Reservoir, reported as used by 34 percent of boaters (Figure 7). **Deck boats** are a recent innovation that have grown in popularity on TVA reservoirs and were counted as runabout-type craft. Numerous deck boats have been observed on Tims Ford Reservoir. Deck boats have the V-hull typical of runabouts combined with a broad, open deck as seen on pontoon boats. **Fishing boats** were the next most popular boat (27 percent), followed closely by **pontoon boats** (26 percent).

Personal Watercraft, which are exploding in popularity across the country, are the fourth most numerous type of boat launched at Tims Ford Reservoir. However, complaints about discourteous behavior, jumping wakes, speed and noise associated with PWCs often exceeded 50 percent of those surveyed.



*Fewer than 1% of the boats on Tim Ford are cabin cruisers, rowboats/canoes, and sailboats/sailboards.

Figure 7: Types of Boats Found on Tims Ford Reservoir

Sailboats, cabin cruisers, houseboats, and canoes/rowboats are relatively scarce on Tims Ford Reservoir, each comprising less than 3 percent of the boats used by the survey respondents. Houseboats and cabin cruisers are the largest vessels (Figure 8) found on Tims Ford Reservoir and have the highest average horsepower (Figure 9).

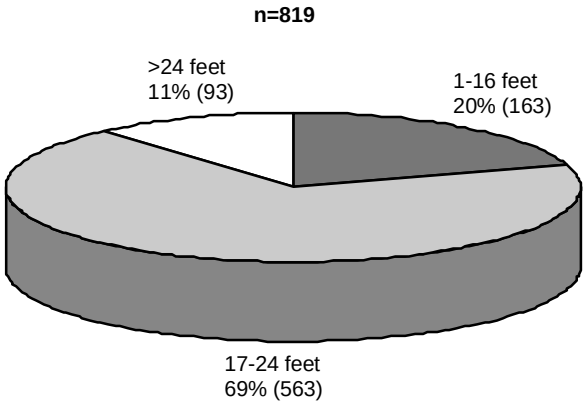


Figure 8: Length of Boats Found on Tims Ford Reservoir

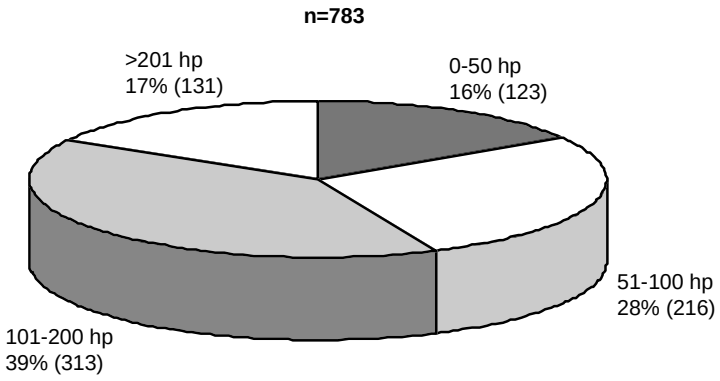


Figure 9: Horsepower of Boats Found on Tims Ford Reservoir

Boater Activities on Tims Ford Reservoir

The types of activities boaters participate in are a good indicator of the conditions they are likely to desire. For example, boaters participating in water-skiing or similar water sports may desire different physical and social conditions than boaters interested in fishing or swimming from and relaxing in an anchored boat. All three boating groups were asked to report the activities, and an estimated proportion of time spent on those activities, during their most recent boat outing on Tims Ford Reservoir.

The three boater groups were similar in the water-based activities they participated in on Tims Ford Reservoir (Figure 10). Cruising (e.g. touring by water) was the activity participated in by the highest percentage of respondents for all boating groups (78 to 56 percent). Fishing was second in popularity, ranging from 42 to 39 percent of all respondents.

Some differences were found between discrete user groups. Most notably, marina slip users were more likely to swim from a boat and relax/sunbathe from a stationary boat than the other two user groups. Also, lakefront property owners were more likely to participate in PWC use as compared to the other two user groups.

By examining the percentage of time boaters spent on specific activities, some interesting observations can be made which provide a more thorough understanding of the relative importance or prominence of various activities. These data reveal that activities with relatively lower participation (e.g., fishing) may be a major part of some participants' visits, and conversely, activities with higher participation (e.g., cruising) may not be equally prominent in terms of time spent. The data on the proportion of their time on the reservoir boaters spent on activities reveal that cruising collectively occupied about one-half (51 percent) of the participants time spent on that activity.

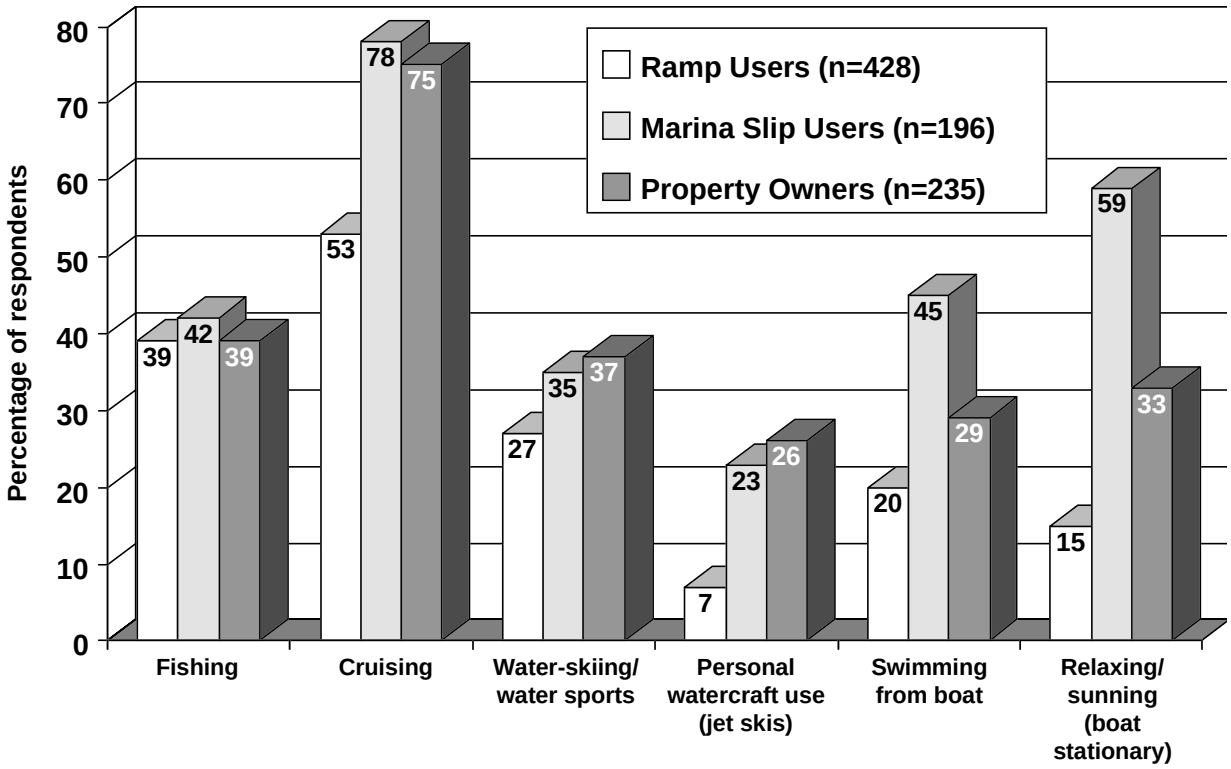


Figure 10: Boaters' Activities on Tims Ford Lake

The activity of fishing provides a good example of why participation rates alone are not sufficient to describe the relative importance of activities. Although fishing was the second most popular activity among the three user groups, participants tended to spend a larger percentage of their time on that activity. This is especially true among the ramp users who fished. They averaged just over 80 percent of their time on that activity. Marina slip users and lakefront property owners also spent, on the average, more time fishing per outing, as compared to the amount of time spent cruising. Given this single-activity focus by anglers using ramps, managers might expect this minority group to be more vocal about perceived negative changes or desired improvements to the fishery or fishing opportunities.

Based on the data collected for this study, the typical activity pattern for Tims Ford Reservoir boaters is to spend one-half or more of the boat outing (perhaps two or three hours) on a core activity, typically cruising or in some cases fishing, with the remaining time divided between two or three other activities, especially water-skiing, swimming from the boat, and/or relaxing/sunning in a boat.

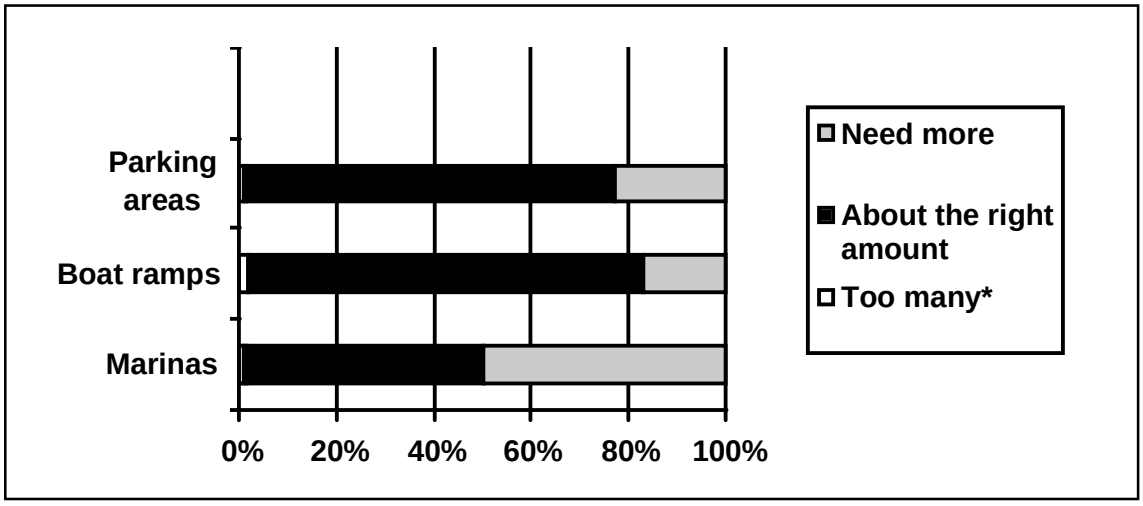
Boater Perceptions and Preferences

The activities of boaters have been observed and described to portray what is happening on Tims Ford Reservoir. However, these activities can only be taken

as broadly descriptive, since boaters often engage in several activities during the same trip, and may switch back and forth between activities. Also, there is much diversity in how each activity may be practiced and the conditions boaters prefer for the activity. For example, some boaters may swim and sunbathe at designated swim areas to be near others and meet new people, while others may want to anchor where they can be alone while participating in the same activity. This diversity in how similar activities may be pursued suggests that we must look beyond simply describing the activities.

Understanding the recreation resource requires an understanding of what draws boaters to the reservoir and what attributes of the setting (conditions) are essential to quality recreation for the diverse range of boaters using the reservoir. The boaters can provide better information on resource and social conditions (and how they are changing) than management personnel can obtain from routine or systematic observation.

In order to discover whether additional facilities would contribute to a quality recreation experience needed on Tims Ford Reservoir, respondents were asked if the number of marinas, parking areas, and boat ramps were too many, too few, or the right amount. Fewer than 2 percent of respondents feel that there are too many marinas, parking areas, and boat ramps (Figure 11). The majority of respondents (78 and 81 percent respectively) indicated that there was about the right amount of parking areas and boat ramps. Half (50 percent) of all respondents indicated that a need for more marinas existed on Tims Ford Reservoir. This finding supports the numerous comments reported in the next section where people stated that there needs to be another full service marina/gas facility on the Winchester end of the reservoir.



*Note: Fewer than 2% of respondents feel that there are too many marinas, parking areas, and boat ramps.

Figure 11: Boater Preferences for Facilities Development

Both marinas located on Tims Ford Reservoir were asked about current occupancy rates. Holiday Landing Resort reported 100 percent occupancy with a waiting list for large covered slips and has plans for expansion. Tims Ford Marina and Resort reported 99 percent occupancy with a waiting list for larger covered slips. The owner would like to add another covered slip dock. For both marinas, open wet slips are generally full in the summer.

Respondents were asked why they favored certain areas of the reservoir (Figure 12) and why they avoided or felt unsafe about other areas (Figure13). The most popular responses to the first question was because the location had good fishing or was convenient (25 percent), followed by solitude (21 percent).

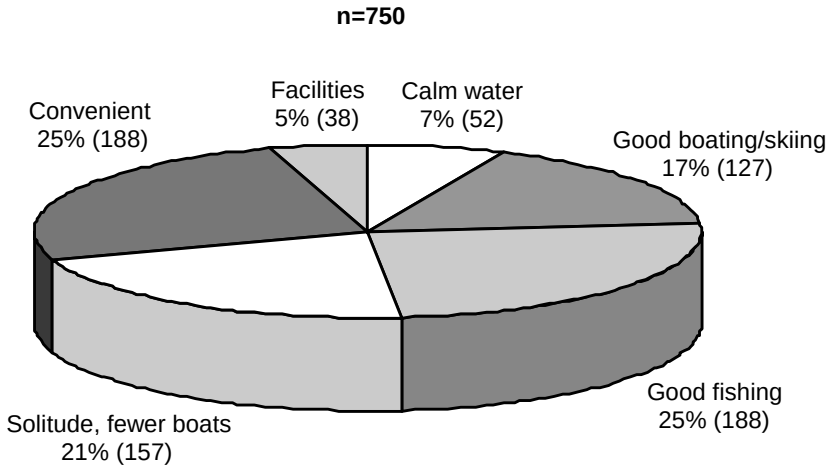


Figure 12: Why do you like certain locations?

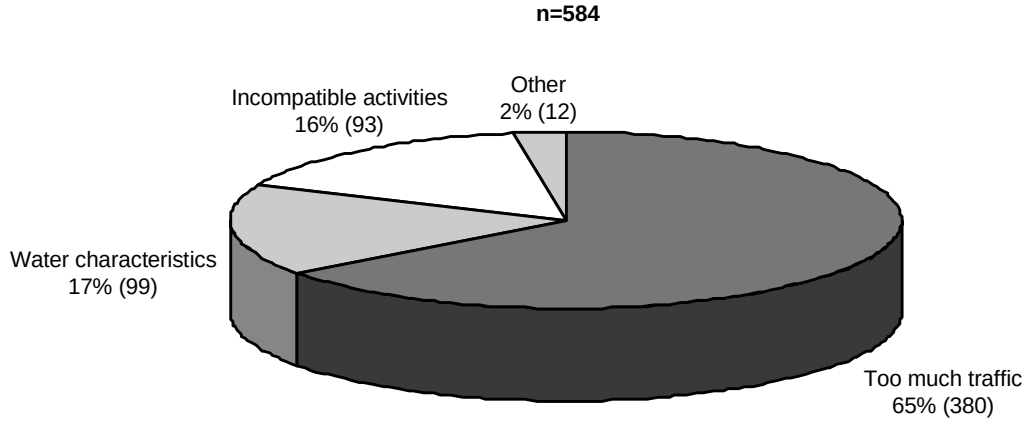


Figure 13: Why do you avoid or feel unsafe at certain locations?

The majority of respondents (65 percent) reported that they avoided or felt unsafe in specific areas because there was too much boating traffic. The second-highest response (17 percent) was related to water characteristics i.e., shallow, or choppy.

Examples of typical responses were:

Solitude
"Quiet, peaceful"
"Not a lot of boats"
"Remote, private"

Calm water
"No-wake zones, calm water"
"Wide, open area of the lake"

Convenient/Familiar
"Closest to home"
"Close to friends and family"
"Close to dock or marina"

Facilities
"Food & gas"
"Parking area is safe"
"Restrooms"

Some typical responses for each of these categories were:

Too much traffic
"Too busy/too crowded"
"Too many jet skis"
"Too much traffic"

Incompatible activities
"Too much partying on the lake"
"Children on jet skis"
"Swimmers at the ramp"
"Break-ins; theft"

Water characteristics
"Shallow spots"
"Water is too choppy"

Other
"Ramp is too steep"
"Area is unfamiliar"
"Too far away"

Figures 14 and 15 illustrate boaters' response to questions about *safety* and *crowding.* The majority (83 percent) of respondents felt "very safe" while boating on Tims Ford Reservoir. Lakefront property owners (5 percent) tended to feel "not safe" more often than marina slip users (3 percent) and ramp users (1 percent). As with safety, most respondents (55 percent) did not feel crowded. Ramp users (63 percent) were more likely to indicate "not crowded" as compared to marina slip users (51 percent) and lakefront property owners (45 percent). Lakefront property owners (19 percent) were more likely than ramp users (11 percent) and marina slip users (13 percent) to feel "very crowded."

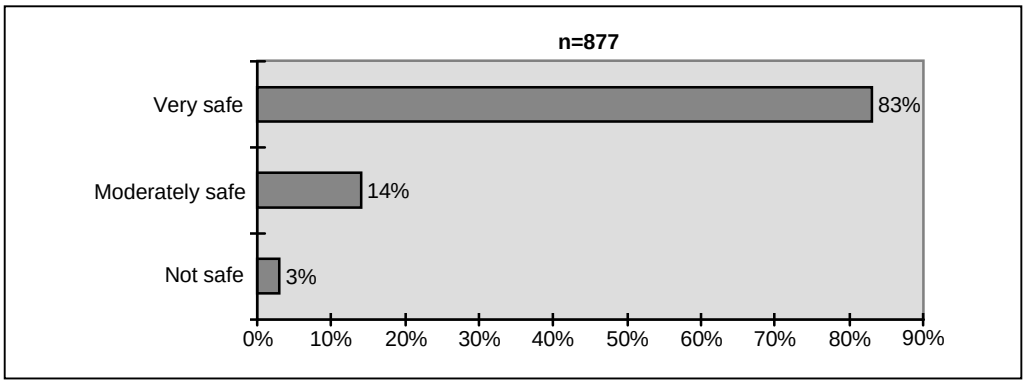


Figure 14: Boaters' Perceptions of Safety on Tims Ford Reservoir

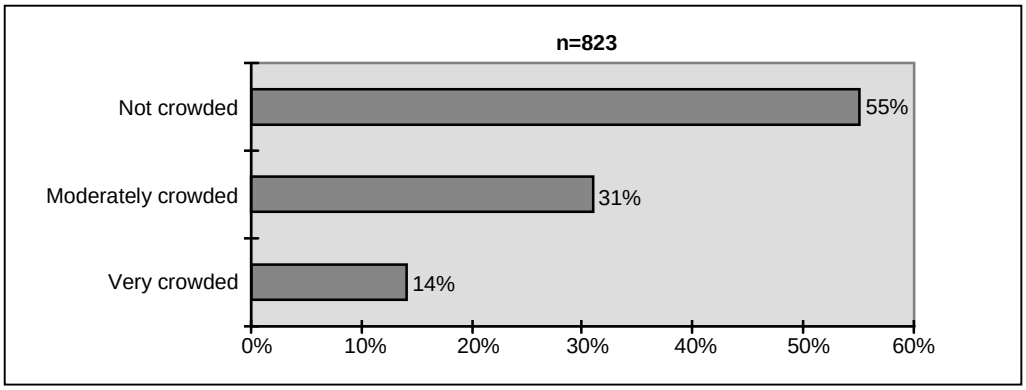


Figure 15: Boaters' Perception of Crowding on Tims Ford Reservoir

Ramp users were asked if seeing and hearing fishing boats, PWC, and pontoons/houseboats detracted from their enjoyment (Table 8). The majority of respondents indicated that seeing and hearing these select boats did not effect their enjoyment. However, *seeing* boats was reported in all cases more often than *hearing*. Also, seeing boats did tend to detract more from their enjoyment than just hearing boats. A test was conducted to determine if there was a statistically significant difference between the effect of seeing PWC as compared to other boat types. As shown in Table 8, seeing PWC detracted more from enjoyment (29 percent) than seeing fishing boats (14 percent). The data show that difference in effect on enjoyment between PWC and other boat types did reach statistical significance (at the 95 percent confidence interval). This points to a potential issue of conflict: PWC use may be in conflict wit other reservoir activities. This conclusion is also supported in the following section "Summary of Open Ended Questions and Additional Comments under "Increase in unsafe watercraft use.".

Table 8: Ramp Users' Perceptions of Density and Conflict						
	Rarely	Occasionally	Very Often	Added to my enjoyment	No effect on my enjoyment	Detracted from my enjoyment
Today, how often did you *see* **ski or fishing boats**?	42 *10%*	65 *16%*	301 *74%*	18 *4%*	332 *82%*	59 *14%*
Today, how often did you *hear* **ski or fishing boats**?	71 *18%*	85 *22%*	228 *59%*	8 *2%*	376 *93%*	20 *5%*
Today, how often did you *see* **personal watercrafts**?	53 *14%*	45 *11%*	311 *76%*	15 *4%*	273 *67%*	120 ***** *29%*
Today, how often did you *hear* **personal watercrafts**?	76 *20%*	61 *16%*	248 *64%*	5 *1%*	346 *85%*	55 *14%*
Today, how often did you *see* **pontoons/ houseboats**?	71 *17%*	79 *19%*	259 *63%*	21 *5%*	340 *84%*	46 *11%*
Today, how often did you *hear* **pontoons/ houseboats**?	134 *35%*	85 *22%*	166 *43%*	5 *1%*	380 *94%*	20 *5%*

***** Significant at .05 level, meaning that seeing personal watercrafts detracted from respondents enjoyment significantly more than seeing and/or hearing other boat types.

Summary of Open Ended Questions and Additional Comments

As part of the mail and exit interview questionnaires, respondents were asked what positive and negative changes they have noticed on Tims Ford Reservoir (Question 18 for the mail surveys and 23 for the exit interview). They were also invited to share any additional comments. Analysis was conducted on 313 mailed-in surveys and 204 exit interviews for Questions 18 or 23. The additional comments were included on 293 mailed-in surveys and 148 exit interviews.

All written documentation from respondents was combined and analyzed. The predominant themes and issues are listed below. Frequency counts (the number of times a comment within that theme was detected) and sample comments are also provided.

Facility/infrastructure comments/improvements (175 total respondents)

Marinas/Restaurants (99)

There needs to be another full service marina/gas facility on the Winchester end of the reservoir
There should be more shops/restaurants accessible by water
We enjoy the management and facilities at Tims Ford Marina
Holiday Marina needs to be totally revamped and updated with modern facilities

Parking/Boat Ramps (37)

More parking areas are needed, especially on weekends and holidays
Need more public use boat ramps and parking areas (i.e., paved and accessible during the winter drawdown
Need restroom facilities at Neal's Bridge and other unimproved public boat ramps
Need lights at the ramps

Camping/Cabins (21)

Additional campgrounds/RV locations are needed (with RV sewage hookups)
Boaters should have more amenities (i.e., park-like activities, refreshments, music, overnight accommodations, etc.)
Campground should be expanded
More cabins/motel rooms should be available on the waterfront
Tims Ford State Park campground needs to be updated. Pull through for RVs needed.

Swimming/Picnicking (17)

There is a need for a larger/additional beach/swim area
Would like to have more public access/day use/picnic areas accessible by boat
Need a beach area on the dam side of the lake

Ski Course (1)

There needs to be a ski course in the Estill Springs Park area

Increase in unsafe watercraft use; boating (58) **and jet skiing** (89) **and safety issues (i.e., accidents)** (29) [200 total respondents]

Increase in thoughtless behavior of boaters
Inexperienced boaters
Unsafe boaters are in abundance
Unsafe/inconsiderate jet ski drivers
Jet skiers show little regard to boaters/fishermen
Jet skis follow our boat too closely
More traffic—the lake is more dangerous

We avoid using the lake on weekends because we feel unsafe
Too many boaters not aware of safe boating rules
Boaters are operating at high speeds, traveling too fast
PWCs are a major hazard
There is a misuse of ski boats and high performance boats
Jet skiers do not observe boaters' right-of-ways or no-wake zones
Jet skiers have no respect for others
Jet skis going too fast…too much horseplay and inattention to other watercraft
Reckless operators are not practicing safe boating
They [jet skis] reach speeds of 80 mph which is very unsafe

In association with irresponsible boaters/jet skiers, respondents expressed concern for an increase in young boaters (10), fast boats (8), and boat wakes (6)

Under-aged boaters/jet skiers [41 total respondents]
Children/teenagers are driving jet skis at high speeds
Put an age limit on operating PWCs
Too many young children are allowed to operate them
Children drive them recklessly
Children have no respect for other boaters

An increase in personal watercraft (108) **and** boats (15) **on the Reservoir** [123 total respondents]
Noticed too many PWCs
Noticed more PWCs
Noticed increase in boat traffic; heavy boat traffic

User conflicts [40 total respondents]
Consuming alcohol while boating is creating a hazardous situation
Too many fishing tournaments; participants are disrespectful to other boaters; the activity is harmful to fish
Swimming at public boat ramps is dangerous
PWC users operate at high speeds in close proximity to where people are trying to load/unload boats
Most of the unsafe boats are bass boats with large motors

Possible solutions [187 total respondents]
More water patrol is needed
PWC need to be better controlled/more regulations; set age limits, speed limits; enforce current regulations
PWC should be restricted to certain areas of the lake
License should be requirement to operate watercraft
There should be noise limits for high performance boats
Current boating regulations need to be enforced

Boats/PWC should be required to stay a safe distance from private docks and the shore
Should have an established quota on the number of boats allowed on the water at any given time
Age requirements are needed
Safety courses similar to driver or hunter education
Should be a speed limit on the lake
PWCs and skiers should be restricted to certain times of the day to be on the water
PWC operators should have a license requirement

Reservoir conditions [121 total respondents]

A need for No Wake Zones (44)
Recommend more "no-wake" floaters
Too many boaters do not observe "no-wake" zones
I would like to see more slow or "no-wake" areas
State should put "no wake" zones in crowded residential/dock areas

Increase of trash in the water (42)
More trash on the water
Trash in water left by boaters
More garbage and trash on shoreline

Water quality (28)
Tims Ford is a clean lake
Tims Ford Lake remains clean and clear
This is the cleanest lake we've been on
The water quality is remarkable

Navigation safety issues (7)
Mile markers and shallow water points should be better marked
The submerged tree and island at Fanning Bend need to be better marked for both day and nighttime visibility

Decrease in the quality of fishing [43 total respondents]
Fishing has gone bad; lake fishing has deteriorated
Bass fishing not as good…rock fish created a decrease in other natural fish
Less fish than there used to be; caught less fish
Lack of good crappie fishing

Decrease in development [26 total respondents]
Not any developments since TERDA
Keeping natural shoreline
Limited development
Less new homes/new subdivisions
There is a lot of development occurring without proper sewer systems

Enjoyment/appreciation of Tims Ford Lake [118 total respondents]

I am very pleased with Tims Ford Lake
We're lucky to have Tims Ford Lake
I love Tims Ford Lake
Tims Ford is a beautiful lake
Tims Ford is the best lake in Tennessee…a great place to spend the day
Clean/calm water

Appreciation for TVA's efforts [24 total respondents]

Liked being involved in the survey effort
Appreciated TVA keeping up the good work

4: Boat Count Results

Introduction

This chapter presents the results of the boat and parking lot counts. Both of these findings provide a strong baseline inventory for understanding the current level of use and where use is occurring. Low cost, practical methods were used in boat count estimations. The process used provides an approximate but relatively reliable count—subject to human error—with the understanding that greater precision is attainable but at an exponentially higher cost. We have learned from other reservoir managers that the extra effort required to read traffic meters at launch sites, or to conduct other time-consuming count procedures to achieve greater precision, is not justified by the uses of the data. The counts conducted for this study allowed data to be collected on the number of boats on the reservoir, traffic patterns for specific Service Areas of the reservoir, with additional information obtained on the distribution and types of boats on the water.

Boat Count Methods and Counts Completed

Boat counts were conducted on the Tims Ford Reservoir from boats traveling the length of six count zones or Service Areas designated during the study planning phase (Exhibit F). Rather than attempting to divide the reservoir into equal sections, the boundaries between Service Areas were chosen on the basis of natural breaks in the reservoir (e.g., main arms) and the ability to count boats within two hours or less. During the two-hour counting period, the presence or absence of features such as marinas with no-wake areas and lengthy or winding coves greatly affected how much area it was possible to cover.

A total of 18 observation trips were scheduled, with each trip covering two of the six Service Areas. These were scheduled throughout the study period (early June through late July) on weekdays (six trips) and weekends (12 trips). Based on data from external boating capacity studies, the selected count times were from 2 p.m. to 6 p.m. because these were the most heavily used periods. During each observation period, the type of each boat observed and its location were plotted on reservoir maps using an identifying letter for each of the various boat types.

The method of conducting observations from a boat moving through designated Service Areas was devised in previous studies (Titre, et al., 1995) as an alternative to aerial photography. This systematic means of gathering information on the amount and patterns of boat traffic, which can be performed by project staff, provides information comparable to that obtained with expensive overflights.

The total number and types of boats observed during each trip were tallied from the maps and are reported in Table 9. These count figures may not represent the exact number of boats on a portion of the reservoir at a specific time because each count took several hours to complete. During that time, it is likely some boats entered and left the count area unobserved. Also, in some cases the number of boats on the reservoir may have been greater when the count was completed than when the observation trip began. The count figures do, however, provide a reliable estimation of use levels and can be used to indicate the relative amount of use within various parts of the reservoir and the relative proportions of different types of boats.

Boat Count Results

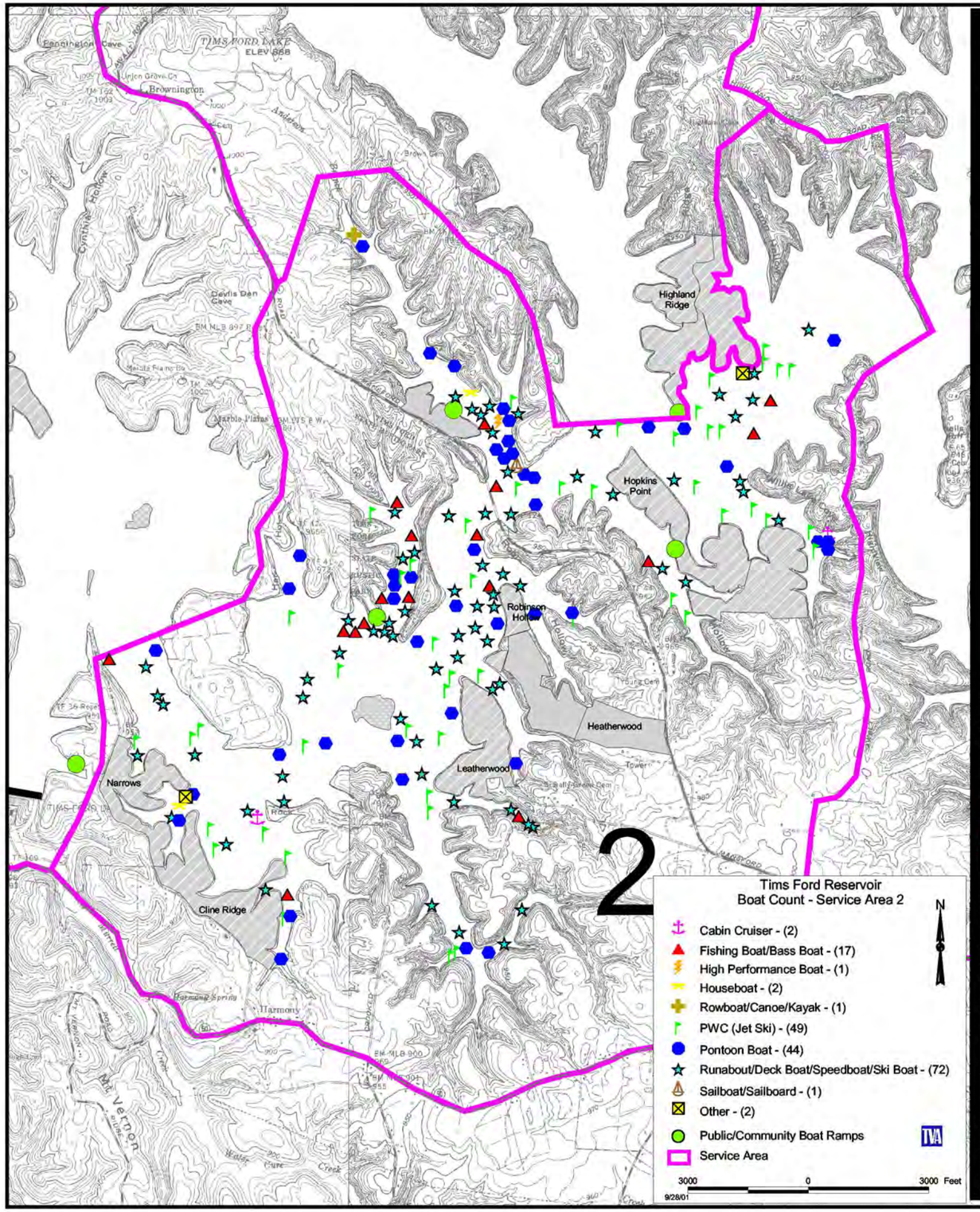
Averaging the **weekend** counts for each Service Areas, we can estimate the approximate potential average use level observed on a typical summer weekend. The average summer weekend peak use is 495 boats (Table 9). This number of boats would be considered a "low" use level because it would result in 22.7 acres per boat reservoir-wide (Table 2).

As expected, **weekday** boat traffic was found to be lighter than weekend traffic at the peak use time of 2:00-6:00 p.m. within all six Service Areas. Overall, weekday use levels in each Service Area were about three-quarters (75 percent) less than the amount of weekend use levels for the same time of day. The number of weekday boats observed would be considered a "very low" use level because that number of boats would result in 82.7 acres per boat reservoir wide. Although all the weekday counts were lower than weekends, the counts were quite consistent between zones for the same time of day.

These observations and data indicate that boater conflicts relating to high use levels are likely to be confined to weekends. Conflicts may occur at any use level, and isolated concentrations of traffic may occur near access points. However, the count data demonstrate that higher boat traffic is most likely a contributing factor to conflicts **only** on weekend and holiday afternoons.

Numbers and Types of Boats Observed

The composition of boat types provides a good indication of how the reservoir is being used and can be an indicator of potential conflicts. Overall ~~-co~~mbining weekend and weekday boat counts ~~-a~~cross the entire reservoir, about two out of every five boats (41 percent) are runabouts. These are the most numerous boats found on the reservoir (Table 9). They are seen as often as pontoon and PWC boats combined. About one out of five (21 percent) boats are pontoons. PWC comprise about the same, with 20 percent being observed on Tims Ford Reservoir during the study period. This number is higher than the 10-15 percent reported in other regions of the United States. Studies conducted during the mid-1990's at U.S. Army Corps of Engineer reservoirs revealed that about 12 percent of the use on weekdays and weekends was attributed to PWC (see Appendix 7).


TIMS FORD LAKE
ELEV 988
Brownington
Devils Den Cave
Highland Ridge
Hopkins Point
Robinson Hollow
Heatherwood
Leatherwood
Narrows
Cline Ridge
Marble Plains
Harmony
Mt Vernon
Tims Ford Reservoir
Boat Count - Service Area 2
Cabin Cruiser - (2)
Fishing Boat/Bass Boat - (17)
High Performance Boat - (1)
Houseboat - (2)
Rowboat/Canoe/Kayak - (1)
PWC (Jet Ski) - (49)
Pontoon Boat - (44)
Runabout/Deck Boat/Speedboat/Ski Boat - (72)
Sailboat/Sailboard - (1)
Other - (2)
Public/Community Boat Ramps
Service Area
3000 0 3000 Feet
9/28/01
2

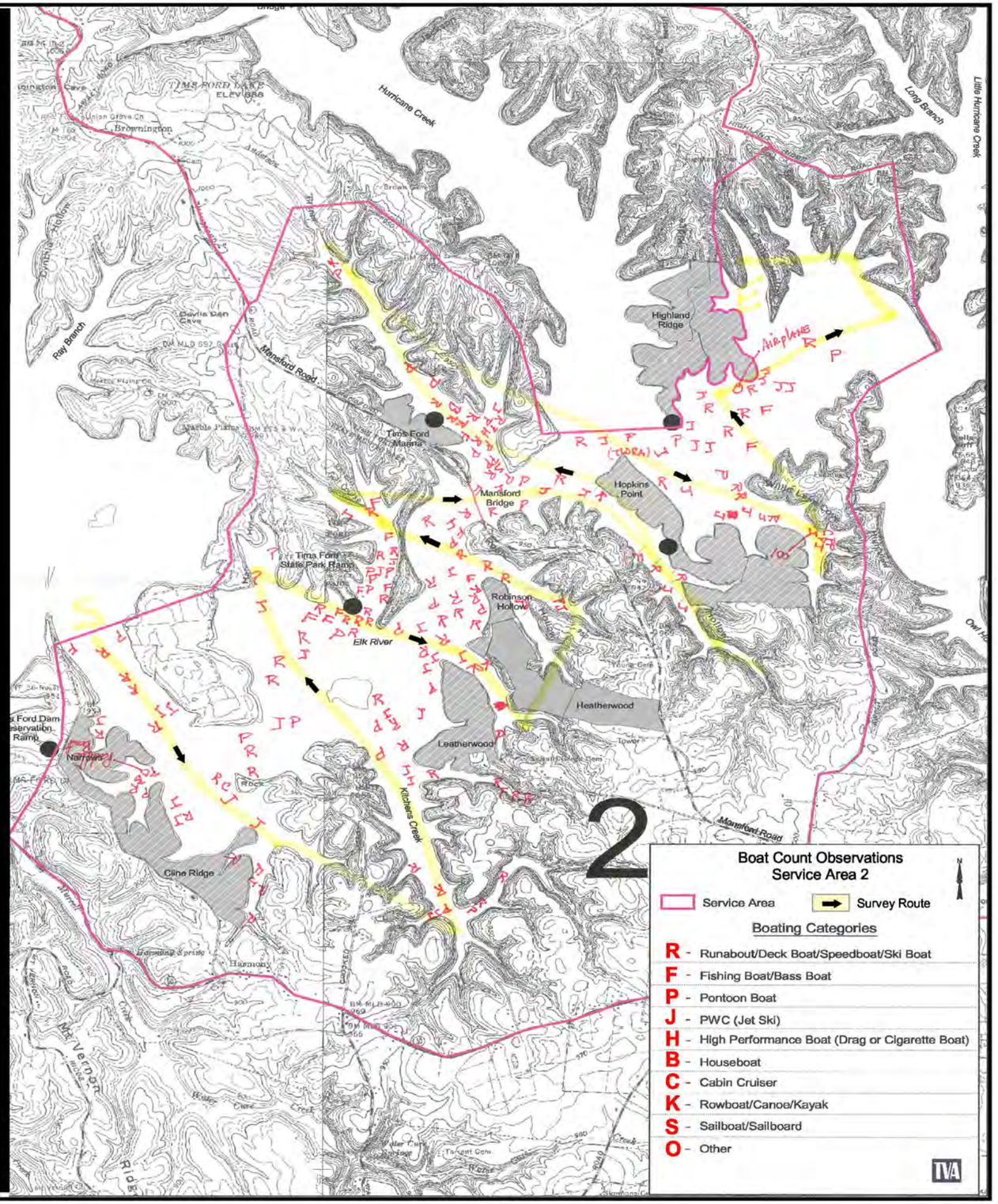

TIMS FORD LAKE
ELEV 988
Hurricane Creek
Long Branch
Little Hurricane Creek
Ray Branch
Mansford Road
Tims Ford Marina
Highland Ridge
Hopkins Point
Mansford Bridge
Tims Ford State Park Ramp
Robinson Hollow
Elk River
Heatherwood
Leatherwood
Ford Dam Observation Ramp
Narrows
Kitchens Creek
Cline Ridge
Harmony
Mt Vernon
Boat Count Observations
Service Area 2
Service Area
Survey Route
Boating Categories
R - Runabout/Deck Boat/Speedboat/Ski Boat
F - Fishing Boat/Bass Boat
P - Pontoon Boat
J - PWC (Jet Ski)
H - High Performance Boat (Drag or Cigarette Boat)
B - Houseboat
C - Cabin Cruiser
K - Rowboat/Canoe/Kayak
S - Sailboat/Sailboard
O - Other
2

Exhibit F

Table 9: Tims Ford Boat Count Results						
Boat Type	Weekend		Weekday		Combined	
	# of Boats	Average %	# of Boats	Average %	Total Boats	Average %
(The greatest values are shown in bold type)						
Fishing/Bass Boat	59	12	21	16	80	13
Personal Watercraft (Jet Ski™)	92	19	32	25	124	20
Pontoon	103	21	27	21	130	21
Runabout/ Speed Boat/Ski Boat/ Deck Boat	**215**	**43**	**43**	**34**	**258**	**41**
Cabin Cruiser	9	2	1	<1	10	2
High Performance	4	<1	1	<1	5	1
Sailboat	2	<1	1	<1	3	<1
Canoe/Kayak	6	1	2	1	8	1
Other	5	<1	0	<1	5	1
TOTAL	495	100	128	100	623	100

Parking Lot Counts

While the ramp interviewers were administering the ramp user survey, they also counted the number of vehicles in the parking lot at the beginning and end of each shift. The information, which was tabulated and averaged as to weekend and weekday use provides baseline information about current use levels at each of the 10 PUAs that has a boat ramp and at the three community ramps. These data can be used to assess the current infrastructure use and better determine if improvements and/or expansions are warranted. Appendix 8 is a sample Daily Record form used by boat ramp exit interviewers.

Similar to the boat count data, **weekend use at these PUAs was two to three times greater as compared to weekday use** (Table 10). For weekend use, Tims Ford Marina and Resort parking lot averaged the highest number of vehicles recorded (145). The next highest used parking lot during the weekend was at Winchester City Park (125), followed by Tims Ford State Park (50 vehicles). The parking lot at Tims Ford State Park boat ramp was the most heavily used (20 vehicles) during the weekday. Pleasant Grove PUA was second highest (13 vehicles), followed by Devils Step PUA (12 vehicles) and Winchester City Park (12 vehicles).

Table 10: Tims Ford Boater Survey Parking Lot Counts

Location	Weekends				Weekdays			
	Average # of Vehicles with Trailers	Average # of Vehicles with PWC Trailer	Average # Vehicles Without Trailers	Total # of Vehicles	Average # of Vehicles with Trailers	Average # of Vehicles with PWC Trailer	Average # Vehicles Without Trailers	Total # of Vehicles
(The greatest values are shown in bold type)								
Dam Reservation	16	3	8	27	2	0	1	3
Lost Creek PUA	22	3	10	35	3	0	4	7
Turkey Creek PUA	9	6	18	33	1	1	5	7
Pleasant Grove PUA	5	0	12	17	4	1	8	13
Devils Step PUA	22	2	8	32	6	0	6	12
Rock Creek PUA	13	1	4	18	8	0	2	10
Winchester CP*	39	5	81	125	6	1	5	12
Tims Ford SP	25	3	22	50	**15**	**1**	**4**	**20**
Hopkins Point CR	1	0	0	1	n/c	n/c	n/c	n/c
Highland Ridge CR	3	1	0	4	n/c	n/c	n/c	n/c
Dripping Springs Community Ramp	5	2	4	11	n/c	n/c	n/c	n/c
Holiday Landing Marina	**15**	**2**	**14**	**31**	n/c	n/c	n/c	n/c
Tims Ford Marina & Resort	**27**	**8**	**110**	**145**	n/c	n/c	n/c	n/c

PUA: Public Use Area
CP: City Park
SP: State Park
n/d: data not collected on weekdays

*During one weekend special event held at Winchester City Park, there were 29 vehicles with trailers, 2 vehicles with PWC trailers, and 653 vehicles without trailers. Because it was not considered a typical situation, these numbers were not factored into the above table.

To better understand vehicle parking lot counts, an estimate was made of how many vehicles with trailers each parking lot could support (Table 11). This estimate allows for traffic circulation and a vehicle and trailer turning radius adequate for loading and unloading a boat. It should be noted that not all vehicles accounted for in Table 10 had trailers, thus more vehicles could fit into a parking area than the estimated allocation of spaces.

On a typical summer weekend, the public ramps (excluding the three community ramps) were at 62 percent capacity. This percentage adjusts for those parking lots that exceeded their estimated capacity. The reason that three of the PUA parking lots exceeded their estimated capacity is because most vehicles counted did not have trailers, and parking was occurring around the perimeter beyond the

standard designated parking spaces. Four PUA parking lots were over 75 percent filled (Tims Ford Marina and Resort, Tims Ford State Park, Winchester City Park, and Turkey Creek). Two PUA parking lots were over 50 percent filled (the TVA Dam Reservation and Pleasant Grove).

Table 11: Distribution of Vehicles With Trailers at Boat Ramp Parking Lots

Location	Estimated Number of Parking Spaces That Accommodate Vehicles with Trailers*	Average Number of Vehicles Counted (Weekends)	Percent that Parking Lot is Filled
	(The greatest values are shown in bold type)		
Dam Reservation	42	27	64%
Lost Creek PUA	20	35	**100%**
Turkey Creek	41	33	80%
Pleasant Grove PUA	30	17	57%
Devils Step PUA	80	32	40%
Rock Creek PUA	65	18	28%
Winchester CP	66	125	**100%**
Tims Ford SP	51	50	98%
Hopkins Point CR	12	1	8%
Highland Ridge CR	18	4	22%
Dripping Springs CR	25	11	44%
Holiday Landing Marina	**100**	31	31%
Tims Ford Marina & Resort	40	**145**	**100%**
Totals	590	529	

PUA: Public Use Area
CP: City Park
SP: State Park
*Most parking lots were not striped, so estimates are based on standard parking lot design criteria. Many lots exceeded these estimates during high use hours, with vehicles parking on the pavement more closely than marked spaces would have allowed and overflowing onto the grass.

5: Management Compartments

The existing physical conditions of each compartment are described in the following sections. Information is provided on surface area, shape of the compartment, shoreline conditions, and unique attributes. Key information from boat count and survey data includes observed boating activity, recreation use, and boater preference data.

Each section concludes with a compartment discussion. This discussion explains why the compartment was assigned a particular class designation (Class I-IV), characterizes the type of reservoir area included in the compartment; describes present managerial conditions; and finally suggests management strategies for the future.

Management Compartment No.: 1 **Name:** Estill Springs

1. **Surface Area -** 248.3 acres

2. **Shape -** Open and round - channel approximately one mile long

3. **Shoreline Conditions -** No shoreline development

4. **Observed Boating Activity/Recreational Use -** Little boating activity

5. **Unique Attributes -** Water depth shallow (8-18 ft.), mud flats, marsh to wet shoreline conditions, vegetated shoreline, abandon surface mine pits adjacent to channel

6. **Service Area ID -** 5

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp Users	3	0	0
Marina Users	0	0	
Shoreline Property Owners	1	4	

8. **Compartment Discussion -** This area is placed in a Class IV Management Compartment, because of extremely low boat density, even at peak use times, and low incidence of conflict. General assessment of the area related to managerial conditions is as follows: Some of these areas may receive little

water patrol attention related to conflict. However, like other categories, especially Class IIs or IIIs, enforcement of fishing regulations by the appropriate agency will likely occur within these areas. Anglers utilize these areas because of vegetated shoreline, solitude, tranquility, and quietness. Other related recreational activity taking place within a Class IV area provide opportunities for primitive camping, bird watching, or nature and wildlife observation. These areas should be managed for compatible recreation opportunities. This compartment would not be considered as a priority for water based recreation development. As noted in the Land Plan, the TVA public land is allocated for sensitive resource management.

Management Compartment No.: 2 **Name:** Elk River

1. **Surface Area -** 1,235.3 acres

2. **Shape -** General narrow river corridor, meandering channel approximately 600 to 800 feet-wide and 10.3 miles long

3. **Shoreline Conditions -** Heavily developed shoreline from neighboring residential subdivisions, heavy concentrations of private water-use facilities, city park development at north end, and good highway access to both sides of corridor.

4. **Observed Boating Activity/Recreational Use -** Heavy jet ski population, as well as high levels of fishing boat, runabout/ski boat and moderate pontoon boat use. Most fishing boats stay within the coves and secondary tributaries during peek weekend periods.

5. **Unique Attributes -** Two moderately large tributaries to the north:
   - Rock Creek
   - Taylor Creek

6. **Service Area ID -** 5

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	46	11	64
Marina User	13	9	
Shoreline Property Owner	74	24	

8. **Compartment Discussion -** This area is placed in a Class II Management Compartment because of moderate boat density, at peak use times, and moderate incidence of conflict. General assessment of the area related to managerial conditions is as follows: Conflicts between boaters will likely be less common than in Class I because of decreased levels of traffic and more regular travel patterns. These areas will likely exhibit less diversity of boat types. Generally the boat density is between 15 and 20 surface acres per boat. This compartment has a strong potential for becoming a Class I area because of heavily developed residential shoreline which could sustain increases for future growth as allocated in the Land Plan. Current conditions for recreational use would not likely support proposals for commercial water base development within this area.

Management Compartment No.: 3 **Name:** Winchester Tailwaters

1. **Surface Area -** 112.9 acres

2. **Shape -** Central area moderate-size pond with both ends rather narrow and restricted via a serpentine channel.

3. **Shoreline Conditions -** One large subdivision to the southeast, and the balance of shoreline is a narrow strip of vegetation.

4. **Observed Boating Activity/Recreational Use -** Very little boating traffic observed and only at the highway where water depth is about 15 to 18 feet.

5. **Unique Attributes -** Water depth is about 8 to 12 feet deep. At Highway 64 and rail crossing at northern end of Boiling Fork Creek, shoreline is not steep along bank.

6. **Service Area ID -** 6

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	1	0	1
Marina User	0	0	
Shoreline Property Owner	0	0	

8. **Compartment Discussion -** This area is placed in a Class IV Management Compartment because of low boat density, even at peak times and low incidence of conflict. General assessment of the area related to managerial conditions is as follows: Some of these areas may receive little water patrol attention related to conflict. However, like other categories, especially Class IIs or IIIs, enforcement of fishing regulations by the appropriate agency will likely be the focus within these areas. Anglers utilize these areas because of vegetated shoreline, solitude, tranquility, and quietness. Other related recreational activities taking place within a Class IV area provide opportunities for primitive camping, bird watching, or nature and wildlife observation. These areas should be managed for compatible recreation opportunities. This area is a remote region of the reservoir characterized by shallow water and limited public access, supporting some residential development. Study data would conclude keeping this compartment at a Class IV level of recreational use. This is further supported by the Land Plan which allocates most of the shoreline for natural resource management.

Management Compartment No.: 4 **Name:** Boiling Fork

1. **Surface Area -** 463.2 acres

2. **Shape -** West end of main channel, round in shape, and branches into two major tributaries:
   - Boiling Fork Creek
   - Wagner Creek

3. **Shoreline Conditions -** To the east, adjacent to Boiling Fork and Wagner Creek, the city limits of Winchester and Decherd, Tennessee. To the north, a well developed city park with boat access ramp. To the south, sparse development with agricultural shoreline conditions.

4. **Observed Boating Activity/Recreational Use -** Moderate levels of boat traffic composed of fishing and pontoon boats and light to moderate use by runabouts and jet skis.

5. **Unique Attributes -** Good water depth near shore along the south and north sides up to 48 feet at center of compartment. A major highway bridge crossing (Highway 130) bisects the compartment.

6. **Service Area ID -** 6

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	17	26	14
Marina User	4	9	
Shoreline Property Owner	17	17	

8. **Compartment Discussion -** This area is placed in a Class II Management Compartment because of very low boat density, at peak use times, and moderate incidence of conflict. General assessment of the area related to managerial conditions is as follows: Conflicts between boaters will likely be less common than in Class I because of decreased levels of traffic and more regular travel patterns. These areas will likely exhibit less diversity of boat types. Generally the boat density is greater than 25 surface acres per boat. This compartment receives a reasonable level of use from local Winchester and Tullahoma residents, but can sustain additional water base recreational development. Many survey respondents desired a full service marina to be located at the eastern end of the reservoir. Data from the study would support such commercial proposals within this compartment. This conclusion is also supported in the Land Plan.

Management Compartment No.: 5 **Name:** Dry Creek Tailwater

1. **Surface Area -** 77.8 acres

2. **Shape -** Triangular in shape with northern end being the widest reach of the cove 800 to 1000 feet-wide with tapering shoreline to the south.

3. **Shoreline Conditions -** Mostly wooded vegetation along shoreline. The west bank having moderately steep slope and the east bank having minimum slope to rolling topography. Some potential for residential shoreline development to the west and commercial development opportunity along the east bank. No shoreline improvements presently observed.

4. **Observed Boating Activity/Recreational Use -** Most boating activity observed was passive use by pontoon boats or light jet ski activity mostly pulling tubes or learning how to operate craft within the calm water of the cove.

5. **Unique Attributes -** Shallow water depths between 8 to 18 feet back to front, respectively. Some mud flats present to the east and rear (south end) of the compartment.

6. **Service Area ID -** 6

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend
Ramp User	2	0	2
Marina User	0	0	
Shoreline Property Owner	0	0	

8. **Compartment Discussion -** This is placed in a Class IV Management Compartment because of a very low boat density, even at peak times, and no incidence of conflict. General assessment of the area related to managerial conditions is as follows: This area may receive little water patrol attention related to conflict. However, like other categories, especially Class IIs or IIIs, enforcement of fishing regulations by the appropriate agency will likely be the focus. Anglers utilize these areas because of vegetated shoreline, solitude, tranquility, and quietness. Other related recreational activities taking place within a Class IV area provide opportunities for primitive camping, bird watching, or nature and wildlife observation. This area should be managed for compatible recreation opportunities. Study data support maintaining recreational boating activity at the current low level. At some point in time, recreational boating may need to be discouraged within this compartment depending on the type of future industrial/commercial access needed as proposed within this compartment via the Land Plan.

Management Compartment No.: 6 **Name:** Devils Step

1. **Surface Area -** 401.8 acres

2. **Shape -** A mixture of wide open water at confluence of the Elk River with Matthew Branch and Dry Creek tributaries providing less open water areas.

3. **Shoreline Conditions -** The southern shoreline is predominately developed, comprised of a heavily used public boat ramp and a state operated public campground. Also, a large 110+ home subdivision (Dripping Springs) which exhibits high density private shoreline facilities including a community boat ramp and parking lot. A second public boat ramp is located at mouth of Dry

Creek. The northern shoreline is a vegetated natural resource area with subdivision (Lee Ford), also providing high levels of community and private water-use facilities.

4. **Observed Boating Activity/Recreational Use -** Because of the level of shoreline development and multiple options for public and private boat access, this compartment has a very high concentration of all types of watercraft. There is a high concentration of ski boats, runabouts, and jet skis near the campground area and an even greater concentration of jet ski activity in Dry Creek cove. This is due to a number of reasons: 1) less wind in cove; 2) easy access via nearby public ramps; 3) swimming beach at Dry Creek provides an audience for "hot doggers"; 4) adjacent residential neighborhood increases numbers of jet ski users within the compartment; 5) the long, narrow configuration of Dry Creek provides a sense of a racing corridor (slalom course experience).

5. **Unique Attributes -** The waterfront campground increases boating traffic, and the character of the reservoir configuration provides for a diverse experience, because the water surface ranges from large open areas to nearby protected coves. Water depth ranges from 28 to 68 feet.

6. **Service Area ID -** Some in 4; most in 6

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	19	35	27
Marina User	4	19	
Shoreline Property Owner	8	49	

8. **Compartment Discussion -** This area is placed in a Class I Management Compartment because of high boat density, at peak use times, and high incidence of conflict. General assessment of the area related to managerial conditions is as follows: Oftentimes these areas of the reservoir account for many boating accidents. Typically these areas require a greater presence of law enforcement officials. Due to high concentration of boaters, these reaches of the reservoir could require greater levels of restrictions or regulations such as no-wake area or speed zones. This compartment receives a very high level of use from an inflow of boaters and PWC via the highly developed regions of the Elk River (north) and community recreational users from Winchester and outlying subdivisions from the east (Boiling Fork Creek) and south (Dry Creek) regions. Additional boating congestion is related to a popular state operated campground and adjoining public use boat ramp (Devils Step). There are plans to improve and expand this

campground as noted in the Land Plan. Because many campers are also boaters, a new management strategy should be planned and implemented to avoid adding a large increase of boating activity to this compartment which is already a Class I area.

Management Compartment No.: 7 **Name:** Owl Hollow

1. **Surface Area -** 168.8 acres

2. **Shape -** A very long (9000 feet) but narrow (400 to 600 feet wide) cove with numerous side or tributary coves along both shorelines.

3. **Shoreline Conditions -** Both east and west shorelines are very steep, having no current or planned private water-use facilities. Entire shoreline is wooded.

4. **Observed Boating Activity/Recreational Use -** The main corridor is highly favored by runabouts, ski boats, and deck boats, while many of the side coves are used by pontoon boats. Almost no observations of jet skis located in this compartment.

5. **Unique Attributes -** The steep shoreline provides protection from the wind and the water depth from the mouth and the back of the hollow is 88 to 28 feet, respectively. The water clarity is almost always excellent. A lot of shade near the water's edge.

6. **Service Area ID -** 4

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	15	0	12
Marina User	14	1	
Shoreline Property Owner	15	1	

8. **Compartment Discussion -** This area is placed in a Class III Management Compartment because of a high boat density, even at peak times, and a low incidence of conflict. General assessment of the area related to managerial conditions is as follows: These areas termed as "escape coves" offer opportunities to avoid heavy choppy water, wakes, and noise from cruising boats and PWC activities. Boaters use these areas to relax or engage in stationary water-related activities such as swimming, snorkeling, sunbathing,

and fishing. Management of shoreline resources should emphasize natural vegetative conditions and protect other aesthetic features, such as bluffs, rock outcrops, or natural beach areas. Typically, presence of regulatory authority is light unless isolated incidence related to drinking and noise are encountered where large numbers of boats congregate in relation to each other (boats rafting together). Management could consider designating these coves as no-wake to even further enhance the desired experience. This compartment provides a temporary haven from "fast pace" boating activity on the main body of the reservoir. Because of the central location of this large, protected embayment and the social conditions observed on the water and from study data, this compartment should be maintained as an "escape cove," Class III area. The Land Plan supports this position by allocating the entire shoreline for sensitive resource management. This zone does not consider the development of water-use facilities.

Management Compartment No.: 8 **Name:** Maple Bend

1. **Surface Area -** 1,792.8 acres

2. **Shape -** This is the largest water body of all the 23 compartments. Even though its shape is serpentine, it is so wide (5000 feet in places) that its configuration does not constrict boating traffic.

3. **Shoreline Conditions -** The north shoreline is very heavily developed for private residential use, while the south shoreline exhibits almost no development except at the extreme western end of the compartment.

4. **Observed Boating Activity/Recreational Use -** This area is impacted by the total spectrum of boat users. It is relatively balanced among ski boats, runabouts, deck boats, pontoons, fishing boats, and jet skis. However, few stop and enjoy this area. It appears that most are cruising and moving toward the west to visit the state park or the two commercial marinas, or to the east toward Devils Step, The Elk River, or Winchester City Park. Even though a large number of watercraft occupy this area, the surface acres of water are so great, few boaters feel endangered.

5. **Unique Attributes -** There are three large islands within this compartment. A great number of large peninsulas are located along the northern and southern shorelines. The water depth is about 18 feet near the islands, with a 38 to 68-foot depth within the main channel reaches.

6. **Service Area ID -** Mostly in Service Area Number 4, with part of the compartment to the west within Service Area 2.

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	20	7	62
Marina User	14	11	
Shoreline Property Owner	33	15	

8. **Compartment Discussion -** This area is placed in a Class IV Management Compartment because of very low boat density, at peak use times, and a low incidence of conflict. General assessment of the area related to managerial conditions is as follows: Some of these areas may receive little water patrol attention related to conflict. However, on Tims Ford, some Class IV compartments are located in more open water situations. These areas should be managed for compatible recreation opportunities. There is an acknowledgment that these Class IV areas have potential for additional shoreline development, which would result in an increase in boating density. Over time, some of these areas could become a Class II compartment. Unlike other Class IV compartments located at the back of embayments and typically receiving low levels of boaters and PWC use, this compartment provides a transition corridor between two Class I compartments. Many boaters are traveling between areas seeking other final destinations. Density calculations are driven to lower levels because of the size (acreage) of water surface within this reach of the reservoir. Current shoreline conditions exhibit moderate levels of residential development. The capacity study data support the Land Plan which allocates additional land for residential access to the water. This compartment can support increased levels of recreational boating activity as planned growth occurs.

Management Compartment No.: 9 **Name:** Little Hurricane

1. **Surface Area - 459.1** acres

2. **Shape -** A major tributary of the reservoir (approximately three miles long), with two secondary streams, Carver Branch from the east and Long Branch from the west forms this subwatershed. This large embayment has many small finger coves.

3. **Shoreline Conditions -** The entire shore is covered with woody vegetation. The only current development within this large embayment is a PUA called Pleasant Grove. There is a boat ramp with convenience pier, paved parking lot, picnic tables, and restroom facilities. Just downstream and on the right

bank is a section of shoreline allocated for conservation partnership access and could provide an opportunity for private shoreline development.

4. **Observed Boating Activity/Recreational Use -** The majority of boating activity is related to runabouts and ski boats. Observations support pontoon boats and fishing boats as secondary users. This compartment has a very high density of boaters. However, the use is relatively passive with low conflict among recreation boat users. All but the very upper end of the compartment is considered a favorite boating location. Because of the remote location of Pleasant Grove PUA, the boating public does not feel as safe within a half-mile of the boat ramp. Oftentimes users perceive the area to be congested and unsafe experiencing high conflict among land and water users.

5. **Unique Attributes -** The convoluted shoreline within this embayment offers the boaters numerous quiet places out of the wind and away from the high speed activity most of which are found on the main channel. The steep banks provide deep water close to shore within numerous small coves. The water depth ranges 88 feet from the channel to the back of coves approximately 18 feet.

6. **Service Area ID -** 4

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	28	6	34
Marina User	27	9	
Shoreline Property Owner	20	12	

8. **Compartment Discussion -** This area is placed in a Class III Management Compartment because of a high boat density, even at peak times, and a low incidence of conflict. General assessment of the area related to managerial conditions is as follows: These areas termed as “escape coves” offer opportunities to avoid heavy choppy water, wakes, and noise from cruising boats and PWC activities. Boaters use these areas to relax or engage in stationary water-related activities such as swimming, snorkeling, sunbathing, and fishing. Management of shoreline resources should emphasize natural vegetative conditions and protect other aesthetic features, such as bluffs, rock outcrops, or natural beach areas. Typically, presence of regulatory authority is light unless an isolated incident related to drinking and noise are encountered where large numbers of boats congregate in relation to each other (boats rafting together). Management could consider designating these coves as no-wake to even further enhance the desired experience. Observations revealed some conflict associated with activities at Pleasant

Grove PUA within the upper reaches of the compartment. The conflict was land based, not water related. This compartment provides a temporary haven from "fast pace" boating activity on the main body of the reservoir. Study data support maintaining the recreational boating activity at its current level. Because of the central location of this large, protected embayment and the social conditions observed on the water and from study data, this compartment should be maintained as an "escape cove," Class III area. The Land Plan supports this position by allocating almost the entire shoreline for natural resource management. This zone does not consider the development of water-use facilities**.**

Management Compartment No.: 10 **Name:** Mansford Bridge

1. **Surface Area - 1,940.6** acres

2. **Shape -** This compartment is the largest body of water on the entire reservoir. Its serpentine shape has a mixture of large open water and constricted regions along the main channel. The region west of Mansford Bridge at Leatherwood Island is over a mile wide (east to west). However, at the bridge crossing, the reservoir is less than 1000 feet-wide giving this compartment an hourglass configuration.

3. **Shoreline Conditions -** Well over half the shoreline to the south is developed for residential access and supports high levels of shoreline facilities except the peninsula bisected by Mansford Road, currently a remote part of Tims Ford State Park. The northern shoreline is primarily part of the state park and the balance a mixture of wooded shoreline and residential development. Two of the three commercial marinas (supporting destination tourism facilities) on Tims Ford are located within the central regions of this compartment. There are also two community boat ramps at the eastern end of this reach of the reservoir.

4. **Observed Boating Activity/Recreational Use -** This area of the reservoir has the highest concentration of every type watercraft identified in the study. It is the gateway for two of the largest bodies of water on the entire reservoir, Lost Creek and Hurricane Creek. From this compartment boaters are in transition, traveling to or leaving from one of the three commercial marinas on the reservoir and converging at one of the most constricted reaches, Mansford Bridge. The recreation use is "wide open," or "fast action" activity among runabouts, ski boats, PWC, and bass boats. Even pontoon and deck boats were observed as moving through this area at high cruising speeds. The conditions are defined as high density and high conflicts. The highly developed residential shoreline to the south only adds to the numbers of recreational boaters observed within this compartment.

5. **Unique Attributes -** The main channel exceeds 100-foot depths, and with the exception adjacent to Leatherwood Island, water depths near the shore exceed 30 feet. Many of the areas within this compartment experience rough surface water conditions due to boating activity and exposure to wind conditions. Food, ice, fuel, and a variety of public and community boat ramps and state park activities attribute to drawing boaters to the area.

6. **Service Area ID -** 2

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	35	80	154
Marina User	58	59	
Shoreline Property Owner	50	94	

8. **Compartment Discussion -** This area is placed in a Class I Management Compartment because of high boat density, at peak use times, and a high incidence of conflict. General assessment of the area related to managerial conditions is as follows: Oftentimes these areas of the reservoir account for many boating accidents and injuries. Typically, these areas require a greater presence of law enforcement officials. Due to high concentration of boaters, these reaches of the reservoir could require greater levels of restrictions or regulations such as no-wake area or speed zones. This area currently has the highest concentration of water based development of the entire reservoir. The results of this study show that caution should be given when developing a management strategy for this compartment and considering requests for additional water based recreational development. Because of current congestion within the area, management strategy should consider providing increased attention for boating safety and education.

Management Compartment No.: 11 **Name:** Kitchens Creek

1. **Surface Area -** 143.6 acres

2. **Shape -** Fairly wide and straight cove with several fingers, two of which are long a very scenic shoreline. It is almost one mile long, and it is almost 800 feet wide at its widest point.

3. **Shoreline Conditions -** The shoreline is comprised of TVA public land. This land is highly valued for its unique habitat and wooded shoreline condition.

4. **Observed Boating Activity/Recreational Use -** A "high" level of boat use (based on acres per boat on a typical weekend) occurs in this management compartment. It is relatively balanced among ski boats, runabouts, deck boats, pontoons, fishing boats, and PWC. Boaters often use this area to swim, sunbathe, and relax.

5. **Unique Attributes -** Pristine cove with deep, clear water and wooded shoreline. Water depth ranges from about 68 feet at the mouth to 28 feet in the upper reaches of the cove.

6. **Service Area ID -** 2

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	14	0	11
Marina User	12	0	
Shoreline Property Owner	9	0	

8. **Compartment Discussion -** This area is placed in a Class III Management Compartment because of a high boat density, even at peak times, and a low incidence of conflict. General assessment of the area related to managerial conditions is as follows: These areas termed as "escape coves" offer opportunities to avoid heavy choppy water, wakes, and noise from cruising boats and PWC activities. Boaters use these areas to relax or engage in stationary water-related activities, such as swimming, snorkeling, sunbathing, and fishing. Management of shoreline resources should emphasize natural vegetative conditions and protect other aesthetic features, such as bluffs, rock outcrops, or natural beach areas. Typically, presence of regulatory authority is light unless an isolated incident related to drinking and noise is encountered where large numbers of boats congregate in relation to each other (boats rafting together). Management could consider designating these coves as no-wake to even further enhance the desired experience. This compartment provides a temporary haven from "fast pace" boating activity on the main body of the reservoir. Study data support maintaining the recreational boating activity at its current level. Social conditions observed on the water and from study data support this compartment to be maintained as an "escape cove," Class III area. The Land Plan supports this position by allocating the entire shoreline for sensitive resource management. This zone does not consider the development of water-use facilities.

Management Compartment No.: 12 **Name:** Tims Ford Dam

1. **Surface Area -** 127.1 acres

2. **Shape -** Open and rectangular - main channel approximately one-half mile long.

3. **Shoreline Conditions -** Steep ridges. There are TVA dam operation infrastructures visible from the water. The land adjacent to this management compartment is mostly comprised of TVA dam reservation property. Informal recreation activities are occurring on open space areas within the reservation boundary. There is a public boat ramp located on the dam reservation.

4. **Observed Boating Activity/Recreational Use -** A "medium" level of boat use (acres per boat on a typical weekend) occurs in this management compartment. Runabout boats dominate the waterway, followed by fishing boats.

5. **Unique Attributes -** Water depth is the deepest found on this reservoir, approximately 128 feet.

6. **Service Area ID -** 1

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	13	11	7
Marina User	3	2	
Shoreline Property Owner	4	5	

8. **Compartment Discussion -** This area is placed in a Class II Management Compartment because of moderate boat density, at peak use times, and a low incidence of conflict. General assessment of the area related to managerial conditions is as follows: Conflicts between boaters will likely be less common than in Class I because of decreased levels of traffic and more regular travel patterns. These areas will likely exhibit less diversity of boat types. Generally the boat density is between 15 and 20 surface acres per boat. Data from this study would support proposals related to expansion of public recreation facilities at the TVA public boat ramp. According to the Land Plan, the surrounding land base is zoned as project operations and natural resource management. These zones would typically limit most development potential.

Management Compartment No.: 13 **Name:** The Narrows

1. **Surface Area -** 675.2 acres

2. **Shape -** Open and round - main channel approximately one mile long

3. **Shoreline Conditions -** The west side of this management compartment is TVA public land, where there are no existing or anticipated development/ shoreline alterations. The east side is owned and managed by Tennessee state parks.

4. **Observed Boating Activity/Recreational Use -** A "very low" level of boat use (acres per boat on a typical weekend) occurs in this management compartment. This area is impacted by the total spectrum of boat users. It is relatively balanced among ski boats, runabouts, deck boats, pontoons, fishing boats, and PWC**.**

5. **Unique Attributes -** There are two islands present. Water depth varies greatly from 8 to 128 feet. this is the second-widest stretch on the reservoir.

6. **Service Area ID -** 1

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	15	6	20
Marina User	14	2	
Shoreline Property Owner	21	2	

8. **Compartment Discussion -** This area is placed in a Class IV Management Compartment because of very low boat density, even at peak times, and a low incidence of conflict. General assessment of the area related to managerial conditions is as follows: Some of these areas may receive little water patrol attention related to conflict. This Class IV compartment is located in a more open water situation. These areas can be managed for compatible recreation opportunities. There is an acknowledgment that these Class IV areas have potential for additional shoreline development, which would result in an increase in boating density. Over time, some of these areas could become a Class II compartment. Study data support an opportunity to increase recreational boating activity above the current level. This Class IV compartment serves as a release from the more congested and constricted adjacent Class I and Class II areas (see Exhibit E). Boaters now

have an opportunity to adjust their travel patterns to a more relaxed and less confrontational mode.

Management Compartment No.: 14 **Name:** Anderson Branch

1. **Surface Area -** 47.3 acres

2. **Shape -** A fairly straight cove with nine small fingers. It is approximately three-quarters of a mile long. At its widest point, this cove is up to 200 feet wide.

3. **Shoreline Conditions -** There is residential access available at the head of this cove. Also there is some developed recreation potential which exists on the almost half of the lower portion of the left (west) bank.

4. **Observed Boating Activity/Recreational Use -** A "very low" level of boat use (acres per boat on a typical weekend) occurs in this management compartment. The only boat types observed in this management compartment were fishing boats.

5. **Unique Attributes -** This is the head of a cove. Water depth ranges from 8 feet at the head of the cove to 68 feet at the beginning of this management compartment.

6. **Service Area ID -** 2

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	0	1	1
Marina User	1	0	
Shoreline Property Owner	1	0	

8. **Compartment Discussion -** This area is placed in a Class IV Management Compartment because of very low boat density, at peak use times, and a low incidence of conflict. General assessment of the area related to managerial conditions is as follows: Some of these areas may receive little water patrol attention related to conflict. However, like other categories, especially Class IIs or IIIs, enforcement of fishing regulations by the appropriate agency will likely be the focus within these areas. Anglers utilize these areas because of vegetated shoreline, solitude, tranquility, and quietness. Other related

recreational activities taking place within a Class IV area provide opportunities for primitive camping, bird watching, or nature and wildlife observation. These areas should be managed for compatible recreation opportunities. This compartment is adjacent to a Class I area. Observations reveal this compartment to be used mostly by anglers. Most recreational boaters stop short of this compartment, because their destination is Tims Ford Marina and Resort. Most boating traffic moves south toward open water. The no-wake zone for the Anderson Branch embayment slows boating activity to a point that most recreational users don't extend their travel past the marina. The Land Plan has allocated public land at both the upper and lower reaches of this embayment for residential access and for expansion of the marina, respectively. The proposed development could increase boating activity within this compartment, however, this compartment serves less active recreational boating activity**.**

Management Compartment No.: 15 **Name:** Ray Branch

1. **Surface Area -** 85.8 acres

2. **Shape -** A fairly straight cove with six small fingers. It is just over three-quarters of a mile long. At its widest point, this cove is approximately 1,000 feet-wide.

3. **Shoreline Conditions -** The entire cove is encompassed by Tennessee State Park Property. The south side of this cove is available for developed recreation use. The shoreline is currently in an undeveloped wooded character.

4. **Observed Boating Activity/Recreational Use -** A "medium" level of boat use (acres per boat on a typical weekend) occurs in this management compartment. The majority of boat types observed in this management compartment were runabouts. Most of the observed use is taking place at the mouth of the cove. Other boats can be seen further into the cove idling. Boaters often use this area to swim, sunbathe, and relax.

5. **Unique Attributes -** This is a pristine cove. Water depth ranges from 88 feet at the mouth to 8 feet at the head of the cove.

6. **Service Area ID -** 1

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	1	0	5
Marina User	4	1	
Shoreline Property Owner	4	0	

8. **Compartment Discussion -** This area is placed in a Class III Management Compartment because of moderate boat density, even at peak times, and a low incidence of conflict. General assessment of the area related to managerial conditions is as follows: These areas termed as "escape coves" offer opportunities to avoid heavy choppy water, wakes, and noise from cruising boats and PWC activities. Boaters use these areas to relax or engage in stationary water-related activities, such as swimming, snorkeling, sunbathing, and fishing. Management of shoreline resources should emphasize natural vegetative conditions and protect other aesthetic features, such as bluffs, rock outcrops, or natural beach areas. Typically, presence of regulatory authority is light unless an isolated incident related to drinking and noise is encountered where large numbers of boats congregate in relation to each other (boats rafting together). Management could consider designating these coves as no-wake to even further enhance the desired experience. Density data would have categorized this compartment as a Class II. However, observations and social conditions showed that this cove was, in fact, used as an escape cove. Because of the shape and size of the cove, adjacent land management (state park), and it being highly favored as a quiet area by boaters, this compartment's best use would be a Class III escape cove**.**

Management Compartment No.: 16 **Name:** Graves Branch

1. **Surface Area -** 54.5 acres

2. **Shape -** A fairly straight cove with only a few very small inlets. It is just over three-quarters of a mile long. At its widest point, this cove is approximately 600 feet-wide.

3. **Shoreline Conditions -** The entire cove is encompassed by TVA public land. The shoreline is in an undeveloped wooded character.

4. **Observed Boating Activity/Recreational Use -** A "very high" level of boat use (acres per boat on a typical weekend) occurs in this management

compartment. It is relatively balanced among ski boats, runabouts, deck boats, pontoons, fishing boats, and PWC. Runabouts were not as prevalent in this cove as compared to most other places on the reservoir. Most boats were observed to be seen further into the cove at an idle or anchored position. Boaters often use this area to swim, sunbathe, and relax.

5. **Unique Attributes -** This is a pristine cove. Water depth ranges from approximately 78 feet at the mouth of the cove down to 8 feet at the cove's head.

6. **Service Area ID -** 3

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	2	1	6
Marina User	13	0	
Shoreline Property Owner	1	1	

8. **Compartment Discussion -** This area is placed in a Class III Management Compartment because of very high boat density, at peak use times, and a low incidence of conflict. General assessment of the area related to managerial conditions is as follows: These areas termed as "escape coves" offer opportunities to avoid heavy choppy water, wakes, and noise from cruising boats and PWC activities. Boaters use these areas to relax or engage in stationary water-related activities, such as swimming, snorkeling, sunbathing, and fishing. Management of shoreline resources should emphasize natural vegetative conditions and protect other aesthetic features, such as bluffs, rock outcrops, or natural beach areas. Typically, presence of regulatory authority is light unless isolated incident related to drinking and noise is encountered where large numbers of boats congregate in relation to each other (boats rafting together). Management could consider designating these coves as no-wake to even further enhance the desired experience. This compartment is only one of two Class III areas within Hurricane Creek area. The entire shoreline of this compartment is zoned in the Land Plan for natural resource management, protecting the integrity of the aesthetic character making it ideal for an escape cove. The need for this compartment to be placed in Class III is emphasized by its location near a Class I area, Compartment 10. Study data show the area to be highly favored by boaters as a rest area.

Management Compartment No.: 17 **Name:** Lower Hurricane Creek

1. **Surface Area -** 657.1 acres

2. **Shape -** A long and wide arm with several coves meandering off from the main stem. It is about 1 1/2 miles long. At its widest point, this cove is approximately 1600 feet-wide.

3. **Shoreline Conditions -** Most of the shoreline is TVA public land. It provides a natural scenic buffer between the water and existing backlying uses. There is some residential access that is visible from the water. The upper portion (Awalt Road Bridge and along the northern bank of Jackson Hollow) of this management compartment is available for residential access. Highland Ridge subdivision is located along the left bank - lower segment of this compartment.

4. **Observed Boating Activity/Recreational Use -** A "very low" level of boat use (acres per boat on a typical weekend) occurs in this management compartment. It is relatively balanced among ski boats, runabouts, deck boats, pontoons, fishing boats, and PWC. Boats are moving through this management compartment at varying speeds. Boaters were observed cruising, sightseeing and water-skiing through this area, and fairly well distributed throughout the management compartment.

5. **Unique Attributes -** Water depth ranges from about 68 feet to 108 feet.

6. **Service Area ID -** 3

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	10	1	23
Marina User	32	2	
Shoreline Property Owner	15	2	

8. **Compartment Discussion -** This area is placed in a Class IV Management Compartment because of very low boat density, even at peak times, and a low incidence of conflict. General assessment of the area related to managerial conditions is as follows: Some of these areas may receive little water patrol attention related to conflict. This Class IV compartment is located in a more open water situation. These areas should be managed for compatible recreation opportunities. There is an acknowledgment that these Class IV areas have potential for additional shoreline development, which

would result in an increase in boating density. Over time, some of these areas could become a Class II compartment. Because the majority of the adjacent shoreland is zoned through the Land Plan as natural resource management, this compartment will likely remain in a Class IV status. If the upper portion of this compartment is developed as planned, sections of this compartment could become Class II. This compartment could sustain additional recreational boating density and still not exceed capacity.

Management Compartment No.: 18 **Name:** Cynthia Hollow

1. **Surface Area -** 40.8 acres

2. **Shape -** This is a mid-size cove that is straight with two fingers extending northerly. It is less than three-quarters of a mile long. At its widest point, this cove is approximately 400 feet-wide.

3. **Shoreline Conditions -** All of the adjoining shoreline is Tennessee state park property. It provides a wooded scenic buffer between the water and backlying uses.

4. **Observed Boating Activity/Recreational Use -** A "high" level of boat use (acres per boat on a typical weekend) occurs in this management compartment. It is relatively balanced among ski boats, runabouts, deck boats, pontoons, fishing boats, and PWC. It was observed that there were a few PWC in the back of this cove. However, most boats using the cove were idle. Boaters often use this area to swim, sunbathe, and relax.

5. **Unique Attributes -** Water depth ranges are from 88 feet at the mouth to 8 feet near the head of the cove.

6. **Service Area ID -** 3

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	1	0	4
Marina User	1	0	
Shoreline Property Owner	2	0	

8. **Compartment Discussion -** This area is placed in a Class III Management Compartment because of high boat density, at peak use times, and a low

incidence of conflict. General assessment of the area related to managerial conditions is as follows: These areas termed as "escape coves" offer opportunities to avoid heavy choppy water, wakes, and noise from cruising boats and PWC activities. Boaters use these areas to relax engage in stationary water-related activities, such as swimming, snorkeling, sunbathing, and fishing. Management of shoreline resources should emphasize natural vegetative conditions and protect other aesthetic features, such as bluffs, rock outcrops, or natural beach areas. Typically, presence of regulatory authority is light unless an isolated incident related to drinking and noise is encountered where large numbers of boats congregate in relation to each other (boats rafting together). Management could consider designating these coves as no-wake to even further enhance the desired experience. This compartment is the second Class III compartment within the Lost Creek area. Even though there are two coves larger in size (Anderton and Cooper Branches) within the general vicinity, the study data criteria, combined with current and planned shoreline development, negate these areas for use as escape coves. However, this compartment is a favored scenic area for passive use**.**

Management Compartment No.: 19 **Name:** Lost Creek

1. **Surface Area -** 974.8 acres

2. **Shape -** This is a long creek with numerous fingers and coves dispersed throughout. It is over three miles in length, and just over 1000 feet-wide in several places.

3. **Shoreline Conditions -** Portions of the shoreline within this management compartment are managed by Tennessee state parks and a remnant parcel is managed as TVA public land. Most of the adjoining shoreline is developed for private subdivisions (Beech Hill and Ridgeville) and can be considered for residential shoreline alterations.

4. **Observed Boating Activity/Recreational Use -** A "medium" level of boat use (based on acres per boat on a typical weekend) occurs in this management compartment. It is relatively balanced among ski boats, runabouts, deck boats, pontoons, fishing boats, and PWC. Many boats can be seen in the back of coves in a resting position, while other boats are moving through this management compartment at varying speeds. Boaters can be seen cruising, sightseeing, and water-skiing through this area. Boats seem to be fairly well distributed throughout the management compartment. However, there does appear to be a high concentration of runabout boats in Cooper Branch.

5. **Unique Attributes -** Water depth ranges from aapproximately 108 feet to 28 feet. There are some shallow places near the shore that are approximately 8 feet-deep.

6. **Service Area ID -** 3

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	46	7	63
Marina User	28	4	
Shoreline Property Owner	34	9	

8. **Compartment Discussion -** This area is placed in a Class II Management Compartment because of moderate boat density, even at peak times, and a low incidence of conflict. General assessment of the area related to managerial conditions is as follows: Conflicts between boaters will likely be less common than in Class I because of decreased levels of traffic and more regular travel patterns. Generally the boat density is between 15 and 20 surface acres per boat. This compartment is subject to high density of residential shoreline development and may require a presence of regulatory authority. The upper half of this compartment is favored for active recreational boating. This could be related to the level of adjacent residential development. Further, water-based development could be supported without exceeding capacity. Concentration of boating activity at the upper and lower reaches of this compartment are the result of Lost Creek and Anderton Branch PUAs. Neither of the PUAs appear to be at capacity even on peak holidays.

Management Compartment No.: 20 **Name:** Awalt Road Cove

1. **Surface Area -** 16.9 acres

2. **Shape -** A small, short cove. It is less that one-half mile in length, and approximately 200 feet-wide near the mouth.

3. **Shoreline Conditions -** The shoreline is TVA public land and is in a wooded condition.

4. **Observed Boating Activity/Recreational Use -** A “medium” level of boat use (based on acres per boat on a typical weekend) occurs in this

management compartment. The predominate boat type found in this management compartment is fishing boats. Boats are mostly stationary while in this cove.

5. **Unique Attributes -** There is an informal use area just off of Awalt Road that is in the very back reaches of this cove. Water depth ranges from approximately 48 feet at the mouth and dropping to less than 8 feet at the back of the cove.

6. **Service Area ID -** 3

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	0	0	1
Marina User	1	0	
Shoreline Property Owner	0	0	

8. **Compartment Discussion -** This area is placed in a Class III Management Compartment because of moderate boat density, at peak use times, and a low incidence of conflict. General assessment of the area related to managerial conditions is as follows: These areas termed as “escape coves” offer opportunities to avoid heavy choppy water, wakes, and noise from cruising boats and PWC activities. Boaters use these areas to relax or engage in stationary water-related activities, such as swimming, snorkeling, sunbathing, and fishing. Management of shoreline resources should emphasize natural vegetative conditions and protect other aesthetic features, such as bluffs, rock outcrops, or natural beach areas. Typically, presence of regulatory authority is light unless an isolated incident related to drinking and noise is encountered where large numbers of boats congregate in relation to each other (boats rafting together). Management could consider designating these coves as no-wake to even further enhance the desired experience. This compartment is the only “escape cove” above Awalt Road. The entire cove is visible from the road; however, it is very scenic due to heavy vegetation along the left bank. Density data would have categorized this compartment as a Class II. However, observations and social conditions revealed this small cove is being used as an escape cove. Because the adjacent land is allocated for natural resource management, via the TVA Land Plan, this compartments best use would be a Class III escape cove. Strategically this compartment provides a useful area because of the two (moderately used) PUA ramps and a commercial marina (Holiday Resort) located within the large adjacent Class II and Class IV compartments.

Management Compartment No.: 21 **Name:** Upper Lick Creek

1. **Surface Area -** 14.4 acres

2. **Shape -** Head of a rather long creek. It is less than one-half mile in length. It is just over 200 feet wide at its widest point.

3. **Shoreline Conditions -** The shoreline on the east side of this management compartment is allocated for a proposed state park expansion. The west side is TVA public land and is currently in a wooded condition.

4. **Observed Boating Activity/Recreational Use -** A "moderate" level of boat use (based on acres per boat on a typical weekend) occurs in this management compartment. The predominate boat type observed was the fishing boat.

5. **Unique Attributes -** Water depth ranges from about 18 feet to only a couple feet. The cove quickly becomes narrow, and the shallow water depth makes boating impractical further toward the head of this creek.

6. **Service Area ID -** 3

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	0	0	1
Marina User	0	0	
Shoreline Property Owner	0	0	

8. **Compartment Discussion -** This area is placed in a Class IV Management Compartment because of moderate boat density, even at peak times, and a low incidence of conflict. General assessment of the area related to managerial conditions is as follows: Some of these areas may receive little water patrol attention related to conflict. However, like other categories, especially Class IIs or IIIs, enforcement of fishing regulations by the appropriate agency will likely be the focus within these areas. Anglers utilize these areas because of vegetated shoreline, solitude, tranquility, and quietness. Other related recreational activities taking place within a Class IV area provide opportunities for primitive camping, bird watching, or nature and wildlife observation. These areas should be managed for compatible recreation opportunities. Observations reveal this compartment is used mostly by anglers. Most recreational boaters stop short of this compartment because their destination is Holiday Resort Marina or adjacent PUA boat

ramp. The TVA Land Plan has allocated the west side of the compartment for residential access. Study data would support this increase in development which could alter the boating density.

Management Compartment No.: 22 **Name:** Upper Hurricane/Turkey Creek

1. **Surface Area -** 751.8 acres

2. **Shape -** One long tributary (Hurricane Creek) with two secondary creeks (Turkey and Lick) feeding into it. The length of Hurricane creek is about 3 1/2 miles long. Turkey Creek is less than 1 1/2 miles long. Lick Creek is about a mile long. This compartment is almost 1,400 feet-wide at its widest point.

3. **Shoreline Conditions -** The shoreline around this management compartment is comprised of a wide variety of uses. This includes Tennessee state park public access areas, TVA public land, undeveloped commercial recreation property, a commercial marina, and shoreline residential access. There are also several existing private subdivisions (Moor-Lin Cabin Sites, Holiday Hide-A-Way, and Lakehaven. Much of this shoreline is expected to be developed in the future.

4. **Observed Boating Activity/Recreational Use -** A "medium" level of boat use (based on acres per boat on a typical weekend) occurs in this Management Compartment. It is relatively balanced among ski boats, runabouts, deck boats, pontoons, fishing boats, and PWC. However, boating generally appears to be congested in the vicinity of Holiday Landing Resort.

5. **Unique Attributes -** Water depth ranges from approximately 68 feet to 8 feet in the upper reaches of the coves.

6. **Service Area ID -** 3

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	32	30	45
Marina User	31	13	
Shoreline Property Owner	15	20	

8. **Compartment Discussion -** This area is placed in a Class II Management Compartment because of moderate boat density, at peak use times, and a

moderate incidence of conflict. General assessment of the area related to managerial conditions is as follows: Conflicts between boaters will likely be less common than in Class I because of decreased levels of traffic and more regular travel patterns. Generally the boat density is between 15 and 20 surface acres per boat. Study data would support the proposed increase in public recreation, as well as residential development for this compartment. Observations confirm moderate to heavy boating activity adjacent to Neal Bridge and Turkey Creek PUA ramps and Holiday Marina/ramp. Survey results reported concentrations of conflict among boaters within the immediate vicinity of these above mentioned facilities.

Management Compartment No.: 23 **Name:** Sanders Hollow

1. **Surface Area -** 69.3 acres

2. **Shape -** This is the head of Lost Creek. It is slightly less than one mile long, and is almost 500 feet-wide at its widest point.

3. **Shoreline Conditions -** The shoreline is mostly comprised of TVA public land. There is some shoreline available for residential access. Much of the shoreline is currently in a wooded condition.

4. **Observed Boating Activity/Recreational Use -** A "very low" level of boat use (based on acres per boat on a typical weekend) occurs in this management compartment. Most boat traffic ends at the Lost Creek Road Bridge.

5. **Unique Attributes -** Water depth ranges from approximately 28 feet at the road crossing to 8 feet in the upper reaches of the cove.

6. **Service Area ID -** 1

7. **Boater Survey Responses and Boat Count** (data from Appendix 9)**:**

Sample Populations	Favorite Area	Conflict (avoid/unsafe)	Boat Count (average weekend)
Ramp User	0	0	1
Marina User	1	0	
Shoreline Property Owner	1	0	

8. **Compartment Discussion -** This area is placed in a Class IV Management Compartment because of very low boat density, even at peak times, and a

low incidence of conflict. General assessment of the area related to managerial conditions is as follows: Some of these areas may receive little water patrol attention related to conflict. However, like other categories, especially Class IIs or IIIs, enforcement of fishing regulations by the appropriate agency will likely be the focus within these areas. Anglers utilize these areas because of vegetated shoreline, solitude, tranquility, and quietness. Other related recreational activity taking place within a Class IV area provide opportunities for primitive camping, bird watching, or nature and wildlife observation. These areas should be managed for compatible recreation opportunities. Observations reveal this compartment is used mostly by anglers and some PWC. Most recreational boaters stop short of this compartment because passage under Lost Creek Road is through a box culvert. This constriction limits the type of watercraft seeking to use this reach of the reservoir. Because of limited opportunity for residential growth within this compartment, this area should continue to be managed as a Class IV, low density compartment.

6: Findings

Pilot Assessment

The section in Chapter 1 entitled "Pilot Project Purpose" lists six items by which project success can be measured. The following addresses how well the pilot project met these expectations.

Schedule

The primary work of the pilot project was accomplished on time and within budget. The work schedule (Figure 2) allocated 12 months to the project. However, half of the tasks in the schedule (approximately three months of work) relate to foundational preparation of a process model and methodology. This is work that will not need to be repeated in the future. Therefore, it is expected that future studies using the Model would only take nine months to complete. In order for the data to be collected in the summer, as needed, the study would have to be started in January.

Cost

The pilot project was completed for $148,000—$17,000 less than the $165,000 budgeted. TVA's strategy for carrying out the pilot was to use existing staff, coached by an expert consultant, to lead and execute the various project tasks. Use of a consultant as an advisor proved to be a wise investment and has added validity to the final product. Throughout the study period, TVA staff were not only developing and testing the Model and its methodology, but constantly seeking ways to improve or streamline the study process—such as reducing the number of field data collection staff and cutting travel costs by hiring local contractors, developing an alternative method of counting boats from the air by helicopter instead of by boat—resulting in a savings of $17,000. The cost of future boating capacity projects will depend on the size of the reservoir and the number of existing boat ramps, marinas, private docks, piers, and boathouses present on that reservoir.

Replication

The TVA Boat Capacity Model process has proven itself to be cost effective, time efficient, and flexible enough to apply to any reservoir in the Valley. Based on this Pilot Study, it is recommended that Resource Stewardship consider using this process to provide data-supported rationale to help guide management issues related to recreational boating capacity.

The Study Team now has the capability to manage other reservoir boating capacity studies using the Model. This expertise gives TVA the flexibility to consider three options for executing future boating capacity studies:

- **Turn-key project using in-house expertise**. The Study Team could conduct one or two boating capacity studies per year, with the support of the respective Watershed Teams.
- **Broadening in-house expertise at the TVA Watershed Team level**. Instead of conducting studies, the Study Team could teach others to implement the Model. In this scenario, either the Study Team or the external consultant would provide training and oversight to TVA Watershed Teams that choose to conduct boating capacity studies.
- **Outsourcing.** Another option would be to locate an experienced outside consultant to conduct a turn-key project for TVA. TVA staff would provide have oversight and minimal staff involvement in data collection, analysis, and report writing.

Support for Corporate Goals and Critical Success Factors

TVA now has the capability to address questions related to boating capacity or marina expansion on Tims Ford Reservoir, such as those asked by the U.S. Fish and Wildlife Service during review of the Guntersville Land Plan Draft Environmental Impact Statement. Using boating capacity study results, TVA can better understand the relationship between resource, social, and managerial conditions. This improved understanding could help ensure TVA manages its reservoirs for maximum sustainable growth opportunities.

Data Highlights

Much has been learned during this study about how much and how often boaters use Tims Ford Reservoir. We have found that the characteristics of boaters are closely related to how they react to observed changes occurring on the reservoir and in what they perceive to be quality recreation opportunities. The survey methods used were successful in obtaining a wide variety of baseline information about all boater types using Tims Ford Reservoir. A rich pool of data now exists that describes their boating activity and their perceptions about and preferences for the conditions that most affect their use and enjoyment of the reservoir.

Key Findings

The primary finding of the Tims Ford Boating Capacity Study is that Tims Ford Reservoir, as a whole, has ***not*** reached a critical threshold for boating capacity. Only two of the 23 management compartments—2,343 surface acres—were placed into Class I, indicating a high level of crowding and conflict.

Another key finding is that Tims Ford Reservoir has a higher percentage of PWC (20 percent) than reservoirs of similar size nationally. The consultant's studies have shown that PWC use on U.S. Army Corps of Engineer recreational lakes is around 12 percent (Appendix 7). The high percentage of PWC on Tims Ford Reservoir could account for a reported increase in boating accidents involving PWC and is reflected in the boater preference survey data reported in the following section.

The survey data also showed that the addition of new water-based infrastructure would improve the recreation experience of some boaters on Tims Ford Reservoir. Most notable was a desire for a full service marina near Winchester near the mouth of Dry Creek. Other suggestions included construction of retail shops/restaurants accessible by water and land, and improvement of existing PUAs (i.e., additional parking with painted lines, restroom facilities, and lights at all boat ramps).

Boater Preference

Much has also been learned about how boaters spend their time on the reservoir. The most consistent attributes for which boaters expressed a preference were calm water, few wakes, solitude, and the presence of fewer boats. These were often stated to be the desired conditions for participation in their primary activities such as cruising, swimming, and water-skiing.

Although cruising is the most popular activity, many boaters also spend time fishing. Those who said their primary activity was fishing tended to spend most of their time on that activity. Cruisers, on the other hand, typically take short cruises, with their remaining time divided between relaxing or sunning in the boat while stationary, swimming from the boat, or perhaps some fishing (about one-quarter also spend time skiing). Boaters may do these "stationary boat" activities in congested areas where boats congregate, but most look, at least part of the time, for more secluded places. Those that participate in cruising report that they are easily disturbed by PWC or other boats coming too close and causing wakes. Increasing boat traffic has made it harder to find quiet, secluded areas.

The prevalence of boaters with more than five years of experience and the presence of significant numbers of those with more than 15 years of Tims Ford Reservoir use, increase the demand to maintain the status quo or for a return to past, uncrowded conditions. It also appears that a greater number of complaints about crowding and noise were made by shoreline property owners than by ramp users.

On the other hand, relative newcomers (i.e., those with less than five years of boating on Tims Ford Reservoir) may accept higher density conditions and more frequent conflicts because they do not have a reference point based on previous conditions. As these boaters become a larger part of the boating population, and more long-time users stop using the reservoir (a few lakefront property owners indicated they sold their boats or stopped boating due to age or infirmities), complaints about crowding and conflicts may actually decrease, even though density may be increasing.

Boating Safety

There are indications that Tims Ford Reservoir is experiencing some boat-related safety problems. TWRA reported (Rider, 2000) that out of the 23 reservoirs where data were collected, Tims Ford Reservoir ranked the highest in

number of overall accidents (with a total of 19). Although Tims Ford is a much smaller reservoir than Watts Bar, Tims Ford was rated the second highest for PWC accidents (with a total of 7). From the 19 reported boating accidents on Tims Ford Reservoir (which includes the 7 PWC accidents), there were four fatalities, 62 serious injuries, and 15 minor injuries. Many of those surveyed for the Tims Ford study expressed concern about an increase in unsafe jet skiing, boating, and safety concerns. Specific comments were voiced about the number of boaters who appeared to be unaware of existing boating regulations and were generally traveling too fast.

Activities like fishing, swimming, picnicking, and water skiing, which were frequently mentioned when boaters described their favorite locations, are also less enjoyable when too many boats are using an area. The survey data indicated the reasons for avoidance of specific areas of the reservoir were high numbers of boats, incompatible boat types in the area, or unsafe boating behavior. The unsafe behaviors mentioned ~~-b~~oats coming too close to other boats, swimmers, or skiers; causing wakes too close to other boats; going too fast ~~-a~~re often a symptom of, or are exacerbated by, high density boating.

Management Strategies

As stated in Chapter 1 of this document, the purpose of the Tims Ford Boating Capacity Study was to select and pilot a process for determining the boating capacity of TVA reservoirs. The methodology has proven to be a useful tool and shows promise in helping TVA make land use and permitting decisions elsewhere on the reservoir system.

The pilot study focused on testing the methodologies for collecting and analyzing data, but did not include the development of a plan of action. Now that the pilot has been successfully completed, the decision must be made whether to move on to complete an Action Plan (Steps 3-5 in Figure 1), or to simply use the data collected during the study to enhance management decisions. With specific data now available about recreation boating issues on Tims Ford Reservoir, the basis has been provided for discussion with the public about planning for desired future conditions. Continued public involvement can occur with less danger of discussion becoming bogged down in opinions and conjecture regarding current recreation activities and problems.

Analysis of the study data has revealed several important considerations for developing management strategies on Tims Ford Reservoir. Reservoir management is a complex task for which conflicting recreation needs must be balanced with the constant changes occurring in resource and social conditions. Management actions designed to meet diverse needs can be evaluated based on their effects on the recreation opportunities and experiences that TVA intends to provide. The following questions could be asked regarding each proposed management action: "What effect will this action have on the recreation

opportunities the reservoir provides, and will those effects hinder or facilitate boaters' attainment of their desired experiences?"

Management strategies for Tims Ford Reservoir should be written in the form of statements of the desired resource, social, and managerial conditions in each Management Compartment. As the study data show, visitors attracted to particular areas of the reservoir typically share similar recreation values. Effective strategies will be those that match the strengths and weaknesses of each compartment to the needs of each distinct user group.

Following are some examples of strategies that are strongly suggested by the study data which can serve as a springboard for improving future recreational boating conditions on Tims Ford Reservoir:

- Using the study data and the resulting Management Compartment Classification System, reservoir managers can anticipate, with greater confidence, how new development will likely affect recreational water-based activity within a specific reach of the reservoir. In general, the Class II and some Class IV Management Compartments have adequate water surface area and adjacent reservoir shoreline to sustain additional watercraft activity and shoreline growth. Therefore, a key management strategy for Tims Ford Reservoir could be to direct development to those areas without moving them to Class I status. In other words, to help initiate sustainable growth patterns; e.g. growth without congestion.

  Class II compartments (those with moderate density and conflict) offer the greatest capability for future growth because they are relatively underdeveloped areas that physically can support growth. Class IV (low density/low conflict) compartments are typically located within the shallow reaches of coves which would not normally be managed as growth opportunities. In fact, most of these areas provide unique aquatic habitat and adjacent vegetated shoreline environments offering diversity for recreational boating experiences. However, on Tims Ford Reservoir a few Class IV compartments offer areas for potential growth as well. Compartments 8, 13, and 17 are located within the main channel reaches of the reservoir. Compartment 8 has large areas with low-to-moderate levels of private water-use facility development, while Compartments 13 and 17 are relatively undeveloped.

  As strategies are developed to address growth opportunities on Tims Ford Reservoir, caution should be given to preventing the increase of lake congestion to undesirable high density/high conflict (Class I) levels. Over time, implementation of any particular management strategy, influenced by local development patterns, could move compartments to different classifications. At this point, the existing capacity study would need to be updated to reflect current conditions.
- The study results provide a road map for state and local law enforcement officials to redirect their use of limited resources for boating

regulations on Tims Ford Reservoir. The division of the reservoir into compartments and the classification of those compartments provided a more clear picture of where enforcement problems are likely to occur. Efficiencies can be gained by coordinating reservoir patrol schedules between law enforcement agencies (TDEC, TWRA, TVA, as well as city and county officers) based on knowledge of conflict areas. The potential exists to increase boaters' tolerance of greater numbers of boats on the reservoir and increase "boating capacity" if the unsafe and discourteous behaviors—exacerbated by higher density conditions—can be reduced through increased boater awareness and regulation enforcement. The data can also serve to help prioritize immediate problems, some of which might be acted upon before any further planning steps are taken.

- The need to preserve quiet areas of the reservoir is particularly important at Tims Ford Reservoir because they are important to many of the users contacted. The study identified important, low-use, and minimally developed areas and coves supplying highly valued opportunities to escape high density, fast-moving boat traffic, heavy wakes, and wind. Management actions to protect and maintain the unique conditions of these escape coves are recommended to preserve these recreational opportunities.
- Data results from the boating capacity study strengthen and support the allocations made in the Land Plan. Managers can use the Tims Ford Boating Capacity Study in conjunction with the Land Plan as a tool to help formulate defensible decisions in regard to requests for shoreline development.

When is a Recreational Boating Capacity Study Needed?

Several factors can point to the need for a reservoir boating capacity study:

- Questions or identification of issues related to perceived crowding, safety, noise, water quality, specific recreational activities, or development proposals from individuals or citizen groups concerned about a particular policy or land-use action. They may want to meet directly with TVA managers and field staff. Notice of concern may be conveyed through the news media or letters from elected political representatives.
- An increase in population growth, altering use patterns or types of recreation use within a reservoir setting. Normally this type of change occurs over a long period of time. Increases in population are often driven by changes in the regional or local economy. Increases in reservoir visitation and recreational use can sometimes be the result of an unusual increase in the housing market on or adjacent to a reservoir. Such capital investment can be linked to an increase in the job market, the opening of a new highway corridor, construction of a new or

expanding industry, commercial development, retail complex, or development of a major tourism attraction.

- An increase in the number of requests for docks, piers, boathouses, marinas, and marina expansions.
- A documented increase in the number of boat-related water accidents, violation citations for unsafe boating, or complaints about crowding.
- An observed increase in the number of vehicles with boat trailers parked at public use boat ramps is a trigger.

In order to keep informed about potential changes affecting future reservoir conditions, it is essential that TVA Watershed Teams continue to meet and communicate with concerned citizens, interest/user groups, peer agencies, political leaders, developer and realtor associations, and local utility distributors. Collecting intelligence from these sources can provide TVA managers with advanced knowledge and an opportunity to develop an appropriate management strategy, budget, and schedule to meet the needs of TVA and its reservoir recreation users.

Although there is no set length of time that survey data remain valid, some indication of the "shelf life" of the data can be obtained by looking at the stability of the groups surveyed. When the growth in new marina and ramp user groups is high (e.g., the average length of experience of reservoir users decreases), the data will need to be updated more frequently.

Water Quality

The relationship of water quality to recreational boating on TVA reservoirs was raised during this study. The concern was whether water quality would be impacted if a reservoir becomes crowded or exceeds its boat capacity (more than one boat per 10-surface acres). Some potential impacts include increased shoreline erosion, decreased water clarity, discharge of petroleum products, and presence of pathogens associated with septic discharges. Determination and qualification of impacts is complicated due to the interaction of many physical, biological, and chemical processes. Many agencies continue to study these impacts and the results—as they become available—will be useful to resource managers responsible for protecting reservoir water quality. A discussion of the potential impacts from recreational boating activities on water quality follows:

- **Water Clarity.** Several studies have shown recreational boating activities to affect water clarity (summarized in Asplund, 2000). The primary impacts are in shallow reservoirs or shallow areas of reservoirs and near-shore sites were resuspension of sediments occurs or the shoreline is susceptible to erosion. The degree of impact varied but several studies established a direct correlation between the level of boat activity and increases in turbidity. In addition, the resuspension of sediments can increase the availability of

phosphorus and stimulate algal growth, which may in turn reduce water clarity. However, impacts are most often localized with water clarity returning to the same level as prior to the disturbance within hours after boat activity ceased.

- **Petroleum Products.** Conventional outboard engines and PWCs have predominantly used two-cycle engines. Because two-cycle engines accomplish fuel intake and exhaust in the same cycle, they tend to release unburned fuel and oil along with the exhaust gases. As much as 20 to 30 percent of the gas/oil mixture can be released unburned directly into the water (EPA 2002) . Because of pollution concerns from marine engines, EPA has been working to develop and implement emission standards for commercial and recreational marine engines (EPA 1996a, EPA 1996b). The marine industry continues to developed better technology for a new generation of low emission, high performance engines. These four-stroke engines (which isolate the intake and exhaust cycles, reducing the amount of pollution generated by as much as 90% [EPA 2002]) or direct fuel injection two-stroke engines, are being phased into the marketplace between 1998 and 2006. By 2006, all new outboard engines and PWC sold in the U.S. will be required to use the low-pollution engines (EPA 2002).

  Studies of the aquatic environment have predominantly focused on petroleum hydrocarbon compounds. Many of these compounds are of concern because they are known and/or suspected carcinogens and some leave a noticeable taste and odor in drinking water supplies. These compounds are more commonly released into the water from boat motors or from oil and gas spillage at marinas. Studies have shown these pollutants are usually not detectable in the water, except during the peak boating season and more often during weekends (Mastran et al., 1994; Reuter et. Al., 1998). Because these pollutants tend to diminish quickly due to dilution and evaporation, concentrations of these pollutants can be affected by water inflow and volume. Therefore, isolated coves with marinas or high boat traffic may experience higher concentrations than open water areas. It is also possible that higher concentrations could be found in smaller tributary reservoirs which have a lot of boating activity and long water retention times. Tributary reservoirs tend to stratify during summer (when cold bottom water is separated from the warmer upper layer). This can prevent surface waters pollutants from mixing with deeper water and would decrease the rate of dilution, but could increase evaporation, if the pollutants remain in closer proximity to the surface. In 2000, TVA assisted Alabama Department of Environmental Management in monitoring for the fuel octane enhancer methyl-tertiary-butyl-ether (MTBE) at 45 water intakes (ground water and surface water sources) across North Alabama. Intakes with surface water sources were monitored quarterly with samples taken immediately after the 4th of July and Labor Day Holidays. MTBE was not detected in any samples.

More studies are needed on the short and long term effects of these contaminants. Because many hydrocarbons do not remain for long periods of time in the aquatic environment, effects may not be severe. However, some of these compounds attach to suspended particles and sediment and can persist in the environment for several years. Other sources of these pollutants include urban runoff and air born particles that settle to the surface. Concentrations in both the water and sediments will vary depending on these inputs, but some studies have shown increased concentrations close to marinas and boat ramps (Mastran et al., 1994).

- **Pathogens.** Some violations of health standards for fecal coliform (the indicator used to detect sewage pollution) have been related to periods of high-intensity recreational use, such as holiday weekends, and this could be due to either boater discharges or the activities that stir up sediments where pathogens might be concentrated, or both (EPA, 2000). The presence of pathogens can be attributed to a variety of sources such as wildlife, cattle, improperly functioning septic tanks, and combined sewer outfall overflows. Studies that have attempted to determine whether there is a correlation between boating density and pathogen concentrations in reservoirs are divided in their conclusions.

  TVA conducts bacteriological monitoring at over 200 locations along the Tennessee River and its major tributaries, including four recreational sites on Tims Ford Reservoir (Winchester City Park Boat Ramp, Tims Ford State Boat Ramp, Dry Creek Embayment Beach, and Estill Springs Park Swim Area). Only Dry Creek Embayment Beach has experienced elevated concentrations of fecal coliform. The primary source of contamination has been waterfowl which is consistent with findings at other monitoring stations Valleywide.

TVA has developed the Tennessee Valley Clean Marina Initiative to addresses activities such as sewage management, oil and gas control, marina siting, and erosion prevention at marina sites. The program certifies marinas that are in compliance with pollution-control standards and allows them to use the Clean Marina logo and flag. TVA also participates in the National Clean Boating Campaign, which is sponsored by federal agencies, conservation organizations, and the boating industry. Each summer TVA's twelve Watershed Teams help organize Clean Boating events at Tennessee Valley marinas and boat ramps. Boaters learn about proper fueling techniques and about products like bilge socks that can help keep pollutants out of the water. In addition, TVA's Shoreline Management Policy (SMP) sets forth policy for improving the protection of shoreline and aquatic resources, in part, through the promotion of best management practices for the construction of docks, management of vegetation, stabilization of shoreline erosion, and other shoreline alterations. TVA's Watershed Teams also work in cooperation with other agencies and groups to implement bank stabilization projects.

Tims Ford has been designated as a no discharge reservoir. This means the only legal marine sanitation devices are Type III holding tanks that must be pumped into sewage treatment systems. No sewage, treated or untreated, is allowed to be discharged into these water bodies. Sewage is to be discharged at shore-based disposal sites. As a part of TVA's Clean Marina Initiative, TVA, in cooperation with local marinas, is seeking to establish several pumpout facilities on Tims Ford Reservoir.

7: Supporting Information

Project Participants

Study Team

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Acronyms and Abbreviations

cfs	Cubic Feet per Second
FEIS	Final Environmental Impact Statement
GIS	Geographic Information System
kW	kilowatt
Land Plan	Tims Ford Land Management and Disposal Plan
Model	Boating Capacity Model
PUA	Public Use Area
PWC	Personal Watercraft
QUAL	Quality Upgrading and Learning Process
RMIS	Recreation Management Information System
SPSS	“Statistical Package for Social Sciences” software program
Study Team	Tims Ford Reservoir Boating Capacity Study Team
TDEC	Tennessee Department of Environment and Conservation
TVA	Tennessee Valley Authority
TWRA	Tennessee Wildlife Resources Agency

APPENDIX 1: QUALITY UPGRADING AND LEARNING (QUAL) PROCESS

QUALITY UPGRADING AND LEARNING (QUAL) PROCESS TO DETERMINE RECREATIONAL CARRYING CAPACITY

Step I. Management Goal: Quality Recreation

a. Operational definition of "quality recreation" (Wagar 1966)
   1. Provide a range of recreation opportunities
   2. Zoning different activities in different places
   3. Specify management practices by zones
   4. Interpret area attractions
   5. Survey visitors for perceptions of conditions

b. Obtain consensus on management goal
   1. Determine interest groups involved
   2. Identify area changes or issues of concern
   3. Determine appropriate planning process
   4. Consider level of planning effort needed

Step II. Inventory Existing Conditions

a. Reconnaissance of area
   1. Maps, preliminary examination of ecological characteristics
   2. Special significance or importance of area
   3. Examine patterns of use, types of users
   4. Examine area history, records, management practices

b. Comparison of area to other recreation areas
   1. Use Recreation Opportunity Spectrum (ROS) land classification system or equivalent

b. Divide management area into subunits
   1. Use Recreation Area Division and Subdivision (RADS) system
   2. Identify Travel Pattern Concentrations (TPC) recreation settings and priorities for management attention

b. Measurements on priority subunits
   1. Site analysis of TPC patterns of use, impacts
   2. Assess site impacts
   3. Visitor observations, counts, interviews

Step III. Analysis of Alternatives

a. Locate study area on ROS classes framework (or equivalent)
   1. Indicate relative abundance of areas in ROS classes for the region
   2. Assess implications of changing study area conditions into another class, in terms of relative abundance
   3. Find out what area visitors perceive as the existing range of opportunities for their activity/experience

b. Determine if there are area aspects of uniqueness or fragility (determined by inventory, visitor perception)

c. Other factors to consider: visitor safety, legislative mandates, etc.

d. Public review and discussion

Step IV. Objective-Setting and Implementation

a. Select desired recreation opportunities/set of conditions to be achieved or maintained as management objectives
    1. Specify indicators of desired conditions (social, ecological, managerial) to achieve or maintain
b. Develop interpretive plan to highlight area significance, and to direct use to particular places
c. Select management strategies, techniques, prepare plan
d. Public review and discussion
e. Implement strategies/techniques to achieve objectives
f. Communicate progress in achieving programs and objectives

Step V. Monitoring and Evaluation

a. Periodic re-measurement of key indicators of desired conditions
b. Evaluation of indicator data on changes occurring, achievement of objectives
c. Decisions to take management actions to deal with changes to begin process of re-planning

APPENDIX 2: RECREATION MANAGEMENT INFORMATION SYSTEMS (RMIS)

RECREATION MANAGEMENT INFORMATION SYSTEM (RMIS)

A Systematic Process for Gathering and Utilizing Visitor Data for Recreation Area Management Decisions

STEP I. DESIGN (with managers)

1. Select/recruit study supervisor.
2. Identify concerns/questions to be answered by the study.
3. Examine study area, determine user groups and sampling points.
4. Develop a survey sampling plan and boat count schedule.
5. Develop survey instruments and count forms.
6. Prepare press release for local news media.

STEP II. DATA COLLECTION

1. Train field data collectors in exit interview and count methods.
2. Maintain quality control during data collection.
3. Train and supervise data collectors in data coding and entry.
4. Prepare bi-weekly summary reports.

STEP III. DATA ANALYSIS AND REPORTING

1. Summarize and categorize cleaned and edited survey data.
2. Prepare maps of spatial data from surveys.
3. Tally count results and prepare count results maps.
4. Prepare preliminary report for managers' review.
5. Discuss report, modify as needed.
6. Prepare final technical report for distribution.

STEP IV. DISCUSSION OF DATA, FOLLOW-UP (with managers)

1. Discuss to determine whether data and data collection procedures are clearly understood.
2. Discuss implications of data for priority management issues.
3. Discuss and designate Service Areas and Management Compartments and discuss management objectives for Compartments.
4. Discuss needs for additional or other kinds of data, ways to improve data collection and sample.
5. Design data collection for following year.

APPENDIX 3: BOAT COUNT OBSERVATIONS SCHEDULE

CARRYING CAPACITY STUDY - DATES AVAILABLE FOR ELK/DUCK TEAM MEMBERS TO PARTICIPATE IN SURVEY - 2 PEOPLE PER BOAT PER SERVICE AREA

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
					1	**2** TWO BOAT COUNTERS (CONTRACTORS) 5~6
3 TWO BOAT COUNTERS (CONTRACTORS) 3~4	4	5	6	7	8	**9** TWO BOAT COUNTERS (CONTRACTORS) 3~4
10 TWO BOAT COUNTERS (CONTRACTORS) 5~6	11	**12** TWO BOAT COUNTERS (WATERSHED TEAM) 5~6	**13** TWO BOAT COUNTERS (WATERSHED TEAM) 3~4	**14** TWO BOAT COUNTERS (WATERSHED TEAM) 1~2	15	**16** TWO BOAT COUNTERS (CONTRACTORS) 1~2
17 TWO BOAT COUNTERS (CONTRACTORS) 1~2	**18** TWO BOAT COUNTERS (WATERSHED TEAM)	**19** TWO BOAT COUNTERS (WATERSHED TEAM)	**20** TWO BOAT COUNTERS (WATERSHED TEAM)	**21** TWO BOAT COUNTERS (WATERSHED TEAM)	**22** TWO BOAT COUNTERS (WATERSHED TEAM)	**23** TWO BOAT COUNTERS (CONTRACTORS) 1~2
24 TWO BOAT COUNTERS (CONTRACTORS) 3~4	25	26	27	28	29	**30** TWO BOAT COUNTERS (CONTRACTORS) 5~6

J U N E 2 0 0 1

LEGEND

Boat Counting Days

Alternate Boat Counting Days

3~4 Service Area Identification Numbers

CARRYING CAPACITY STUDY - DATES AVAILABLE FOR ELK/DUCK TEAM MEMBERS TO PARTICIPATE IN SURVEY - 2 PEOPLE PER BOAT PER SERVICE AREA

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1 TWO BOAT COUNTERS (CONTRACTORS) **1~2**	2	3	4	5	6	**7** TWO BOAT COUNTERS (CONTRACTORS) **5~6**
8 TWO BOAT COUNTERS (CONTRACTORS) **1~2**	9	10	**11** TWO BOAT COUNTERS (WATERSHED TEAM) **5~6**	**12** TWO BOAT COUNTERS (WATERSHED TEAM) **1~2**	**13** TWO BOAT COUNTERS (WATERSHED TEAM) **3~4**	**14** TWO BOAT COUNTERS (CONTRACTORS) **3~4**
15 TWO BOAT COUNTERS (CONTRACTORS) **5~6**	**16** TWO BOAT COUNTERS (WATERSHED TEAM)	**17** TWO BOAT COUNTERS (WATERSHED TEAM)	**18** TWO BOAT COUNTERS (WATERSHED TEAM)	19	20	21
22	23	24	25	26	27	28
29	30	31				

JULY 2001

LEGEND

Boat Counting Days

Alternate Boat Counting Days

3~4 Service Area Identification Numbers

APPENDIX 4: BOAT RAMP EXIT INTERVIEW SCHEDULE

TIMS FORD EXIT RAMP INTERVIEW SCHEDULE Public and Community Ramps				
Location	**Weekday AM**	**Weekday PM**	**Weekend AM**	**Weekend PM**
Tims Ford Dam Reservation	**One interviewer** 6/18	**One interviewer** 5/31, 7/11	**One interviewer** 6/2	**Two interviewers** 6/10 **One interviewer** 6/3 **One interviewer** 7/1
Lost Creek PUA	**Two interviewers** 6/6	**Two interviewers** 7/10	**One interviewer** 6/16	**One interviewer** 7/8
Turkey Creek PUA	**Two interviewers** 6/14	**Two interviewers** 6/14, 7/18	**One interviewer** 7/15	**One interviewer** 6/10 **Two interviewers** 7/14
Pleasant Grove PUA	**Two interviewers** 6/28	**Two interviewers** 6/18, 6/6	**Two interviewers** 7/8	**One interviewer** 6/16 **Two interviewers** 6/17
Devils Step Campground	**One interviewer** 5/30, 6/29	**Two interviewers** 6/28, 5/30	**Two interviewers** 6/16	**One interviewer** 6/30 **Two interviewers** 7/15
Rock Creek PUA (Tyler Market)	**One interviewer** 6/7, 6/22	**Two interviewers** 6/22, 7/16	**Two interviewers** 6/30	**One interviewer** 6/9, 6/30 **One interviewer** 7/15
Winchester City Park (Tims Ford Bass Club)	**One interviewer** 5/31, 6/25	**Two interviewers** 6/7, 7/6	**One interviewer** 6/10 **One interviewer** 7/1	**One interviewer** 6/16 **One interviewer** 7/1
Tims Ford State Park	**One interviewer** 7/10	**One interviewer** 6/25, 6/29	**One interviewer** 7/15	**One interviewer** 6/9, 7/8 **One interviewer** 7/1
Hopkins Point Community Ramp	–	–	**One interviewer** 6/9	**One interviewer** 7/15
Highland Ridge Community Ramp	–	–	**One interviewer** 6/9	**One interviewer** 6/30
Dripping Springs Community Ramp	–	–	**One interviewer** 6/10	**One interviewer** 6/2
Tims Ford Marina	–	–	**One interviewer** 6/23, 6/24 **One interviewer** 7/1	**One interviewer** 6/23, 6/24 **One interviewer** 7/1
Holiday Resort & Marina	–	–	**One interviewer** 6/23, 6/24 **One interviewer** 7/7	**One interviewer** 6/23, 6/24 **One interviewer** 7/7

This table shows that we will need help on the following **weekdays**:

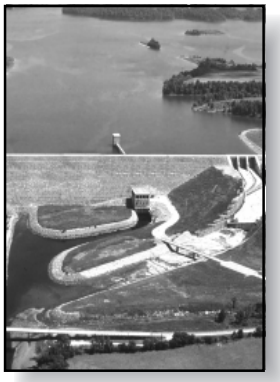
Wed. May 30: One shift 10am to 2pm, and one shift 4 to 8pm.
Thur. May 31: One shift 10am to 2pm, and one shift 4 to 8pm.
Wed. June 6: One shift 10am to 2pm, and one shift 4 to 8pm.
Thur. June 7: One shift 10am to 2pm, and one shift 4 to 8pm.
Thur. June 14: One shift 10am to 2pm, and one shift 4 to 8pm.
Mon. June 18: One shift 10am to 2pm, and one shift 4 to 8pm.
Fri. June 22: One shift 10am to 2pm, and one shift 4 to 8pm.
Mon. June 25: One shift 10am to 2pm, and one shift 4 to 8pm.
Thur. June 28: One shift 10am to 2pm, and one shift 4 to 8pm.
Fri. June 29: One shift 10am to 2pm, and one shift 4 to 8pm.
Fri. July 6: One shift 4 to 8pm.
Tue. July 10: One shift 10am to 2pm, and one shift 4 to 8pm.
Wed. July 11: One shift 4 to 8pm.
Mon. July 16: One shift 4 to 8pm.
Wed. July 18: One shift 4 to 8pm.

This table shows that we will need help on the following **weekends**:

Sat. June 2: One shift 10am to 2pm, and one shift 4 to 8pm.
Sun. June 3: One shift 4 to 8pm.
Sat. June 9: Two shifts 10am to 2pm, and two shifts 4 to 8pm.
Sun. June 10: Two shifts 10am to 2pm, and two shifts 4 to 8pm.
Sat. June 16: Two shifts 10am to 2pm, and two shifts 4 to 8pm.
Sun. June 17: One shift from 4 to 8pm
Sat. June 23: Two shifts 10am to 2pm, and two shifts 4 to 8pm.
Sun. June 24: Two shifts 10am to 2pm, and two shifts 4 to 8pm.
Sat June 30: One shift 10am to 2pm, and two shifts 4 to 8pm.
Sun. July 1: One shift 10am to 2pm, and three shifts 4 to 8pm.
Sat. July 7: Two shifts 10am to 2pm, and two shifts 4 to 8pm.
Sun. July 8: One shift 10am to 2pm, and two shifts 4 to 8pm.
Sat. July 14: One shift 4 to 8pm.
Sun. July15: Two shifts 10am to 2pm, and two shifts 4 to 8pm.

APPENDIX 5: TIMS FORD EXIT INTERVIEW

Tims Ford
Boater Survey
Exit Interview



Supporting a Thriving River System

TIMS FORD BOATER SURVEY

Ramp Users

Date _____/_____/_____ Location _____ Survey No. _____

Time _____ (military clock: 8:00 am = 0800, 4:00 pm = 1600, 8:00 pm = 2000)

"Hello. My name is _____. I am conducting a survey of boaters to help TVA learn more about your boating experience on Tims Ford Reservoir. Could I take a few minutes of your time to ask these questions? This survey is voluntary and strictly confidential."

1. Have you boated on Tims Ford **before this visit**? ☐ YES ☐ NO

   IF YES... How many years have you been boating on Tims Ford? _____ YEARS

   (*IF THIS IS YOUR FIRST YEAR, ANSWER "0"*)

2. How many weekend and weekdays did you boat on Tims Ford last year?

   NUMBER OF WEEKEND DAYS IN 2000 _____ NUMBER OF WEEKDAYS IN 2000 _____

3. How many are in your party **today**? _____ PEOPLE

   How many of those are under 18 years of age? _____ INDIVIDUALS

SKIP QUESTION (4.) WHEN INTERVIEWING FROM A COMMUNITY RAMP

4. How many days will you be visiting Tims Ford on this visit? _____ DAYS

5. How much time did you spend on the water **today**? _____ HOURS _____ MINUTES

6. What type of boat(s) did you use **today**? (*CHECK ALL THAT APPLY*)

   ☐ Runabout/Speedboat/Ski boat
   ☐ Houseboat
   ☐ Fishing boat/Bass boat
   ☐ Cabin cruiser
   ☐ Pontoon boat
   ☐ Rowboat/canoe
   ☐ Personal watercraft (Jet Ski™)
   ☐ Sailboat/Sailboard
   ☐ High performance boat (cigarette boat)
   Other _____

7. What is the length of the primary boat you used **today**? _____ FEET

8. What is the horsepower of that boat? _____ HP

9. Please estimate the percentage of time you spent **today** on the following activities.

Fishing (from boat)	_____ %	Swimming (from boat)	_____ %
Cruising	_____ %	Relaxing/Sunning (boat stationary)	_____ %
Waterskiing/water sports (tubing)	_____ %	Other Activities	_____ %
Personal watercraft use (Jet Ski™)	_____ %	describe: _____	

(*TOTAL SHOULD = 100%*)

Now I would like to ask you some questions about where you go on Tims Ford.

SHOW BOATER MAP OF LAKE AND TELL THEM: "YOU ARE HERE"

10. Do you have a **favorite** location to go on Tims Ford? ☐ YES ☐ NO

11. **Why** is that/are those your favorite location(s)?

Name of first location: _____

(*Please circle the above location on the map and mark as **F1***)

Reasons: _____

(*Be as specific as possible in your descriptions*)

Name of second location: _____

(*Please circle the above location on the map and mark as **F2***)

Reasons: _____

(*Be as specific as possible in your descriptions*)

12. Are there any locations on Tims Ford you deliberately **avoid**? ☐ YES ☐ NO

13. **Why** do you avoid that/those location(s) of the lake?

Name of first location: _____

(*Please circle the above location on the map and mark as **A1***)

Reasons: _____

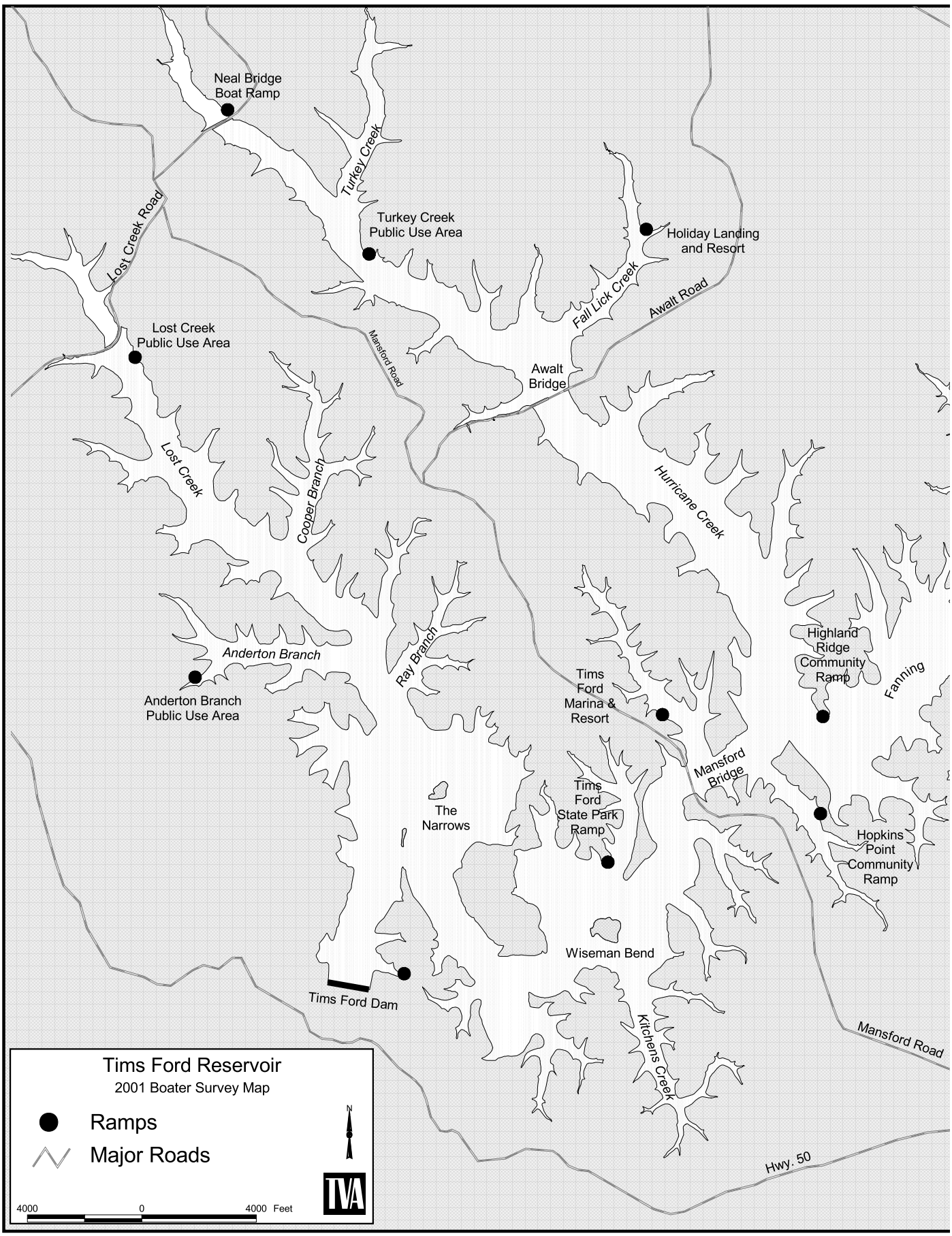
(*Be as specific as possible in your descriptions*)

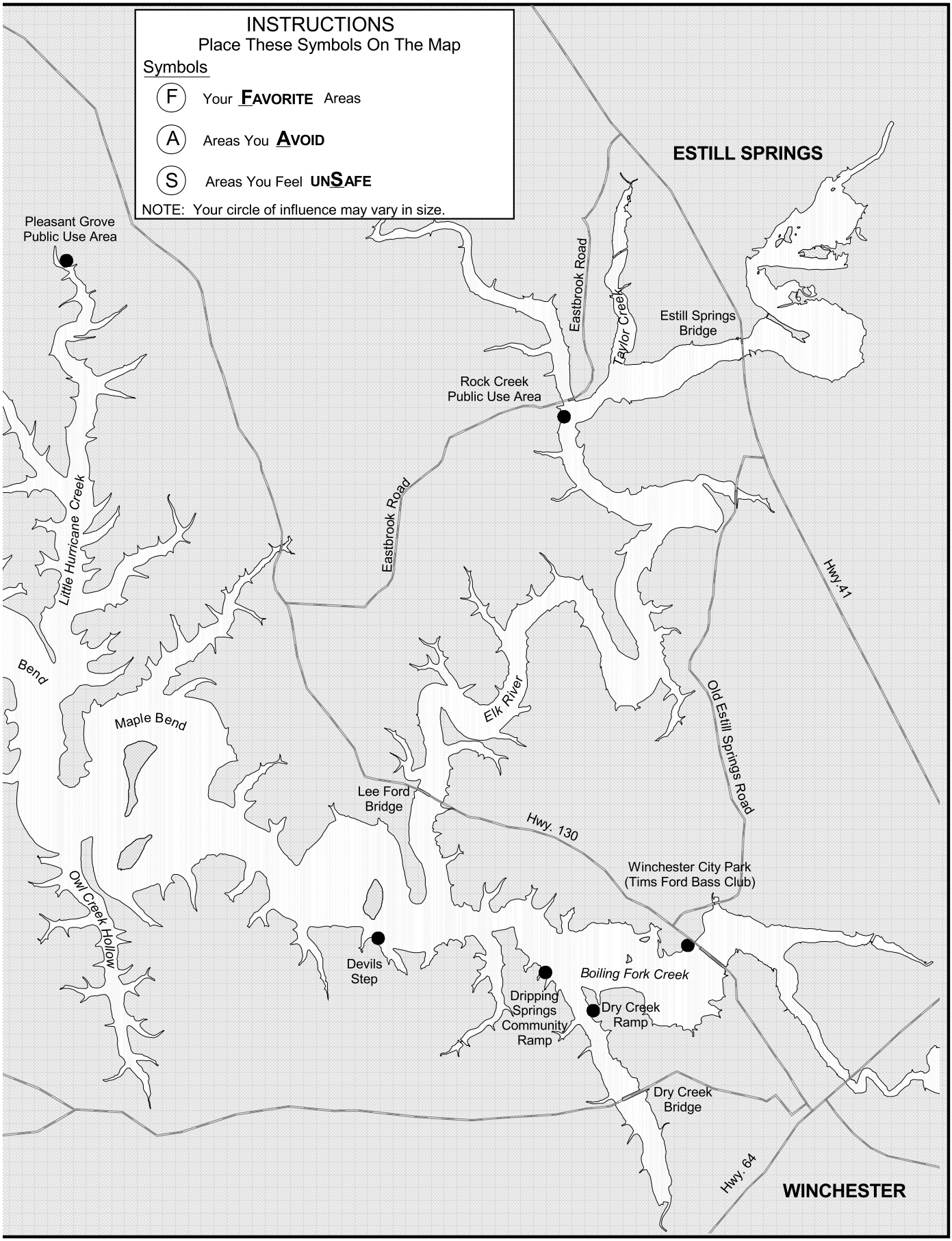
Name of second location: _____

(*Please circle the above location on the map and mark as **A2***)

Reasons: _____

(*Be as specific as possible in your descriptions*)


Neal Bridge
Boat Ramp
Turkey Creek
Turkey Creek
Public Use Area
Holiday Landing
and Resort
Lost Creek Road
Fall Lick Creek
Awalt Road
Lost Creek
Public Use Area
Mansford Road
Awalt
Bridge
Lost Creek
Cooper Branch
Hurricane Creek
Anderton Branch
Ray Branch
Highland
Ridge
Community
Ramp
Fanning
Anderton Branch
Public Use Area
Tims
Ford
Marina &
Resort
Mansford
Bridge
Tims
Ford
State Park
Ramp
The
Narrows
Hopkins
Point
Community
Ramp
Wiseman Bend
Tims Ford Dam
Kitchens Creek
Mansford Road
Hwy. 50
Tims Ford Reservoir
2001 Boater Survey Map
Ramps
Major Roads
N
4000
0
4000 Feet
TVA


INSTRUCTIONS
Place These Symbols On The Map
Symbols
F Your FAVORITE Areas
A Areas You AVOID
S Areas You Feel UNSAFE
NOTE: Your circle of influence may vary in size.
ESTILL SPRINGS
Pleasant Grove Public Use Area
Eastbrook Road
Taylor Creek
Estill Springs Bridge
Rock Creek Public Use Area
Little Hurricane Creek
Eastbrook Road
Hwy.41
Bend
Maple Bend
Elk River
Old Estill Springs Road
Lee Ford Bridge
Hwy. 130
Winchester City Park (Tims Ford Bass Club)
Owl Creek Hollow
Devils Step
Boiling Fork Creek
Dripping Springs Community Ramp
Dry Creek Ramp
Dry Creek Bridge
Hwy. 64
WINCHESTER

14. Are there any locations on Tims Ford where you feel **unsafe**? ☐ YES ☐ NO

15. Why do you feel unsafe at that/those location(s) on the lake?

Name of first location: _____

(*Please circle the above location on the map and mark as **S1***)

Reasons: _____

(*Be as specific as possible in your descriptions*)

Name of second location: _____

(*Please circle the above location on the map and mark as **S2***)

Reasons: _____

(*Be as specific as possible in your descriptions*)

16. Please rate **how safe** you felt while boating on Tims Ford today. (*HAND SAFETY CARD*)

1	2	3	4	5
Not at all Safe		Moderately Safe		Extremely Safe

17. Do you feel there are an adequate number of boat ramps, parking areas, and marinas on Tims Ford?

Boat ramps	☐ Too many	☐ About right	☐ Need more
Parking areas	☐ Too many	☐ About right	☐ Need more
Marinas	☐ Too many	☐ About right	☐ Need more

(*HAND CONFLICT CARD FOR 18-21*)

18. While you were boating on the lake **today**, how often did you **see** the following?

	Never	Seldom	Occasionnally	Often	Very often
Ski or fishing boat	☐	☐	☐	☐	☐
Personal watercraft (Jet Ski™)	☐	☐	☐	☐	☐
Pontoon/houseboat	☐	☐	☐	☐	☐

19. How did this affect your enjoyment?

	Added to my enjoyment	No effect on my enjoyment	Detracted from my enjoyment
Ski or fishing boat	☐	☐	☐
Personal watercraft (Jet Ski™)	☐	☐	☐
Pontoon/houseboat	☐	☐	☐

20. While you were boating on the lake **today**, how often did you **hear** the following?

	Never	Seldom	Occasionnally	Often	Very often
Ski or fishing boat	☐	☐	☐	☐	☐
Personal watercraft (Jet Ski™)	☐	☐	☐	☐	☐
Pontoon/houseboat	☐	☐	☐	☐	☐

21. How did this affect your enjoyment?

	Added to my enjoyment	No effect on my enjoyment	Detracted from my enjoyment
Ski or fishing boat	☐	☐	☐
Personal watercraft (Jet Ski™)	☐	☐	☐
Pontoon/houseboat	☐	☐	☐

(*HAND CROWDING CARD*)

22. Did you feel crowded by the number of boaters on Tims Ford **today** at the following locations?

	Not at all Crowded		Moderately Crowded		Extremely Crowded
At the boat ramp	1	2	3	4	5
On the water	1	2	3	4	5

23. Have you noticed any **positive or negative changes** at Tims Ford in the last five years? ☐ YES ☐ NO

(*IF YES*... can you describe those changes)

Positive:_____

Negative:_____

24. Where do you live? _____/_____/_____
City State Zip

25. Do you have any additional comments? (*write comments on back cover of survey*)

THANK YOU FOR YOUR TIME

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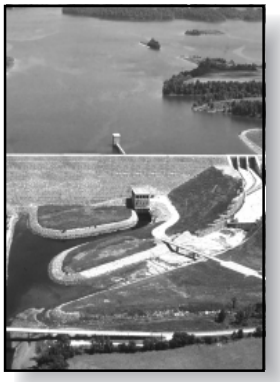
APPENDIX 6: TIMS FORD MAIL Questionnaire

Tims Ford
Boater Survey

Mail Questionnaire



Supporting a Thriving River System

TVA

TIMS FORD BOATER SURVEY

I. Please tell us how long you've been boating on Tims Ford and how often you boat there:

1. How many years have you been boating on Tims Ford? _____ YEARS
   (*IF THIS IS YOUR FIRST YEAR, ANSWER "0"*)

2. About how many days did you boat on Tims Ford **last year**? _____ DAYS

   How many weekend and weekdays did you boat on Tims Ford last year?

   NUMBER OF WEEKEND DAYS IN 2000 _____ NUMBER OF WEEKDAYS IN 2000 _____

*II. Now tell us about your boating experience **the last day** you boated on Tims Ford:*

3. When was the last day you boated on Tims Ford? _____/_____/_____
   Month Day Year

4. What time did you leave and what time did you return to your slip or dock the last day you boated?
   (If you made several trips, indicate when you first went out and when you finished boating that day.)

   TIME DEPARTED _____ : _____ *circle* AM or PM

   TIME RETURNED _____ : _____ *circle* AM or PM

5. What type of boat did you use the last day you boated? (*CHECK ALL THAT APPLY*)

   - ☐ Runabout/Speedboat/Ski boat
   - ☐ Fishing boat/Bass boat
   - ☐ Pontoon boat
   - ☐ Personal watercraft (Jet Ski™)
   - ☐ High performance boat (cigarette boat)
   - ☐ Houseboat
   - ☐ Cabin cruiser
   - ☐ Rowboat/canoe
   - ☐ Sailboat/Sailboard
   - Other _____

6. What is the **length** of the primary boat you used the last day you boated? _____ FEET

7. What is the **horsepower** of that boat? _____ HP

8. Please estimate what percent of your time you spent on the following activities while boating on Tims Ford the last time out.

Fishing (from boat)	_____ %	Swimming (from boat)	_____ %
Cruising	_____ %	Relaxing/Sunning (boat stationary)	_____ %
Waterskiing/water sports (tubing)	_____ %	Other Activities	_____ %
Personal watercraft use (Jet Ski™)	_____ %	(describe) _____	

(*TOTAL SHOULD = 100%*)

III. Now we would like to ask you some questions about where you go on Tims Ford. (Please take some time to orient yourself to the map on the following pages)

9. Do you have a **favorite** location to go on Tims Ford? ☐ YES ☐ NO

10. **Why** is that/are those your favorite location(s)?

Name of first location: _____

(*Please circle the above location on the map included and mark as **F1***)

Reasons: _____

(*Be as specific as possible in your descriptions*)

Name of second location: _____

(*Please circle the above location on the map and mark as **F2***)

Reasons: _____

(*Be as specific as possible in your descriptions*)

11. Are there any locations on Tims Ford you deliberately **avoid**? ☐ YES ☐ NO

12. **Why** do you avoid that/those location(s) on the lake?

Name of first location: _____

(*Please circle the above location on the map and mark as **A1***)

Reasons: _____

(*Be as specific as possible in your descriptions*)

Name of second location:_____

(*Please circle the above location on the map and mark as **A2***)

Reasons: _____

(*Be as specific as possible in your descriptions*)

13. Are there any locations on Tims Ford where you feel **unsafe**? ☐ YES ☐ NO

14. Why do you feel unsafe at that/those location(s) on the lake?

Name of first location: _____

(*Please circle the above location on the map and mark as* ***S1***)

Reasons: _____

(*Be as specific as possible in your descriptions*)

Name of second location:_____

(*Please circle the above location on the map and mark as* ***S2***)

Reasons: _____

(*Be as specific as possible in your descriptions*)

15. Please rate **how safe** you felt while boating on Tims Ford the last day you boated (*circle one number*)

1	2	3	4	5
Not at all Safe		Moderately Safe		Extremely Safe

16. For boat ramps, parking areas, and marinas, do you feel that Tims Ford has **too many**, **about the right number**, or it **needs more**?

Boat ramps	☐ Too many	☐ About right	☐ Needs more
Parking areas	☐ Too many	☐ About right	☐ Needs more
Marinas	☐ Too many	☐ About right	☐ Needs more

17. Did you feel crowded by the number of boaters on the water the last time you boated on Tims Ford? (*Please circle the number that best reflects your feelings.*)

1	2	3	4	5
Not at all Crowded		Moderately Crowded		Extremely Crowded

IV. Long-term preferences and general comments about Tims Ford:

18. Have you noticed any **positive** or **negative changes** at Tims Ford in the **last five years**? ☐ YES

(*IF YES*… can you describe those changes) ☐ NO

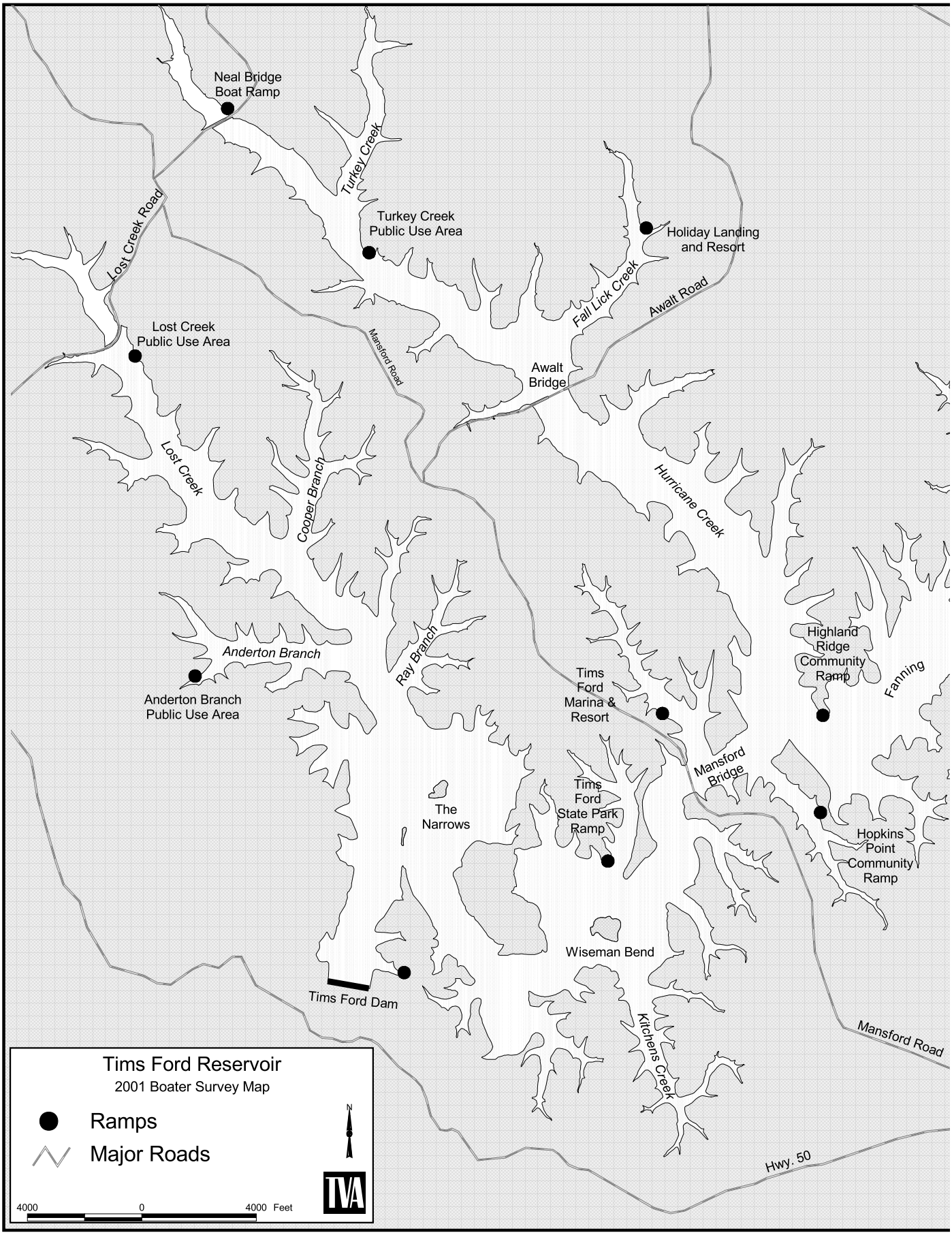
Positive:_____

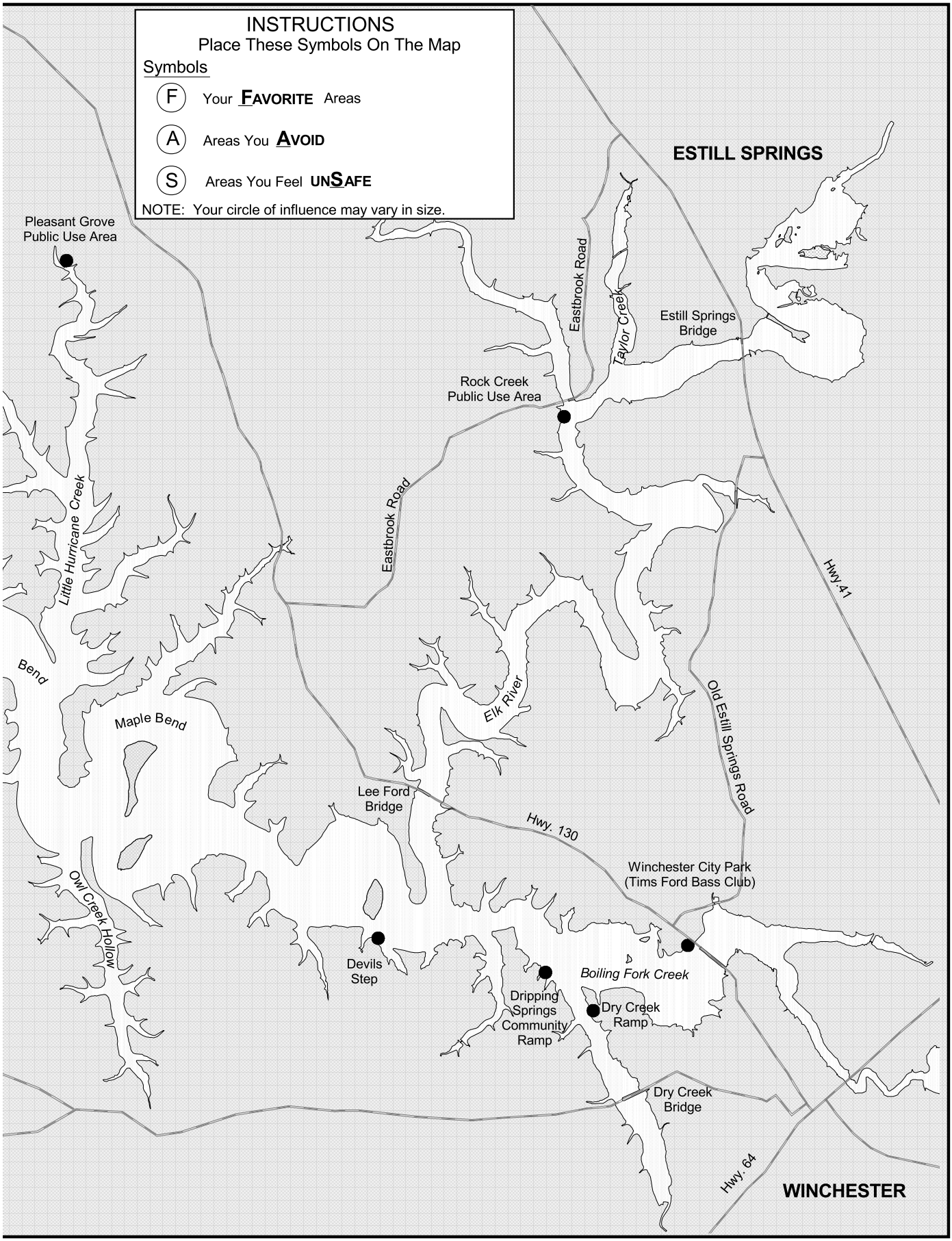
Negative:_____

19. Where do you live? _____/_____/_____
City State Zip

20. Do you have any additional comments?

THANK YOU FOR YOUR TIME


Neal Bridge
Boat Ramp
Turkey Creek
Turkey Creek
Public Use Area
Holiday Landing
and Resort
Lost Creek Road
Fall Lick Creek
Awalt Road
Lost Creek
Public Use Area
Mansford Road
Awalt
Bridge
Lost Creek
Cooper Branch
Hurricane Creek
Anderton Branch
Ray Branch
Highland
Ridge
Community
Ramp
Fanning
Anderton Branch
Public Use Area
Tims
Ford
Marina &
Resort
Mansford
Bridge
Tims
Ford
State Park
Ramp
The
Narrows
Hopkins
Point
Community
Ramp
Wiseman Bend
Tims Ford Dam
Kitchens Creek
Mansford Road
Hwy. 50
Tims Ford Reservoir
2001 Boater Survey Map
Ramps
Major Roads
N
4000
0
4000 Feet
TVA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S Areas You Feel UNSAFE
NOTE: Your circle of influence may vary in size.
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Estill Springs Bridge
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Maple Bend
Elk River
Old Estill Springs Road
Lee Ford Bridge
Hwy. 130
Winchester City Park (Tims Ford Bass Club)
Owl Creek Hollow
Devils Step
Boiling Fork Creek
Dripping Springs Community Ramp
Dry Creek Ramp
Dry Creek Bridge
Hwy. 64
WINCHESTER

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APPENDIX 7: STUDY RESULTS SHOWING PWC USE FROM RAMP USERS ON FOUR U.S. ARMY CORPS OF ENGINEERS RESERVOIRS

STUDY RESULTS SHOWING PWC USE FROM RAMP USERS ON FOUR U.S. ARMY CORPS OF ENGINEERS RESERVOIRS		
Percentage of PWC Use from Ramp Users		
Reservoir	**Percentage**	**Year of Study**
Bull Shoals, MO	10	1994
Shenango, PA	11	1994
Summersville, PA	14	1995
Beaver, AR	11	1995
All four reservoirs*	**11.5 average**	
*These reservoirs represent typical PWC use during those years. The data in this table was provided by John Titre, Park Studies, Inc.		

APPENDIX 8: EXIT INTERVIEWER DAILY RECORD

TIMS FORD BOATER SURVEY
Daily Record

Location:
1. Dam Reservation
2. Lost Creek PUA
3. Turkey Creek
4. Pleasant Grove PUA
5. Devils Step Campground
6. Rock Creek PUA (Tyler Market)
7. Winchester City Park (Tims Ford Bass Club)
8. Tims Ford State Park
9. Hopkins Point Community Ramp
10. Highland Ridge Community Ramp
11. Dripping Springs Community Ramp

Temperature:
1. 61-70
2. 71-80
3. 81-89
4. 90-over

Sky cover:
1. Clear
2. Partly Cloudy
3. Overcast
4. Raining

Wind:
1. Calm
2. Light Breeze(1-5 mph)
3. Windy (6-10 mph)
4. Very Windy (>10 mph)

Month/Day: May, Jun, Jul, _____ (circle one) (date) Start Time _____ End Time _____

PARKING LOT COUNTS				
START TIME*	VEHICLES WITH TRAILER	VEHICLES WITH PWC (JET SKI TRAILER)	VEHICLES WITHOUT TRAILER	TOTAL

* Begin Vehicle count at the **beginning** and **end** of EACH four-hour shift

NUMBER OF PARTIES THAT REFUSED TO PARTIPATE _____

REMARKS: (For example, report if the parking lot was full or nearly full) _____

_____

_____

_____

Please clip this page to each days package of completed questionnaires

APPENDIX 9: SUMMARY OF BOAT PREFERENCES AND BOAT COUNTS

TIMS FORD RESERVOIR - SUMMARY OF BOAT PREFERENCES AND BOAT COUNTS				
Management Compartments		**Survey Responses**		**Boat Count**
Number	**Acreage**	**Favorite Areas**	**Conflict Areas (Avoid/Unsafe)**	**(Average Weekend)**
1	248.29	R - 3 M - 0 P - 1	R - 0 M - 0 P - 4	0
2	1235.31	R - 46 M - 13 P - 74	R - 11 M - 9 P - 24	64
3	112.87	R - 1 M - 0 P - 0	R - 0 M - 0 P - 0	1
4	463.20	R - 17 M - 4 P - 17	R - 26 M - 9 P - 17	14
5	77.77	R - 2 M - 0 P - 0	R - 0 M - 0 P - 0	2
6	401.84	R - 19 M - 4 P - 8	R - 35 M - 19 P - 49	27
7	168.76	R - 15 M - 14 P - 15	R - 0 M - 1 P - 1	12
8	1792.83	R - 20 M - 14 P - 33	R - 7 M - 11 P - 15	62

R = Ramp Users
M = Marina Slip Users
P = Shoreline Property Owners

TIMS FORD RESERVOIR - SUMMARY OF BOAT PREFERENCES AND BOAT COUNTS				
Management Compartments		**Survey Responses**		**Boat Count**
Number	**Acreage**	**Favorite Areas**	**Conflict Areas (Avoid/Unsafe)**	**(Average Weekend)**
9	459.14	R - 28 M - 27 P - 20	R - 6 M - 9 P - 12	34
10	1940.63	R - 35 M - 58 P - 50	R - 80 M - 59 P - 94	154
11	143.61	R - 14 M - 12 P - 9	R - 0 M - 0 P - 0	11
12	127.05	R - 13 M - 3 P - 4	R - 11 M - 2 P - 5	7
13	675.20	R - 15 M - 14 P - 21	R - 6 M - 2 P - 2	20
14	47.27	R - 0 M - 1 P - 1	R - 1 M - 0 P - 0	1
15	85.83	R - 1 M - 4 P - 4	R - 0 M - 1 P - 0	5
16	54.52	R - 2 M - 13 P - 1	R - 1 M - 0 P - 1	6

R = Ramp Users
M = Marina Slip Users
P = Shoreline Property Owners

TIMS FORD RESERVOIR - SUMMARY OF BOAT PREFERENCES AND BOAT COUNTS				
Management Compartments		**Survey Responses**		**Boat Count**
Number	**Acreage**	**Favorite Areas**	**Conflict Areas (Avoid/Unsafe)**	**(Average Weekend)**
17	657.13	R - 10 M - 32 P - 15	R - 1 M - 2 P - 2	23
18	40.83	R - 1 M - 1 P - 2	R - 0 M - 0 P - 0	4
19	974.79	R - 46 M - 28 P - 34	R - 7 M - 4 P - 9	63
20	16.93	R - 0 M - 1 P - 0	R - 0 M - 0 P - 0	1
21	14.35	R - 0 M - 0 P - 0	R - 0 M - 0 P - 0	1
22	751.76	R - 32 M - 31 P - 15	R - 30 M - 13 P - 20	45
23	69.26	R - 0 M - 1 P - 1	R - 0 M - 0 P - 0	1
Total	10,560			558

R = Ramp Users
M = Marina Slip Users
P = Shoreline Property Owners