Alabama Power

600 North 18th Street
Hydro Services 16N-8180
Birmingham, AL 35203
205 257 4892 tel
tlmills@southernco.com

December 5, 2016

***VIA ELECTRONIC FILING***

Project No. 349
Martin Dam Project
Article 411 – Public Education and Outreach Plan

Ms. Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street N.E.
Washington, DC 20426

Dear Secretary Bose,

On December 17, 2015, the Federal Energy Regulatory Commission (FERC or Commission) issued a new license to Alabama Power Company (Alabama Power) for the Martin Dam Project (Project), FERC Project No. 349. In accordance with Article 411 of the new license, Alabama Power is required to file for Commission approval, within one year of license issuance, a revised Public Education and Outreach Plan. Article 411 requires the plan include:

> (1) a brochure for homeowners on best management practices for protecting the Lake Martin shoreline and establishing a vegetative buffer on private lands adjacent to the project boundary; (2) results of a striped bass hooking mortality study; (3) information for boaters and homeowners on methods to prevent shoreline erosion and sedimentation; (4) information about nuisance aquatic vegetation; (5) an "Adopt an Island" program to address litter control on licensee-owned project islands; (6) information on the licensee's participation in efforts to restore longleaf pine forests; and (7) a provision to review and update the plan every 6 years.

On August 1, 2016, Alabama Power sent a draft Public Education and Outreach Plan to the Alabama Department of Conservation of Natural Resources (ADCNR), U.S. Fish and Wildlife Service (USFWS) and the U.S. Bureau of Land Management (BLM), requesting comments or concurrence on the draft Plan within 30 days. Documentation of consultation, the agencies' comments, and Alabama Power's responses to those comments are included in Appendix A of the attached document. As of the date of this filing, the BLM had not provided any comments.

Alabama Power is herein filing, for FERC review and approval, a revised Public Education and Outreach Plan. If there are any questions concerning this submittal, please contact me at tlmills@southernco.com or 205-257-4892.

Sincerely,

Tina L Mills
Hydro Licensing Specialist

cc: Chris Greene – ADCNR
Taconya Goar – ADCNR
Damon Abernethy – ADCNR
Jeff Powell – USFWS
Jennifer Grunewald – USFWS
Duane Winters – BLM
John Sullivan – BLM
Alison McCartney – BLM

# ATTACHMENT
# FINAL PUBLIC EDUCATION AND OUTREACH PLAN

# PUBLIC EDUCATION AND OUTREACH PROGRAM PLAN

## MARTIN DAM PROJECT

FERC NO. 349

***Prepared by:***

Alabama Power

Birmingham, Alabama

December 2016

**PUBLIC EDUCATION AND OUTREACH PROGRAM PLAN**

**MARTIN DAM PROJECT**

**ALABAMA POWER COMPANY**
**BIRMINGHAM, ALABAMA**

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**(FERC NO. 349)**

**ALABAMA POWER COMPANY**
**BIRMINGHAM, ALABAMA**

# 1.0 INTRODUCTION

Alabama Power Company (Alabama Power) is the Federal Energy Regulatory Commission (FERC) licensee of the Martin Dam Hydroelectric Project (FERC No. 349). Alabama Power's draft Public Education and Outreach Program Plan (the 2011 Plan) was filed on December 9, 2011 as part of its response to FERC's August 11, 2011 Additional Information Request (AIR), which included a request to develop a Public Education and Outreach Program Plan (Plan). This Plan seeks to revise the 2011 Plan to incorporate items required by License Article 411, as well as update portions of the Plan to be consistent with Alabama Power's ever evolving Public Education efforts.

Article 411 of the Project license required Alabama Power to file for FERC approval, a Public Education and Outreach Program Plan, including: (1) a brochure for homeowners on best management practices for protecting the Lake Martin shoreline and establishing a vegetative buffer on private lands adjacent to the project boundary; (2) results of a striped bass hooking mortality study; (3) information for boaters and homeowners on methods to prevent shoreline erosion and sedimentation; (4) information about nuisance aquatic vegetation; (5) an "Adopt an Island" program to address litter control on licensee-owned project islands; (6) information on the licensee's participation in efforts to restore longleaf pine forests; and (7) a provision to review and update the plan every 6 years. Further, the article required Alabama Power to include an implementation schedule in the Plan.

FERC also required Alabama Power to consult with the Alabama Department of Conservation and Natural Resources (ADCNR), the U.S. Fish and Wildlife Service (USFWS), and the U.S. Bureau of Land Management (BLM) in the preparation and development of this plan. Documentation of consultation is discussed in further detail in Section 3 and in Appendix A.

### 1.1 PROJECT DESCRIPTION

The Martin Dam Project (hereinafter "Project") is an existing, licensed major hydroelectric facility owned and operated by Alabama Power. Lake Martin, the Project reservoir, is a 31 mile long impoundment located in Coosa, Elmore and Tallapoosa counties in east central Alabama, on the Tallapoosa River, near Dadeville. The Project includes a dam, powerhouse, reservoir, tailrace and certain Project lands which are enclosed by the Project Boundary.

## 2.0 PUBLIC OUTREACH ACTIVITIES AT THE MARTIN DAM PROJECT

Alabama Power conducts multiple outreach activities to educate the public regarding various aspects of hydroelectric power, the environment, recreation, and permitted activities on and around the Project. The following sections describe the current public education and outreach activities at the Project. Alabama Power will meet all license obligations; however, details of education and outreach activities, where not specifically prescribed in the License, are subject to modification by Alabama Power during the license term as needed, based on changes in technology, distribution methods, etc.

### 2.1 *SHORELINES* COMMUNICATIONS

*Shorelines*, formerly the title of Alabama Power's Shoreline Management newsletter, is now Alabama Power's multi-media strategy for public education regarding reservoir related information. The *Shorelines* media portfolio is intended to provide a modern and adaptive communications and public education strategy, which is necessary in a rapidly changing media and communications environment. The *Shorelines* media outlets are used to communicate lake activities and issues as well as provide education and information to homeowners and the general public. *Shorelines* is a dynamic mix of:

- direct mail, currently with a circulation of approximately 26,500[1](see Appendix B)
- website, located at https://apcshorelines.com (discussed further in Section 2.2)

[1] Approximate circulation as of January 2016

- *Alabama Power Shorelines* mobile application, which is available for iOS and Android devices and currently has more than 24,000 registered users
- blog, located at https://apcshorelines.com/blog/
- social media presence on Facebook, Twitter, and Instagram using the handle @apcshorelines

Both the website and certain print communications contain notices to property owners regarding the need to consult with Alabama Power for permits prior to conducting shoreline construction, maintenance and landscaping. Historically, this information has been provided to the public through Alabama Power's Reservoir Information System (1-800-LAKES11). Today, more and more people are using Alabama Power's *Shorelines* website and mobile application to obtain shoreline permitting information which combined, have more than 231,000 individual users.

## 2.2 ALABAMA POWER *SHORELINES* WEBSITE

Alabama Power's website contains valuable information regarding its reservoirs, shoreline permitting and recreation. The following is a sampling of the information available:

- permit guidelines (residential and non-residential)
- best management practices, including a brochure for homeowners on best management practices for protecting the shoreline and establishing a vegetative buffer on private lands adjacent to the Project Boundary (Appendix C)
- information for boaters[2] and homeowners on methods to prevent shoreline erosion and sedimentation
- useful links and other related information (e.g., pollution control programs, plant selection guides)
- electronic request for permit applications
- sample permits
- contact information
- public recreation facility locations
- special dam operations

[2] Information for boaters will be included in the Best Management Practices brochure and on the *Shorelines* website within one year of FERC approval of this Plan

- nuisance aquatic vegetation, including reporting and contact information
- "Adopt an Island" program on Lake Martin[3] (discussed further in Section 2.3)

In addition to these requirements, the *Shorelines* website also contains information on lake levels, generation status, recreation, hunting and fishing sites, reservoir history and facts, and the location of hazardous areas near dams. Alabama Power continuously updates its *Shorelines* website as information changes. Alabama Power's *Shorelines* website is located at https://apcshorelines.com and receives over 325,000 visits a year from over 200,000 individual users.

## 2.3 "ADOPT AN ISLAND" PROGRAM

In Article 411 of the Martin License, FERC requires Alabama Power to include an "Adopt an Island" program in its Public Education Plan in order to "address litter control on licensee-owned project islands." Alabama Power has identified 26 islands and island groups which Alabama Power owns within the Martin Project Boundary and which will be included in the "Adopt an Island" Program. Maps of Islands selected for inclusion in the program are included in Appendix D. These islands are classed as Natural/Undeveloped and are open to the public for a variety of recreational uses.

Alabama Power's "Adopt an Island" Program is an opportunity for local groups such as churches, scouting organizations, schools and other civic groups to "adopt" an island on Lake Martin and partner with Alabama Power to conduct litter removal from their adopted island throughout the year. Litter may include:

- cans, bottles, boxes, plastic, paper, white beaded foam
- bagged household trash
- tires
- sports equipment, fishing lures, floats, life jackets

[3] Information regarding the "Adopt an Island" program will be posted to the *Shorelines* website within 6 months of Plan approval by FERC.

Litter does NOT include aquatic plants, terrestrial plants, grasses, trees, underbrush, dead wood or drift wood. These items should be left undisturbed as they provide valuable wildlife habitat, protect against erosion and enhance water quality. If adopting groups identify nuisance aquatic vegetation, they should report it using Alabama Power's aquatic vegetation management website at https://apcshorelines.com/aquatic/.

Adopting groups will be responsible for transportation to and from the island(s), garbage bags or other containers used to hold litter as well as the proper disposal of the litter. Adopting groups will also be required to sign letters of understanding defining their roles and responsibilities concerning the adopted island and confirming that the island must remain natural, undeveloped and open for recreational use by the general public.

Large items found on the island, such as old piers, floats, or appliances, should be reported to the Alabama Power Martin Shoreline Management Office so that removal can be arranged.

Interested groups should contact the Martin Shoreline Management Office at (256) 825-0053.

## 2.4 STRIPED BASS HOOKING MORTALITY STUDY

For years, Lake Martin has been a destination for anglers hoping to catch large striped bass (*Morone saxatilis*). The "Gulf-strain" striped bass population in Lake Martin was established through stocking efforts by the ADCNR beginning in 1978. During the recent relicensing process for Martin Dam, concerns were raised regarding the occasional mortality of adult striped bass, primarily during the late summer. In 2010, Alabama Power contracted Dr. Steve Sammons of Auburn University to study the movement and survival of striped bass in the lake.

The final report, *Adult Striped Bass Habitat Use and the Effects of Catch and Release Angling During the Summer in Lake Martin, Alabama* (see Appendix E), determined that quality striped bass habitat (defined as water with temperatures <21.3 degrees C and dissolved oxygen concentrations >2.6 mg/L) decreased rapidly once the lake stratified during the late summer. Periodic late-summer mortalities of adult striped bass were likely associated with a lack of ideal habitat especially following periods of heavy rainfall and subsequent above average temperatures.

Additionally, the study found some preliminary evidence that striped bass which are caught and returned to the reservoir during summer months could have low survival rates. This was thought to be due to a combination of the warm waters found at the surface of the lake, barotrauma suffered from the changes in pressure as the fish are brought from cooler areas deep in the lake up to the surface and the physiological trauma inherent in the angling experience. However, these findings are considered preliminary due to a very small sample size and the authors recommended further study was necessary to verify initial findings.

In order to inform the public informed regarding the results of this study, within one year of Plan approval, Alabama Power will publish an article in *Shorelines* and submit an article that provides results of the striped bass hooking mortality study for publication in *Lake Magazine*[4].

## 2.5 LONGLEAF PINE RESTORATION

Through Longleaf Legacy, a partnership with Southern Company and its operating companies and the National Fish and Wildlife Foundation, Alabama Power works to restore Alabama's longleaf pine ecosystem. Since 2004, Longleaf Legacy projects have resulted in more than 26,000 acres of restored longleaf pine forest and more than 6,500 acres of new longleaf pine forest in Alabama. Information about the program is available on Southern Company's website at: http://www.southerncompany.com/what-doing/corporate-responsibility/economic-stewardship/ecosystems.cshtml.

## 2.6 NUISANCE AQUATIC VEGETATION

Aquatic vegetation in Project reservoirs is managed in compliance with local, state and federal laws and regulations to optimize all the uses of the reservoir.

Aquatic Plant Control will be considered if the vegetation:

- Creates a potential public health hazard by providing mosquito breeding habitat;

[4] *Lake Magazine: Lake Martin Alabama Edition* is a locally published, widely available magazine which serves the Lake Martin region of East Central Alabama

- Poses a threat to power generation facilities or water withdrawal structures;
- Restricts recreational use of the reservoir; and/or
- Poses a threat to the ecological balance of the reservoir.

Aquatic vegetation will be left in its natural state in areas which do not meet the above criteria (as deemed appropriate by Alabama Power biologists and staff) to enhance fishery habitat and reservoir aesthetics.

Alabama Power's aquatic plant control program is directed toward, but not limited to, exotic species listed in the "Alabama Nonindigenous Aquatic Plant Control Act," as noted in Table 2-1.

Public education is an essential part of the aquatic plant management program. Whether responding to complaints or requests, giving presentations on Alabama Power's invasive species management activities, interacting with various stakeholder groups and governmental agencies, or serving in various capacities in professional societies, the staff establishes credibility for the program and for Alabama Power. Maintaining good public relations enhances Alabama Power's monitoring of potential problems on Project reservoirs by encouraging communication among Alabama Power staff, lake residents, and visitors.

In 2015, Alabama Power developed a "Hydrilla Awareness" brochure as well as an "Aquatic Plant Management" webpage at https://apcshorelines.com/aquatic/. The webpage includes photographs and descriptions of nuisance aquatic vegetation as well as an electronic form and phone number that allows stakeholders to report nuisance vegetation.

Alabama Power also prepared aquatic plant articles for lake associations to include in their quarterly newsletters. In 2015, Alabama Power staff served as President-Elect for the Alabama Vector Management Association as well as President of the Midsouth Aquatic Plant Management Society. Alabama Power staff also attended multiple HOBO meetings.

**TABLE 2-1: NONINDIGENOUS AQUATIC PLANTS PROHIBITED BY THE STATE OF ALABAMA***

| Common Name | Scientific Name |
|---|---|
| African elodea | *Lagarosiphon spp* |
| alligatorweed | *Alternanthera philoxeriodes* |
| Brazilian elodea | *Egeria densa* |
| curlyleaf pondweed | *Potamogeton crispus* |
| Eurasian watermilfoil | *Myriophyllum spicatum* |
| floating waterhyacinth | *Eichhornia crassipes* |
| giant salvinia | *Salvinia molesta* |
| hydrilla | *Hydrilla verticillata* |
| hygrophila | *Hygrophila polysperma* |
| limnophila | *Limnophila sessiliflora* |
| parrot-feather | *Myriophyllum aquaticum* |
| purple loosestrife | *Lythrum salicaria* |
| rooted waterhyacinth | *Eichhornia azurea* |
| spinyleaf naiad | *Najas minor* |
| water-aloe | *Stratiotes aloides* |
| water-lettuce | *Pistia stratiotes* |
| water chestnut | *Trapa natans* |
| water spinach | *Ipomea aquatica* |

*Chapter 220-2-.123 of the Alabama Administrative Code, as of 12/31/2015

Alabama Power's aquatic plant control program is based on a maintenance control philosophy. Control measures are initiated before noxious weeds reach a problematic stage because once weeds reach this stage, it is difficult to return to the original maintenance level. This philosophy helps to minimize chemical applications and promote plant diversity.

All aquatic plant control measures are directed by staff biologists certified as commercial aquatic applicators by the State of Alabama, Department of Agriculture and Industries. Only EPA approved aquatic herbicides are used in the aquatic plant management program.

## 3.0 SUMMARY OF CONSULTATION

FERC required Alabama Power to consult with the ADCNR, USFWS, and BLM in the preparation of this Public Education and Outreach Program Plan. Appendix A includes a summary of the consultation and how the comments of the agencies were addressed.

## 4.0 IMPLEMENTATION SCHEDULE

Tasks detailed in this Plan, along with their status and schedule are included in Table 4-1. This table reflects updated, as well as ongoing Public Education and Outreach efforts which Alabama Power will continue to execute.

**TABLE 4-1: 2016 MARTIN PUBLIC EDUCATION AND OUTREACH IMPLEMENTATION PLAN**

| TASK | SCHEDULE | STATUS |
|---|---|---|
| Implement an "Adopt an Island" program and post information regarding the program to the *Shorelines* website | Within 6 months of FERC approval of the Plan and for the term of the License | Pending Plan approval |
| Publish an article in *Shorelines* and submit for publication in *Lake Magazine*, an article that provides results of the striped bass hooking mortality study | Within 1 year of FERC approval of the Plan | Pending Plan approval |
| In response to ADCNR's comments, publish a link to ADCNR's website on the *Shorelines* website. | Within 6 months of FERC approval of the Plan and for the term of the License | Pending Plan approval |
| Ensure the brochure for homeowners, which details BMP's for protecting shoreline and methods for establishing vegetative buffers on private lands adjacent to the Project Boundary, is available on Alabama Power's *Shorelines* website and in the Martin Shoreline office | Initial updates to include new Martin License information will be completed within 1 year of Plan approval<br><br>After initial implementation, information will be verified by December 31 annually, during the term of license | A brochure with best management practices information for homeowners is currently available on the *Shorelines* website. Updates to include new Martin License information are pending Plan approval. |

| TASK | SCHEDULE | STATUS |
|---|---|---|
| | | |
| File any updates/revisions to the Public Education and Outreach Program | The first update will be filed with FERC 6 years from Plan approval and every 6 years following, for the term of the License | Pending Plan approval |
| Alabama Power currently maintains a brochure on its website and hard copies in its local offices which detail best management practices for protecting the shoreline from erosion. Updates will include information educating boaters on methods to prevent shoreline erosion and sedimentation | Information for boaters will be added to the existing BMP brochure and website within 1 year of Plan approval;<br>All information will then be verified by December 31 annually, during the term of license | A brochure with best management practices information for homeowners is currently available on the *Shorelines* website. Updates to include boater information are pending Plan approval. |
| Ensure up to date and accurate information regarding the Long Leaf Pine Legacy program and Alabama Power's participation is provided on the Alabama Power website | By December 31 annually, during the term of license | Information regarding nuisance aquatic vegetation is currently available on the Alabama Power website |
| Ensure up to date and accurate information regarding nuisance aquatic vegetation is provided on the *Shorelines* website | By December 31 annually, during the term of license | Information regarding nuisance aquatic vegetation is currently available on the *Shorelines* website |

# APPENDIX A

# SUMMARY OF CONSULTATION

## MARTIN PUBLIC EDUCATION AND OUTREACH PROGRAM PLAN

## SUMMARY OF CONSULTATION

Alabama Power distributed an initial draft of the Martin Public Education and Outreach Program Plan to the U.S. Fish and Wildlife Service (USFWS), Alabama Department of Conservation and Natural Resources (ADCNR) and the Bureau of Land Management (BLM) on August 1, 2016 and requested comments on or before September 1, 2016.

The following provides a list of commenting entity, the nature of the comments, and how Alabama Power addressed each comment.

| COMMENTING ENTITY | DATE | COMMENTS | ALABAMA POWER RESPONSE |
|---|---|---|---|
| ADCNR - Fisheries | 9/8/16 | Based on the results of the striped bass studies conducted during Martin Dam Relicensing and our own observations, we are still concerned that reservoir water quality, during specific years, could continue to negatively impact striped bass survival rates during the late summer months. In order for us to document the frequency of striped bass kills in Lake Martin since the implementation of the rule curve change and conditional fall extension, we encourage APC to publicize our agencies contact information, so we can be reached in the event a fish kill is observed.<br><br>Additionally, we request to be updated should any of the public education and outreach activities be modified or changed. | Alabama Power will include a link to ADCNR's webpage on its *Shorelines* website.<br><br>Alabama Power will consult with ADCNR during the proposed regular updates to the Plan and if specific issues arise between reviews. |
| USFWS | 10/6/16 | The Service does not have additional comments at this time. However, we would like to applaud Alabama Power and Southern Company's commitment to longleaf pine restoration. We also encourage you to continue looking for opportunities to enhance this program, at the Martin Project, as well as continuing to pursue land management opportunities that would benefit the red-cockaded woodpecker habitat around Lake Martin. | N/A |

## Stewart, Amy J.

**From:** Chandler, Keith Edward
**Sent:** Thursday, October 6, 2016 3:35 PM
**To:** Stewart, Amy J.
**Cc:** Freeman, Tina P.; Anderson, David Keith; Anderegg, Angela Segars; Smith, Sheila C.; Trammell, Dennis; St. John, Thomas W.
**Subject:** FW: Martin Public Education and Outreach Program Plan

Please find below USFWS comments on the Public Education and Outreach Plan.


**Keith Chandler**
Alabama Power
Environmental Affairs
Office: 205-257-1091
Cell: 205-438-4165
kechandl@southernco.com


**From:** Grunewald, Jennifer [mailto:jennifer_grunewald@fws.gov]
**Sent:** Thursday, October 06, 2016 3:08 PM
**To:** Chandler, Keith Edward
**Cc:** Jeff Powell
**Subject:** Martin Public Education and Outreach Program Plan

Keith,

Thanks for the opportunity to review and provide comments on the *Martin Public Education and Outreach Program Plan.* The Service does not have additional comments at this time. However, we would like to applaud Alabama Power and Southern Company's commitment to longleaf pine restoration. We also encourage you to continue looking for opportunities to enhance this program, at the Martin Project, as well as continuing to pursue land management opportunities that would benefit the red-cockaded woodpecker habitat around Lake Martin.

Thanks again.


Jennifer P. Grunewald
Fish and Wildlife Biologist
US Fish and Wildlife Service
Alabama Ecological Services Field Office
1208 Main Street - Daphne, AL - 36526
(251) 441-6633 Phone | (251) 441-6222 Fax



***NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.***

## Stewart, Amy J.

**From:** Chandler, Keith Edward
**Sent:** Monday, September 12, 2016 11:28 AM
**To:** Stewart, Amy J.; Stover, Charles M.; Freeman, Tina P.; Anderson, David Keith; Anderegg, Angela Segars; Smith, Sheila C.; Trammell, Dennis; St. John, Thomas W.
**Subject:** FW: Martin Public Education and Outreach Program Plan

Attached are the comments I received from ADCNR.

Thanks,
Keith


**Keith Chandler**
Alabama Power Company
Environmental Affairs
Office: 205-257-1091
Cell: 205-438-4165
kechandl@southernco.com


---

**From:** Greene, Chris [mailto:Chris.Greene@dcnr.alabama.gov]
**Sent:** Thursday, September 08, 2016 6:11 PM
**To:** Chandler, Keith Edward
**Cc:** Goar, Taconya; Jeff_Powell@fws.gov
**Subject:** RE: Martin Public Education and Outreach Program Plan

Keith,

We have reviewed the Martin Dam Project Public Education and Outreach Program Plan and provide the following comments:

Based on the results of the striped bass studies conducted during Martin Dam Relicensing and our own observations, we are still concerned that reservoir water quality, during specific years, could continue to negatively impact striped bass survival rates during the late summer months. In order for us to document the frequency of striped bass kills in Lake Martin since the implementation of the rule curve change and conditional fall extension, we encourage APC to publicize our agencies contact information, so we can be reached in the event a fish kill is observed.

Additionally, we request to be updated should any of the public education and outreach activities be modified or changed.

Thanks,


J. Chris Greene
Assistant Chief of Fisheries
Alabama Wildlife & Freshwater Fisheries Division
64 North Union Street, Suite 551
Montgomery, Alabama 36104
334-242-3471


**From:** Chandler, Keith Edward [mailto:KECHANDL@SOUTHERNCO.COM]
**Sent:** Monday, August 01, 2016 1:42 PM
**To:** Jeff_Powell@fws.gov; Jennifer Grunewald (jennifer_grunewald@fws.gov); Greene, Chris; Abernethy, Damon; Duane_Winters@blm.gov; John M. Sullivan; Alison McCartney
**Cc:** Stover, Charles M.; Anderegg, Angela Segars; Anderson, David Keith; Stewart, Amy J.; Freeman, Tina P.; St. John, Thomas W.; Smith, Sheila C.; Edge, William; Hanks, Rhett
**Subject:** Martin Public Education and Outreach Program Plan

All,

Attached is a draft Public Education and Outreach Program Plan for the Martin Dam Project (FERC No. 349) as required by Article 411 of the Martin License. Additionally, a CD with a copy of this plan and its appendices is being mailed to you today. If you have any questions during your review, we can talk directly or set up a conference call. Please provide comments in track changes or by email.

We would appreciate your comments and/or concurrence by **Thursday, September 1, 2016**.

Thanks,

Keith

**Keith Chandler**

Alabama Power Company

Environmental Affairs

Office: 205-257-1091

Cell: 205-438-4165

kechandl@southernco.com

# APPENDIX B

## *SHORELINES* EXAMPLE

# SHORELINES

THE LAKE LIFESTYLE

2015 | VOL: 3


Old Town

# WATER WHYS

I've taken a few canoe trips, always with a group of friends. My most adventurous was paddling into the Okefenokee National Wildlife Refuge in the southeastern corner of Georgia. We spent a sleepless night on a platform surrounded by noisy critters likely much more fierce in my imagination than they really were, and paddled out the next day.

I can't begin to fathom Trevor Clark's solo canoe trip. Clark paddled the Alabama Scenic River Trail, starting May 20 on Weiss Lake in the northeast corner of the state, and arriving July 15 at Fort Morgan in Mobile Bay 650 miles later. He is one of just two dozen people known to have paddled the entire river trail since its formal inception.

Along the way, Clark slept in a hammock under the stars, shot at copperheads with his .38 pistol, and was handcuffed while sheriff's deputies checked his ID and determined he was doing nothing wrong. The adventure of a lifetime also provided an open-air classroom for Clark as he studied medicinal plants. Clark became interested in herbal medicine after a car wreck his senior year in high school left him in debilitating pain that prescription drugs couldn't relieve.

Also in this issue of Shorelines:

• A wakeboarding champion's passion for helping children led him to start Wake the World, a nonprofit organization that lets less fortunate children spend a day on the lake. Since its first event in 2008, Wake the World now holds events in 23 states and Canada, including one this summer at Smith Lake.

• Now that the weather is cooling down, fishing is heating up. Clint Nail, a chemist for Alabama Power who is an avid fisherman, shares his wisdom and knowledge about fishing in the fall.

• Alabama Power continues to work to help anglers in search of the big catch at its lakes. The company recently planted water willow in Smith Lake and sunk fish attraction devices in Weiss Lake.

We'll also show how Renew Our Rivers teaches environmental stewardship of Alabama's lakes and rivers, and Seibels Cottage's beautiful take on lake living at the Russell Lands on Lake Martin Idea Home.

Enjoy!

*— BOB BLALOCK*

*Left:* Photo by Bernard Troncale — Trevor Clark canoes on the Coosa River portion of the Alabama Scenic River Trail after completing a 60-day journey of the trail this summer.

# CONTRIBUTORS

## STAFF

Bob Blalock, manager of the Content Development Team at Alabama Power, was an award-winning journalist in Alabama for more than three decades, mostly at The Birmingham News. He was named The News' first senior reporter and, as editorial page editor, led a project that was a finalist for the Pulitzer Prize.

Dan Guffey is a graphic designer at Alabama Power whose work has won local and regional ADDY awards, a Utilities Communicators International award, as well as an appearance in Print's Regional Design Annual.

Allison Westlake is a communications specialist at Alabama Power. She has served on the staffs of Coastal Living and Sandra Lee Semi-Homemade magazines, with work published in Celebrate magazine and Julep, an online publication.

*Cover image* – Graham Yelton
On a bright, crisp fall day, it's hard to imagine anything more inviting than relaxing in a comfortable chair with a beautiful view of the lake.

## STAFF WRITERS

Gilbert Nicholson
Anna Catherine Roberson

## GUESTS

Graham Yelton
*Cover photographer*
A Nashville native, now Birmingham resident, Yelton graduated with a degree in graphic design from Samford University. After six years in the agency world, she decided to step out on her own and focus on freelance graphic design and photography. She delights in branding new businesses and photographing food, fashion, products and homes. She loves all things clever, surprising, simple and colorful. Yelton and her husband, Jay, live in Homewood, a suburb of Birmingham. They live with their three dogs, Mister, Maggie and Mezi, and spend most (warm) weekends tending to their small garden.

Billy Brown
*Contributing photographer*
Billy Brown, a Birmingham photographer with a passion for image-making, has been creating photographs for more than 25 years. He specializes in people, and his award-winning work covers an extensive range of advertising, editorial and corporate assignments. Clients include Southern Company, Hanes, Saks, Energen, Oracle, Xerox, Verizon and General Electric. His photographs have appeared in many national publications, including Forbes, Dance, Seventeen, Black Enterprise, Ad Week and The Wall Street Journal.

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A SOUTHERN COMPANY


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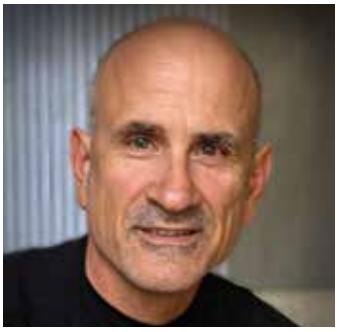
Wynter Byrd
*Contributing photographer*
Wynter Byrd is an award-winning photographer and videographer with more than 26 years of experience. She has photographed three American presidents. She earned an Emmy for her work on "Gorbachev Walk-About" and was nominated for another for "Kids at Risk" with the Public Broadcasting Service-BBC. Byrd won a Kodak Award for her photography on "Where the Children Come From," also with PBS-BBC. Byrd's work has been featured on CNN, CBS, ABC, NBC, BBC and FOX.

Nik Layman
*Contributing photographer*
Nik Layman has lived and worked in Birmingham since 2005. He has shot football from Southeastern Conference sidelines, worked with celebrities and traveled across the state, country and world with his camera. He and his wife, Angela, a makeup artist, enjoy collaborating on fashion and editorial projects.

Clint Nail
*Contributing writer*
Clint Nail is one of Shorelines' fishing experts who shares his wisdom and knowledge about fishing and the right ways to enjoy our lakes. He is an avid fisherman and outdoorsman, and a consistent competitor in fishing tournaments statewide. When Nail isn't fishing, he's a chemist for Alabama Power.

Jimmy Creed
*Contributing writer*
Jimmy Creed is a freelance writer, public relations and marketing consultant and author based in Talladega. He has over 30 years of experience in newspapers and magazines and has served as the editor of The Daily Home, The Jacksonville News and The Piedmont Journal and the sports editor of The Anniston Star.



Bernard Troncale
*Contributing photographer*
Birmingham photojournalist Bernard Troncale has been documenting the people and places of the Southeast for more than 40 years, most recently as a senior photographer with The Birmingham News. He has been the Alabama Associated Press Newspaper Photographer of the Year many times, and has also won a Green Eyeshade Award. His work has appeared in The New York Times, The Washington Post, Sports Illustrated and other publications.

Shorelines - Published by Alabama Power for the pleasure of our great lake lovers.

# Smith Lake hosts *Wake the World*

HOW ONE MAN'S PASSION IS CHANGING LIVES THROUGH WATER SPORTS ACROSS THE NATION.

Greg Hodgin would have never guessed sitting in a church pew one Sunday morning in 2006 that the very thing he questioned would one day be his calling in life.

A North Carolina native, he recalls the moment vividly when he encountered children from a children's home at his church. Hodgin, an avid wakeboarder, had just returned from the wakeboarding national championships in Bakersfield, California. He wondered if they had many opportunities to enjoy the lake and discussed with his wife the possibility of taking the children out for a day of water sports with his family.

One year later, after a devastating car wreck, Hodgin began re-evaluating his life and could not forget the children he had met from the children's home. After being named the Masters Wakeboard United States champion the following year in 2007, Hodgin returned to North Carolina, assured that his passion for water sports and outreach to less fortunate children could go hand in hand.

With seven friends and their boats, Wake the World held its first official water sports event in 2008. They took children from two area children's homes for a full day on the lake to enjoy water sports and recreation.

"Immediately we realized it wasn't just about the kids. It was about all of us. We all felt inspired by sharing the lake with these children and by being involved in the event," said Hodgin.

Wake the World continued to grow and by 2010, people from Tennessee, Alabama, Texas, Virginia and Ohio traveled to North Carolina to volunteer to and learn how to host their own Wake the World events. In 2013, Wake the World became the largest nonprofit organization of its kind, with 300 volunteer boats in multiple events across the country.

"The cool thing about this is we have never approached anyone about Wake the World or fundraising. They have always come to us. We have SL»

"IMMEDIATELY WE REALIZED IT WASN'T JUST ABOUT THE KIDS. IT WAS ABOUT ALL OF US. WE ALL FELT INSPIRED BY SHARING THE LAKE WITH THESE CHILDREN AND BY BEING INVOLVED IN THE EVENT."

– GREG HODGIN

*Opposite:* Photo by Nik Layman — Brothers from Big Oak Ranch take turns wakeboarding during Wake the World this summer.
*Above:* Photo by Nik Layman — Families enjoyed a day of water sports on Smith Lake during the fifth year of Wake the World.

been overwhelmed with support that so many people from across the country have wanted to help," Hodgin said.

Heath Patton, a Birmingham resident, was one of the visitors at the 2010 event in North Carolina. After seeing the event posted online, Patton traveled to North Carolina simply to volunteer, but left inspired to bring the event to Alabama.

"Once I saw the impact on the kids at Wake the World, I jumped at the chance to get on board. I grew up on the water and have always loved wakeboarding. Greg encouraged us to get the kids and to get a place and from there everything would fall into place. And he was right," Patton said.

Patton, his wife, Lauren, and their 11-year-old son have a lake home on Smith Lake. They hosted the first Alabama Wake the World event in 2010 with children from Big Oak Ranch, a ministry for children who have been neglected, abused or abandoned that provides them with a home and house-family.

Since the first event with 23 kids and 10 boats, the Alabama Wake the World event has grown to include more than 100 children and 24 houseparents.

Volunteer boat drivers from the Smith Lake community dedicate a full day on the water, taking children and their houseparents out for tubing, wakeboarding, skiing and kneeboarding.

"We thought with the increase of kids, it would be hard to find volunteers. But each year we have more than enough people volunteering to help us out. We even have four to six boat drivers come from Mississippi," said Patton.

The event is just as rewarding for volunteers as it is for children. Andrea Greene, an attorney in Birmingham, spends many weekends at Smith Lake and jumped at the chance to volunteer as a boat driver this year.

*Above:* Photo by Nik Layman — Brothers from Big Oak Ranch enjoy a boat ride during Wake the World.


"Growing up, my family spent a lot of time at the lake and those were some of my favorite memories as a child. I wanted to be a part to be able to provide the same opportunity for these children," Greene said. "It is also a privilege to support the parents of the Big Oak Ranch; they dedicate their lives to these children and it was fun getting to see them relax for the day with us."

For the families, it's a chance to get away and enjoy the lake.

"Our children look forward to this every year," said Robin O'Leary, a housemom accompanying three of her sons. "They are having a blast out here."

For the Smith Lake team, the passion for sharing the love of the lake with Big Oak Ranch each year is contagious.

"It is such a great experience," said Cary DeWitte, another event organizer. "Restaurants donate food, marinas donate wakeboards, equipment, etc., and volunteers come from across the community."

More than the community support, the volunteers are passionate about the confidence and the experience they can provide each child.

"This is an opportunity for us to connect with the kids and build trust. The cool thing about water sports is it challenges you to get outside your comfort zone," DeWitte explained. "But what's cool about this event is that they have motivation from their houseparents and us as boat drivers there to support them."

Plans are underway for next year's event at Smith Lake and the momentum continues to build for Wake the World as it grows to 27 events in 23 states and Canada.

"It's amazing the people God puts in your life," Hodgin said. "I'd rather have people give action than money, and we have a great team of people who want to give back."

For more information about Wake the World, visit ***waketheworld.org***.

*– ALLISON WESTLAKE*

*Above:* Photo by NIK LAYMAN — More than 100 children with 24 houseparents attended Wake the World on Smith Lake this summer.

# THE ALABAMA *Scenic River Trail*

FIRST, TREVOR CLARK CONQUERED PAIN. THEN, THE FORMER HOOVER RESIDENT CONQUERED 650 MILES OF WATER IN A CANOE FROM WEISS LAKE IN THE NORTHEAST CORNER OF THE STATE TO FORT MORGAN IN MOBILE BAY.

For most folks, spending almost two months in an open canoe paddling some of the most scenic waters in all the United States would be the adventure of a lifetime. For Trevor Clark, it was nearly 60 days in the most wonderful classroom he could ever imagine.

Wait a minute. Canoeing, adventure,classroom — those things don't mix! They did for Clark, who in late July completed the 650-mile journey down the length of the Alabama Scenic River Trail (ASRT), en route covering dozens of miles on the waters of the Coosa River managed by Alabama Power.

Clark put in on Weiss Lake near Cedar Bluff, just a few miles from the Alabama-Georgia border, on May 20, and on July 15 he paddled into Fort Morgan in Mobile Bay at the Gulf of Mexico, his trek complete and his mind electrified with the knowledge he collected along the way.

"I wasn't on the river (trail) to conquer it," said Clark, who laughs when asked if he is an adventurer. "I had not been in a canoe in probably seven years before I went on this trip. I just really like to study plants, especially medicinal plants.

"I like being outdoors, but my interest for the last eight years or so has been studying medicinal plants after my life was saved by a medicinal plant."

Rewind to when Clark, now 29, was a 17-year-old senior at Hoover High School and his car was rear-ended along the interstate and slammed into the back of a heavy-duty Ford F-450 pickup.

Clark didn't go to the hospital because he didn't think he was badly hurt. His neck was a little stiff, but he thought it was just a little whiplash that would soon get better on its own.

*Left:* Photo by Bernard Troncale — Trevor Clark, pictured on the Coosa River, canoed the entirety of the Alabama Scenic River Trail this summer.

What he didn't know until over a year later, when he started experiencing agonizing pain, was that he had suffered a complete fracture through his L-3 vertebra that day, a break that would change his life.

First came spinal fusion surgery from which he struggled to recover. Then came chronic pain conditions like neuropathy, which caused numbness and extreme burning in his hands and feet, and the syndrome fibromyalgia. Muscle inflammation. Joint inflammation. His adrenal glands shut down. Then there were the medications, 11 different kinds a day at one point.

> "THIS IS THE KIND OF STORY THAT NEEDS TO BE AT THE TOP OF PEOPLE'S MINDS WHEN THEY SEE OR HEAR THE WORD 'ALABAMA.'"
>
> – JIM FELDER, EXECUTIVE DIRECTOR OF THE ALABAMA SCENIC RIVER TRAIL.

The pain and the prescriptions engulfed Clark. In the midst of the fog, he went to bed and stayed there for almost four years, struggling to rise, let alone walk, and subsisting mostly on Ensure milkshakes and a little Grape-Nuts cereal. Then came even more startling news.

"My rheumatologist told me, 'This is only going to get worse,'" Clark said. "He said, 'I have you on 11 medications and with the narcotics, the thyroid medication and the adrenal medication, you have to keep increasing the dosage because you get used to it. So we're looking at liver failure in probably 10 to 15 years because the medications are so rough.'"

Fortunately for Clark, his doctor had grown up the son of a missionary in Guatemala, and he told how he had seen people using herbs in place of medicines. He suggested that Clark look there for possible relief.

"I think he was just trying to give me some kind of hope," Clark said.

Still, Clark began reading ethno botany reports and by what even he describes as "dumb luck" found something that worked almost immediately. The third remedy he tried was from the bark of the pau d'arco tree and after using it a short time, he regained his appetite and his mobility, quit all his meds (without asking his doctor beforehand), and finally one day strolled into the doctor's office without a walking cane.

Now, almost a decade later, he's one of just two dozen people known to have paddled the entire ASRT – along the way sleeping in a hammock under the stars; shooting at copperheads with his .38-caliber pistol; having his campsite flooded in the middle of the night when a dam was opened and being detained in handcuffs by sheriff's deputies while they checked his ID and determined what he was doing.

Still, it was the experience of studying herbs like the basswood – or American linden tree – the tulip poplar, SI»

*Above:* Photo by Bernard Troncale — Clark's canoe journey down the Alabama Scenic River Trail took him 60 days.
*Opposite:* Photo by Bernard Troncale — After suffering a debilitating car wreck in high school, Clark began researching herbal medicine. He used his journey on the ASRT to research herbal medicine and herbs found in the Southeast.


the perennial flowering bloodroot and many others found along the way that Clark will remember most.

"It was a perfect opportunity to study in a bunch of different ecosystems," Clark said. "Just to be able to paddle from the foothills of the mountains down through all those ecosystems is a really unique thing. It is an amazing resource we have."

Another thing that impressed Clark was Alabama Power's commitment to the ASRT.

"They went out of their way to help with the portage trails," said Clark, referring to the paths paddlers take to move canoes and gear around APC dams on the trail. "For groups like Alabama Power and the Army Corps of Engineers to open up access on their land for portage and camping is very important."

ASRT Executive Director Jim Felder agrees that APC's support over the years to help develop, maintain and enhance the trail has played a great part in making a "life event" like Clark's possible.

*Above:* Photo by Bernard Troncale — Clark began his journey on Weiss Lake and traveled 650 miles to the mouth of Mobile Bay.

"A lot of the success of the trail in the northeast part of the state has to do with our relationship with Alabama Power," Felder said. "They have a done a lot for us on a lot of fronts. We likewise think we are doing a lot for them. We are being good stewards. We are promoting it."

Felder is proud the ASRT brought someone like Clark, with a unique purpose and mission in life, to see and enjoy what Alabama has to offer.

"This is the kind of story that needs to be at the top of people's minds when they see or hear the word 'Alabama,'" Felder said. "It was a tremendous story in itself with his personal health aspect, but for us it's the pinnacle of how a trail like the one we have created can be used as a platform for a story like his. And we're proud to be a backdrop for a story that big."

Clark earned an undergraduate degree in herbal medicine from Bastyr University in Seattle in 2011. He left the country just days after his journey ended to visit his father, a nondenominational missionary, in Brazil and study plants and herbs. Then he went on to Peru for more study. Upon his return to the U.S., he hopes to enroll in the University of Mississippi School of Pharmacy to specialize in pharmacognosy, which is the "study of bioactive natural substances found in terrestrial and marine organisms."

Clark certainly achieved much with his trip. He recruited national sponsors like Old Town Canoes & Kayaks and ENO Camping Gear to finance it. He publicized it worldwide through social media and a blog that now has about 132,000 readers. He joined the select group of 24 that, according to the ASRT's president and founder, Fred Couch, has conquered the entire trail since its inception. In Clark's mind, however, his greatest achievement was the simplest.

"The accomplishment for me is just that I kept going," he said. SD

*– JIMMY CREED*

*Above:* Photo by Bernard Troncale — Clark is one of about 24 people who have completed the entire trail.
*Centerfold:* Photo by Bernard Troncale — Clark canoes the Coosa River near Logan Martin Lake at sunset.

# LAKE CABIN *Elegance*

## A BEAUTIFUL SETTING FOR A BEAUTIFUL VIEW.

Dating as far back as the 1930s, the Russell Cabins have long been a part of Lake Martin's history. Here we showcase the Veranda, which was one of the Russell Lands On Lake Martin Show Houses of 2015. The new cabins feature open floor plans with large porches and windows to encourage families to spend time together and enjoy the view.

Working with Nan Jackson of Russell Lands On Lake Martin, the home is decorated and furnished by Seibels in downtown Homewood. Owner Kelly Seibels, designer Trissy Holladay and their team have been outfitting camps and cottages since 1994 with a unique collection of indoor and outdoor furnishings, much of it custom-made by Seibels or privately labeled for customers with their lifestyle in mind.

See more of this show house at *apcshorelines.com.* For more information about Seibels, visit *facebook.com/seibelscatalog* and learn more about Russell Lands On Lake Martin at *russelllandsonlakemartin.com*. SLD

*Opposite:* Photos by Graham Yelton — Russell Lands On Lake Martin has updated and created new versions of the iconic Russell Cabins on Lake Martin.
*Above:* Photos by Graham Yelton — The 2015 Russell Lands Veranda Show House on Lake Martin was furnished and decorated by Seibels in downtown Homewood. The home features open spaces and scenic lake views.

# FALL *fishing.*

FISHING IS A YEAR-ROUND SPORT IN ALABAMA, BUT YOU MAY NEED TO ADJUST YOUR TACTICS AND TOOLS A LITTLE AS THE WEATHER COOLS.

The first cold front of the fall is an exciting time for a bass fisherman. The cool temperatures and cool wind means the dinner bell will be ringing for bass. These pleasant temperatures, along with shortening days, will have a significant cooling effect on the water. The dropping water temperatures cause game fish, especially bass, to give up their summer hiding places and start pursuing and feeding on baitfish.

The most prevalent baitfish, threadfin and gizzard shad, will form large schools and migrate to the back of pockets and creeks. The large concentrations of baitfish in a small confined area create an all-you-can-eat buffet for all game fish, but especially bass.

OK. So you know where they are headed. What's the best way to find these areas, since there are so many places that could potentially be productive?

- Look first to the western areas of lakes or rivers. These pockets and creeks will be shaded from the afternoon sun, allowing the water temperatures to drop faster than the sunnier areas.
- Find areas where runoffs or natural springs add cooler water to the lake or river. The cooler water temperatures act as a magnet for the baitfish.
- Look for a clue from Mother Nature. If there is an abundance of baitfish in a small area, there will also be an abundance of predators feeding on them. You should keep a look out for fish-eating birds including herons, kingfishers and ospreys.
- Once you locate the schools of baitfish, look for predatory fish feeding on them. When feeding on the baitfish, the predators always leave some kind of disturbance on or just under the water's surface that gives away their location.
- Another giveaway that there are lots of fish in an area is the concentration of fishermen. If you see several boats in one area you can safely assume there are also a lot of fish there.

With the tracking underway, what are some of the best lures and baits for catching bass this time of year?

1. Topwater baits like walking or popping lures can be productive and very exciting to use. Use bright colors like white, chrome or chartreuse. Cast the lure into the school of baitfish and work it back, waiting for the explosion.

2. Rattling baits are a good choice in chrome or shad colors. These baits can be cast long distances and allow you to cover lots of water.

3. Crank baits can also be productive. Try different sizes and colors until you find the magic combination.

4. Soft plastic minnow baits and swim baits are a smart choice, since they look almost exactly like the shad the larger fish are feeding on.

5. Always try a spinnerbait during these fishing conditions. Again, try different combinations of colors and blade sizes until you find what the fish prefer.

Here's a term to know: School fishing. This is literally what is happening: You are fishing for schooling bass that are eating schooling baitfish. There can be hundreds of bass feeding on the shad in one area, which means you can sit in one spot and load the boat.

Always watch the water. If you see a swirl or ripple on the water, cast your lure as fast as possible to that spot and hold on. Once you locate one of these magical spots, it's easy to see why fall is one of the best times to be on the water.

*– CLINT NAIL*

*Opposite:* Photo by Mark Sandlin — A pending proposal to raise the winter lake level will extend the summer pool and give more time for recreation on Lake Martin.

# LEARNING *your lures*


CRANKBAIT

It's a good idea to start a young or inexperienced angler fishing with live bait. Nothing appeals to a fish's appetite better than the real thing. The tackle needed for live bait fishing is inexpensive and easy to use and find. All the sporting goods stores will have a good selection of tackle and rods and reels – even gas stations close to Alabama waterways are usually well-stocked.


STICK BAIT

If you're using artificial lures, almost unlimited choices make selection and picking confusing, expensive and at times overwhelming – especially for the beginner.

There is a lure type, color and/or style made for every condition and situation. Start by knowing that you do not need all of these to catch fish. A fish's brain is the size of a black-eyed pea, so keep it simple. Don't fall for all the colors and glitter you see on a website or at the tackle store.

### *Start with the color.*

- Have four basic colors or shades of the color in your tackle box: green, brown, white or black. Most of the prey that makes up the fish's diet will be one of these colors or some variation.
- Use lighter colors – whites and greens, in low-light conditions (dawn or dusk or cloudy), and the other colors as the sun comes up. I may add a little chartreuse (lime-green) or red to the lures for flash – and during the fall.


POPPER


FROG


JIG AND CHUNK

### *Then, select the type.*

Keep it simple. Fish eat minnows, small fish, bugs, worms, crawfish or some unfortunate creature that ends up in the water. In general, the larger the lure you use, the larger the fish you could catch. Bream and crappie will like the smaller lures, and bass and other larger predators like larger ones. The lures to use would be the ones that mimic these food sources.

- Minnow or fish-shaped lures like crankbaits, stickbaits or topwater floating lures are very effective.


BUZZBAIT

- Another lure that mimics minnows is a spinnerbait. It has one or two flashing blades that vibrate as you reel it through the water, along with some type of skirt.
- Try a jig and chunk combination. A jig is a painted head with a hook and skirt attached, with a trailer added to the hook. There's an endless number of color combinations you could use – stay with the basics, at least at the start.


SPINNERBAIT

- Another popular and inexpensive type of lure is the plastic or rubber worm. It is available in countless colors and styles. If a certain color or style doesn't work for you, try a few different ones until you find something you and the fish like.


RUBBER WORM

- The last lure to have is the top water lure. This could be a buzzbait, frog, popper or any other type of lure fished on the surface of the water. These lures are most effective in shallow water and in low-light conditions. They resemble some type of forage animal that is fleeing across the surface, trying to get to safety. The bites are mostly reaction strikes and can be very explosive (and fun to watch).

*– CLINT NAIL*


CREATURE BAIT

*Above:* Photos by Billy Brown — Lures pictured above are essential for any angler's tackle box.

# EDUCATION *that makes a difference*

RENEW OUR RIVERS PROVIDES ENVIRONMENTAL EDUCATION OPPORTUNITIES TO STUDENTS ACROSS THE STATE.

Demopolis High School senior Marlana Mitchell is beginning to understand what it means to be a good environmental steward. After volunteering with Renew Our Rivers, Mitchell is more aware of how actions today have a lasting impact on waterways that surround her community.

As a volunteer at the recent cleanup at Lake Demopolis, Mitchell and 30 classmates worked alongside volunteers that included employees of Alabama Power's Greene County Steam Plant and students from Westside Elementary School, Demopolis Middle School and the University of West Alabama.

The 136 volunteers removed 6.6 tons of trash, 2,100 pounds of tires and abandoned watercraft weighing 1,500 pounds from the lake.

In the midst of collecting trash on this Saturday morning, Mitchell and her classmates found lessons of stewardship and the importance of giving back to their community, all through Renew Our Rivers.

"I learned that a lot of trash was on the riverbanks due to storms and floods. I never thought there would be so much trash on the riverbanks," Mitchell said. "It is important for us to participate in Renew Our Rivers because we should all help keep our communities clean."

"IT'S IMPORTANT TO GET THE NEXT GENERATION INVOLVED, TO HELP CREATE A VISION AND A MINDSET OF THE IMPORTANCE OF KEEPING OUR AQUATIC ECOSYSTEMS CLEAN, FOR ALL THINGS LIVING."

– MIKE CLELLAND, AN ENVIRONMENTAL AFFAIRS SPECIALIST WITH ALABAMA POWER AND COORDINATOR OF VOLUNTEERS FOR RENEW OUR RIVERS.

Cynthia Phillips, an Advanced Placement physics teacher at Demopolis High School, encourages her students to participate in the Renew Our Rivers cleanup each year because of the educational and stewardship opportunities it provides.

"For many of our students, this is the first time for them to go out on a boat and see animals and wildlife that are part of the lake habitat," said Phillips. "But more importantly, they learn what it means to be a good steward while also making connections with others in the community. For them, the experience is priceless."

Like Mitchell, students across Alabama have had similar experiences learning about the environment through Renew Our Rivers.

"The students that come out and participate in a Renew Our Rivers cleanup get to see firsthand how trash from a roadside or parking lot can wash into a ditch and then into a river," said Mike Clelland, an Environmental Affairs specialist who is Alabama Power's coordinator of volunteers for Renew Our Rivers.

"And, as some of the trash that they remove has obviously been in the SL»

*Opposite:* Photo by Wynter Byrd — More than 10.32 tons of trash were collected from the Renew Our Rivers Valley Creek cleanup this year.


river for many years, they become aware of how long even a little bit of trash can impact a river system."

Phillips said her students leave Renew Our Rivers with a greater understanding about their role in the community.

"Every year after the cleanup, the students often say they didn't realize how much trash was in the lake and what kind of trash is out there," Phillips said. "It causes them to become more conscientious of where their trash goes."

Since 2005, the Lake Demopolis cleanup has attracted hundreds of volunteers who have helped remove about 375,000 pounds of trash from the area. And for just as long, students from the surrounding areas have volunteered their Saturday mornings to make a difference.

Clelland said students, like the ones at Demopolis High School, need to continue to convey to others the importance of student involvement in projects like Renew Our Rivers.

"It's important to get the next generation involved, to help create a vision and a mindset of the importance of keeping our aquatic ecosystems clean, for all things living."

Similarly, students from the University of Alabama at Birmingham's (UAB) Honors College recently took part in a Renew Our Rivers cleanup at Valley Creek. Each year, the Honors College hosts a retreat for new students to the program. After seeing the impact of Renew Our Rivers

*Above:* Photo by Wynter Byrd — Students from the University of Alabama at Birmingham's Honors College volunteer in the Valley Creek cleanup.

last year, UAB chose the Valley Creek cleanup for its service component again this year.

"Our students loved the experience. Getting our hands dirty and getting to be a part of the process was very beneficial, especially after we saw the amount of trash. The students could see the difference they were making and that made a lasting impression," said Mellissa Taylor, assistant director of honors advising and retention at UAB.

For students new to the program and to the city of Birmingham, the UAB Honors College incorporates a service learning initiative as a key part of the retreat.

"Service learning is a huge component of what we do in the Honors College. We want the incoming students to start off by giving back to the community that they are going to be a part of," Taylor said.

The UAB Honors College is comprised of 1,300 students pursuing all majors at the university.

"The trash was overwhelming and I can't imagine animals and plants being happy in this ecosystem," said volunteer Sarah Sullivan, a freshman at UAB. "We really felt that this was a really good cause and we are glad for the opportunity to come here."

This was the fifth annual cleanup at Valley Creek and it took place at three locations: Midfield, Bessemer and downtown Birmingham. Valley Creek begins in downtown Birmingham and flows through Bessemer, ending at the mouth of the Black Warrior River.

More than 300 local volunteers from the Water Management Authority Inc., Jefferson County Department of Health's Watershed Protections Division and the Freshwater Land Trust worked alongside the UAB student volunteers and others to remove 10.32 tons of debris and trash from Valley Creek during the three-day event.

"It's about making the connection for our students. They see that they can make an impact on their community and it enhances their student experience as well," Taylor said.

Renew Our Rivers continues to host cleanups across the state. So far this year, more than 2,800 volunteers have removed more than 110 tons of trash and debris from Alabama waterways.

For more information on how you can volunteer with Renew Our Rivers, visit www.renewourrivers.com.

*– BY ANNA CATHERINE ROBERSON AND ALLISON WESTLAKE*

*Above:* Photo by Wynter Byrd — Students from Demopolis High School pitch in at a Renew Our Rivers cleanup.


# ALABAMA POWER *steps up fish habitat efforts*

SMITH LAKE WATER WILLOW AND WEISS LAKE FISH ATTRACTION DEVICES SHOULD BENEFIT ANGLERS FOR YEARS TO COME.

As anglers plied the waters of Weiss and Smith lakes this summer in search of a big catch, Alabama Power was busy casting efforts of its own to make sure anglers are successful for years to come.

The company planted water willow in Smith Lake and deployed fish attraction devices at Weiss Lake.

"We're committed to proactively using various techniques to enhance the fish habitat in our reservoirs," said Wes Anderson, a team leader with Alabama Power's Environmental Affairs department. "It's something we take seriously and will continue to pursue."

> "WE'RE COMMITTED TO PROACTIVELY USING VARIOUS TECHNIQUES TO ENHANCE THE FISH HABITAT IN OUR RESERVOIRS. IT'S SOMETHING WE TAKE SERIOUSLY AND WILL CONTINUE TO PURSUE."
>
> – WES ANDERSON, A TEAM LEADER WITH ALABAMA POWER'S ENVIRONMENTAL AFFAIRS DEPARTMENT

The company sunk 360-square-feet of water willow, anchored with chicken wire and cinder blocks, near the Clear Creek Recreational Area of Smith Lake in Winston County.

Water willow is a native plant that aquatic organisms prefer, but without accelerated growth that bogs down a lake. Further, it is hardy enough to endure exposure to cold temperatures

*Above:* Photo by Wynter Byrd — Students and volunteers with the Weiss Lake Improvement Association place fish attractors in Weiss Lake.

during winter drawdown.

"We hope this water willow takes root and spreads," said Josh Yerby, leader of the Aquatic Vegetation Management program at Alabama Power. "It will provide an excellent fish habitat for all aquatic organisms, starting at the bottom of the food chain. This should in turn attract larger organisms all the way up to bluegill and largemouth bass."

Yerby said water willow has the added benefits of stabilizing shoreline and preventing erosion in Smith Lake, which has relatively little aquatic vegetation.

"We realize the actual area covered by these plantings is small, but we hope it is successful and we can continue to do this for years to come," Yerby said.

Some 100 miles to the northeast, Alabama Power's Mike Clelland led volunteer efforts to build and sink more than 130 fish attraction devices (FAD) in Weiss Lake. Alabama Power partnered with the Weiss Lake Improvement Association and the fishing team from Cherokee County High in nearby Centre.

"One of our goals at Alabama Power in our stewardship programs is to reach out more and more to these student organizations, to get them involved and teach them about conservation," said Clelland, coordinator of the company's Renew Our Rivers clean up effort.

Lane Pentecost, an 11th-grader on the fishing team, was well-aware of the issues at 54-year-old Weiss Lake.

"Back when they first filled the lake up, the fish had a lot of cover out here," Pentecost said. "It's been so long, all of it's just rotted away. Most fish out here don't have cover to get under."

"Cover" consisted mostly of tree stumps, which are now gone. With no place to hide, tiny fish at the bottom of the food chain are overconsumed by larger fish and birds before they have a chance to grow to catchable sizes.

"Now we're putting these FADs down to replace the stumps and give the little-bitty fish a place to hide," said Richard Green, a volunteer.

The students and volunteers from the Weiss Lake Improvement Association made the FADS by cementing bamboo stalks in cinder blocks, then toting them on board two Alabama Power boats.

They were placed strategically in different part of the lake. GPS coordinates were recorded and are posted on *apcshorelines.com* and the Weiss Lake webpage at *alabamapower.com* so anglers can fish on top of them.

"Weiss Lake is known as the 'Crappie Capital of the World,' but these devices will attract and hold bass, bluegill and catfish as well," said fishing guide Lee Pitts as he took a break from loading FADs with hand trucks. "This is really helpful to all species in the lake."

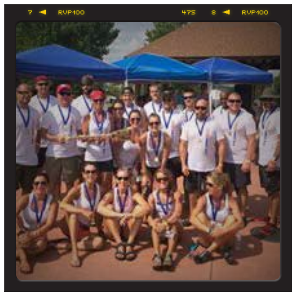
Fishing guide Mark Collins said he hopes he will see more efforts from Alabama Power to help fish in coming years.

"Hopefully, this will turn to an annual deal; we may try to get it going twice a year if we can," said Collins, who also is with the Weiss Lake Improvement Association. "We had a lot of interest seeing this happen on the lake. We didn't have to hunt people around here to volunteer. They came to us." SD

*– GILBERT NICHOLSON*

*Above:* Photo by Wynter Byrd — Water willow is a native plant that was transplanted from the Coosa River to Smith Lake.

# CASTING *off*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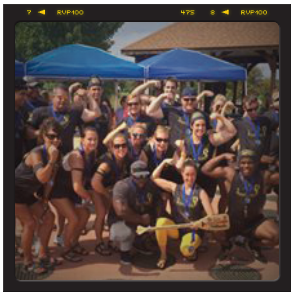
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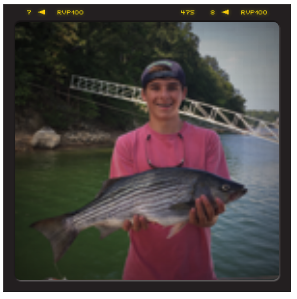
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Gadsden-Etowah Habitat for Humanity 2015 Dragon Boat Festival – Neely Henry Lake: 1) Competition Division First Place Winner, CrossFit Rabid Team; 2) Recreational Division First Place Winner, Gold's Gym; 3) Emma Davidson, Renay Stokes and Chari Bostick; 4) Dora Lynn and Layla Thomas; Seibels open house: 5) Janet Price and Kelly Seibels; 6) Trissy Holladay and Bill Wyatt; 7) John Otey Hutchinson and Laine Pool; Readers' Submissions: 8) Allison Fowler and Lindsay Westlake on Lake Martin; 9) Chandler Coshatt and Sally Grace Sullivan enjoy tubing on Lake Martin; 10) Bill Williford fishes on Lake Jordan; 11) Sydney Grace Edge wakeboards on Smith Lake; 12) Bentley Stroud with his catch on Smith Lake. *Photos courtesy of Suzanne Scharfenberg, Gadsden-Etowah Habitat for Humanity; Ted Tucker; Allison Fowler; Billy Edge and Lindsay Williford.*

# CALL US *Before You Build*

Alabama Power Shoreline managers are here to help you navigate the ownership rights and reservoir characteristics specific to your lake. Because Alabama Power lakes are licensed by the Federal Energy Regulatory Commission (FERC), each lake has unique requirements by which it is operated. To comply with Alabama Power's program, you must get a permit before beginning construction or making changes to existing facilities or the shorelines. Please call your shoreline manager at the numbers listed below and they will be happy to assist you.

# FEEL FREE TO *Contact Us*

SHORELINE MANAGEMENT OFFICES

| | |
|---|---|
| Bouldin | 205-755-4420 |
| Harris | 256-396-5093 |
| Jordan | 205-755-4420 |
| Lay | 205-755-4420 |
| Logan Martin | 205-472-0481 |
| Martin | 256-825-0053 |
| Mitchell | 205-755-4420 |
| Neely Henry | 205-472-0481 |
| Smith | 205-384-7385 |
| Thurlow | 256-825-0053 |
| Weiss | 256-927-2597 |
| Yates | 256-825-0053 |

*Above:* Photo by Mark Sandlin — Fall fishing on Lake Logan Martin.

# ON *the* MOVE

SEND US YOUR INFORMATION

Shorelines wants to make sure we have the most up-to-date information about our readers. Keep in touch, and we will bring you the latest from the lakes.

Share with us your:

Name: _____

Mailing address: _____

_____

Phone: _____

Email: _____

Lake of interest

COOSA:

- ❑ Bouldin
- ❑ Jordan
- ❑ Lay
- ❑ Logan Martin
- ❑ Mitchell
- ❑ Neely Henry
- ❑ Weiss

TALLAPOOSA:

- ❑ Harris
- ❑ Martin
- ❑ Thurlow
- ❑ Yates

WARRIOR:

- ❑ Smith

Contact us:

phone: 205-257-2599

email: G2Shorelines@southernco.com

web: apcshorelines.com

mail: Shorelines
MN-0668
P.O. Box 2641
Birmingham, AL 35291

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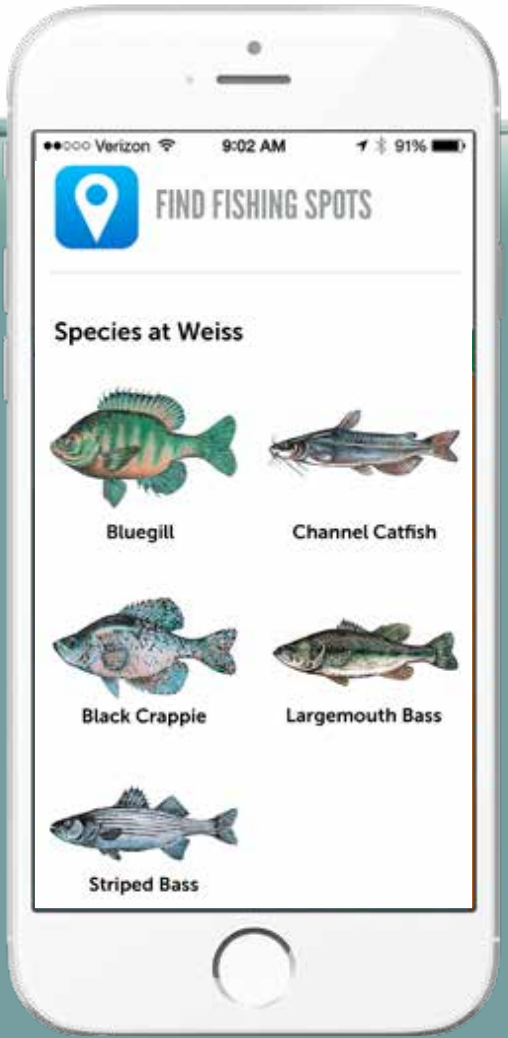


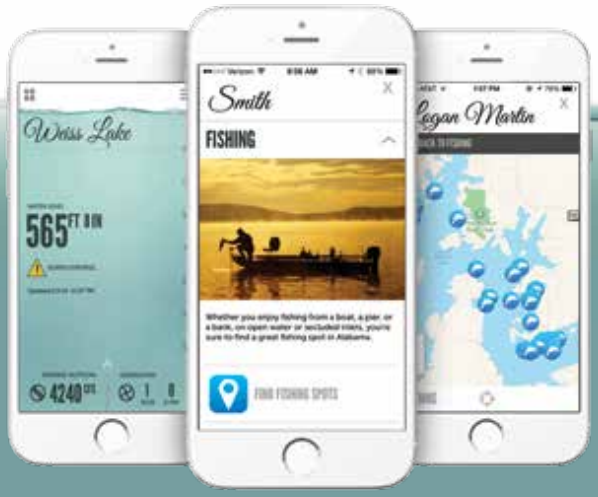


GET IT ON Google play

Download on the App Store

For your next big catch, the Shorelines app will tell you everything you need to know about your favorite Alabama lakes.

If you love life on the lake, you'll love the Alabama Power Shorelines app. It covers all 14 Alabama Power lakes and gives you the power to stay informed and get the most out of your favorite lake. From the hottest fishing spots to lake levels to generation schedule, you'll be smarter and safer every time you visit. So download the Shorelines app today, or visit APCShorelines.com. Then go jump in a lake.

**JUST SOME OF THE FEATURES:**

- Current conditions and water levels
- Generation schedules
- Fishing hot spots and hunting information
- Interactive maps
- Information about day-use parks and lake access

apcshorelines.com

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# APPENDIX C

## BEST MANAGEMENT PRACTICES BROCHURE

# SHORELINE MANAGEMENT PRACTICES


ALABAMA POWER
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# Introduction

For more than 100 years, Alabama Power has harnessed renewable energy from one of the state's most abundant resources - 77,000 miles of rivers and streams directing almost 1/12 of the water that passes through the nation's lower 48 states. Beginning with Lay Dam in 1912, the company constructed 14 hydro facilities during the span of six decades, backing up water to create 11 reservoirs on the Coosa, Tallapoosa and Warrior rivers.

Along with producing energy from the water impounded by these dams, Alabama Power manages lands around the lakes needed for reservoir operations and maintenance called the project boundary. In managing this property, the company is tasked with meeting the needs of a number of individual, industrial and organizational stakeholders with different - and sometimes competing - needs.

The company and its employees work to meet these needs by providing recreational lake access, permitting shoreline structures, striving to educate its stakeholders about the various aspects of its lake management programs and promoting best management practices that can help preserve and protect valuable shoreline resources.

This guide highlights information about the general characteristics of the lakes Alabama Power manages, recreational activities available, permitted shoreline activities and permit types, as well as shoreline best management practices. For a more in-depth conversation on these topics - or others not discussed - please contact your local Alabama Power Shoreline Management office:

| Lake Name | Local Office Number |
|---|---|
| Weiss | 256-927-2597 |
| Neely Henry | 205-472-0481 |
| Logan Martin | 205-472-0481 |
| Lay | 205-755-4420 |
| Mitchell | 205-755-4420 |
| Jordan/Bouldin | 205-755-4420 |
| Harris | 256-396-5093 |
| Martin | 256-825-0053 |
| Yates | 256-825-0053 |
| Thurlow | 256-825-0053 |
| Smith | 205-384-7385 |

Martin Dam, 1928
Spillway gates open.

## Table of Contents

# General Lake Information

## LAKE LEVELS

Along with safely providing low-cost renewable energy, the dams operated by Alabama Power were designed to play different roles in managing the fluctuating flows of state rivers caused by heavy rains or drought conditions that alternately impact Alabama.

Lake-level guidelines were developed for each reservoir by Alabama Power, in cooperation with the Federal Energy Regulatory Commission (FERC) and U.S. Army Corps of Engineers (USACE), as part of Alabama Power's operating licenses to manage both the needs of hydroelectric production as well as those who rely on these lakes for other needs. As part of these guidelines, Alabama Power manages two types of reservoirs: run-of-river and storage.

Lake levels on storage lakes vary seasonally. Typically, these lakes reach their full pool levels in late spring in preparation for the summer months when demand for electricity and recreational use are highest. Beginning in the late summer and early fall, lake levels are lowered to accommodate typical heavy winter and spring rains. Storage lakes provide limited flood control, navigation and recreation.

Because of the seasonal lake-level fluctuation at storage reservoirs, there can be an opportunity for annual shoreline maintenance and repair during winter months while the lakes are below summer pool levels.

By contrast, run-of-river lake water releases are basically the same as the flow into the reservoir. Because of this, water levels in these lakes remain relatively constant, fluctuating only slightly throughout the year. Occasionally, when conditions allow, drawdowns of these run-of-river lakes may occur.

At two of Alabama Power's hydroelectric plants, Bankhead and Holt, the company operates the generating units using flows not needed by the USACE for lock operations. At these plants, Alabama Power owns a powerhouse next to an existing USACE lock and dam and the project boundary includes only a limited amount of land in the immediate vicinity of the powerhouse.


A 1940s illustration from Alabama Power Corporate Archives, showing the hydroelectric system.

## HYDRO PROJECT BOUNDARY

The project boundary, or project lands, includes all of the lands and waters of a hydro generation project under the jurisdiction of FERC.

## RESERVOIR

A reservoir is a body of water impounded – or backed up – by a man-made structure. Due to their size, some reservoirs are often referred to as lakes.

## RESERVOIR TYPES: STORAGE and RUN-OF-RIVER

Storage projects experience seasonal fluctuations in level.

- Weiss
- Neely Henry
- Logan Martin
- Harris
- Martin
- Smith

Run-of-river reservoir levels remain relatively stable throughout the year.

- Lay
- Mitchell
- Jordan/Bouldin
- Yates
- Thurlow

For daily lake-level information, call 1-800-LAKES11 or visit www.alabamapower.com/community/lakes.

# Lake Information

| Location | Area (in acres) | Managed Shoreline (in miles) | Full Pool (Mean Sea Level – in feet) | APC Fee Ownership Above Full Pool (Mean Sea Level – in feet) | Additional Land Rights Held by Alabama Power |
|---|---|---|---|---|---|
| **TALLAPOOSA RIVER** | | | | | |
| Harris (Wedowee)<br>Randolph and Clay counties | 10,660 | 271 | 793 | 795 | Scenic Easement: to 800 feet |
| Martin<br>Coosa, Elmore and Tallapoosa counties | 41,150 | 880 | 491 | Ø | Control Strip: 30 horizontal feet from 491 feet (where applicable) |
| Yates<br>Tallapoosa County | 2,000 | 40 | 345 | 351 | Flood Easement: 363 feet |
| Thurlow<br>Elmore and Tallapoosa counties | 574 | 6 | 288.5 | 299 | None |
| **WARRIOR RIVER** | | | | | |
| Smith<br>Walker, Winston and Cullman counties | 21,200 | 642 | 510 | Ø | Flood Easement: 522 feet |
| Bankhead<br>Walker, Jefferson and Tuscaloosa counties | 9,200 | Ø | 255 | USACE-owned Reservoir | USACE-owned Reservoir |
| Holt<br>Tuscaloosa County | 3,296 | Ø | 187 | USACE-owned Reservoir | USACE-owned Reservoir |

| Location | Area (in acres) | Shoreline Length (in miles) | Full Pool (Mean Sea Level – in feet) | APC Fee Ownership Above Full Pool (Mean Sea Level – in feet) | Additional Land Rights Held by Alabama Power |
|---|---|---|---|---|---|
| **COOSA RIVER** | | | | | |
| Weiss<br>Cherokee County | 30,200 | 447 | 564 | 565<br>(564 in some cases) | Flood Easement: Steps from 572 feet to 578 feet with some areas owned in fee |
| Neely Henry<br>Cherokee, Calhoun, Etowah and St. Clair counties | 11,235 | 339 | 508 | Steps from 509 to 521 | Flood Easement: Steps from 509 feet to 527 feet with some areas owned in fee |
| Logan Martin<br>Calhoun, St. Clair and Talladega counties | 15,263 | 275 | 465 | Steps from 465 to 473 | Flood Easement: Steps from 473.5 feet to 490 feet with some areas owned in fee |
| Lay<br>Chilton, Coosa, Shelby, St. Clair and Talladega counties | 12,000 | 289 | 396 | Steps from 397 to 406 | Flood Easement: Steps from 397 feet to 413 feet with some areas owned in fee |
| Mitchell<br>Chilton and Coosa counties | 5,850 | 147 | 312 | 317 | None |
| Jordan<br>Chilton, Coosa and Elmore counties | 5,880 | 108 | 252 | Ø | Flood Easement: 15 horizontal feet from 252 feet (where applicable) |
| Bouldin<br>Elmore County | 920 | 10 | 252 | 253 in forebay | None |

ALABAMA POWER
A SOUTHERN COMPANY

# Permitting Requirements

## Why do I need a permit?

Permits issued by Alabama Power for work along the shorelines of its reservoirs serve several purposes. Generally, they create standards for construction along the reservoirs and create a record of all structures and shoreline construction along lands and waters under the jurisdiction of FERC, called the project boundary. They also play a role in assisting dam operators manage heavy rains by helping maintain water storage capacity up to a certain elevation on property bordering each reservoir, called a flood or flowage easement.

Along with maintaining flood storage capacity, permits also help protect wetlands, habitats, species and historical resources. Working with employees from Alabama Power's Environmental Affairs Team, shoreline managers review each permit application site to make sure property owners are aware of possible federally protected wetlands, artifacts or threatened and endangered species along the shoreline.

By reviewing all of these considerations during the permitting process, Alabama Power is able to ensure individuals applying for permits are committed to using project land in ways consistent with license requirements and project purposes agreed to with FERC as well as state and federal laws, regulations and USACE general permits.

Lake residents and businesses should always contact the Alabama Power Shoreline Management office for their lake for a permit before beginning construction or maintenance. A permit helps avoid construction delays, the need to remove structures, restoration or mitigation measures and the possibility of legal action should construction begin before a permit is received from Alabama Power.

## How do I get a permit?

Before you construct, modify or improve any structure or facility on land around an Alabama Power reservoir, contact a Shoreline Management representative to discuss your plans and determine the permitting requirements of your project.

Each reservoir is unique in its operation, requirements and Alabama Power ownership rights. General guidelines for shoreline construction activities are available for each reservoir at Alabama Power's Shoreline Management offices or online at alabamapower.com.

## What types of permits are available?

Alabama Power offers several permits that generally fall into two different classifications: Residential and Non-Residential.

## Types of Residential Permits

### GENERAL PERMIT

General residential permits serve single-family dwellings. Examples of facilities requiring these permits include: boat ramps, outbuildings, docks/piers, boat houses, wetslips, seawalls, riprap, gazebos, decks and walkways. In some instances, vegetation clearing and earth moving may also require a permit. A permit fee is required.

### LEGACY PERMIT

A legacy permit may be available for qualifying existing structures within the project boundary or reservoir that do not meet current general guidelines.

## Types of Non-Residential Permits

### GENERAL NON-RESIDENTIAL

General non-residential permits authorize the use of project lands and waters for facilities that are used commercially or will accommodate more than 10 watercraft. Examples of facilities requiring these permits include: public marinas, restaurants, apartments, campgrounds and bed and breakfast facilities. A permit is required for all new developments and for existing developments where additions and modifications are proposed. These permits may require additional consultation and approval by FERC as well as a permit fee.

### LEGACY NON-RESIDENTIAL PERMIT

A legacy non-residential permit may be available for qualifying existing developments within the project boundaries or reservoirs.

### WATER WITHDRAWALS

Alabama Power permits water withdrawals from the reservoirs it manages for municipal, industrial, agricultural and other uses. For water withdrawals in excess of 1 million gallons a day, Alabama Power must seek FERC authorization before issuing a permit. Alabama Power also charges reasonable compensation for the impacts associated with water withdrawal from a reservoir. Adjacent single-family home uses do not require a water withdrawal permit at this time.

## Recreation Opportunities

Alabama Power provides public access at more than 40 public recreation sites and facilities for activities including fishing, boating, swimming and day-use picnic areas. Some of these facilities feature barrier-free access and hunting areas for people with disabilities. For more information on the variety of recreational opportunities, please contact your local Alabama Power Shoreline Management lake office or visit us at **www.alabamapower.com/community/lakes.**

# Shoreline Best Management Practices

## What are shoreline best management practices?

Shoreline best management practices (BMPs) are an array of techniques that assist in the conservation and protection of valuable shoreline resources by minimizing the impact of projects on existing resources. They minimize erosion and stabilize shoreline banks, create fish and wildlife habitat, improve shoreline aesthetics and contribute to improved water quality.

As part of the growing interest in developing shoreline property more naturally, there is movement away from traditional maintenance techniques, which focused on erosion control using suburban landscaping and unnatural erosion barriers. Biologists and property owners continue to find new value in using BMPs that mimick natural ecosystems and maintain and enhance the shoreline.

While landscaping and BMPs along shoreline are now focused on more natural lakeside yards, new techniques do not mean residents must allow vegetation to grow uncontrolled or block their lake view.

Experts suggest retaining as much existing vegetation as possible as part of shoreline landscaping. Adding native grasses and other vegetation is preferrable, as opposed to non-native plants, which may increase landscaping costs, have poor survival rates and provide inadequate erosion control and soil stability. By keeping existing trees and native plants, residents are better able to naturally divert and hold water running through shoreline property.

In an effort to responsibly manage project lands on property it owns, Alabama Power is committed to preserving at least a 15-foot naturally managed vegetative buffer zone from the top summer lake elevation. In this buffer zone, the clearing of native trees and vegetation should be kept to a minimum.

The Alabama Department of Conservation and Natural Resources and the USACE recommend riprap – or the sloped piling of rocks 4-6 inches in diameter – for most shoreline stabilization projects. Alabama Power provides specifications in each lake's shoreline permitting guidelines for residents wishing to apply for a seawall construction permit. Generally, these guidelines require all new seawalls to be constructed as close to the shoreline as possible, with additional approval requirements for the source and type of backfill. Additionally, riprap must be placed at the base of any new seawall at a slope of one to one. Seawalls may not be appropriate for every applicant.

Federally protected areas deemed sensitive due to environmental, cultural resources or other concerns may require site-specific BMPs, which may limit the type of construction and improvement activities permitted as well as when these activities can occur.

## How do BMPs really help?

### Erosion Control and Water Quality

BMPs can reduce the amount of silt or sedimentation produced by erosion as well as other harmful runoff. They can delay or slow the flow of pollutants – even preventing pollutants from entering the water at all. This enhances the overall water quality of a reservoir for wildlife and recreational use.

### Wildlife Habitat

BMPs protect aquatic life in the reservoir and can provide shoreline habitat for certain wildlife. This is particularly important for species listed as rare, threatened and endangered by the United States Fish and Wildlife Service (USFWS). Alabama Power has been working with the USFWS and other agencies to promote good habitat for these species, while allowing for lakeshore development options.

### Scenic Value

BMPs provide a natural view along the shoreline and can increase aquatic wildlife variety and populations.

## When should BMPs be used?

Alabama Power will work with shoreline property owners to incorporate BMPs into their permitted shoreline activities. Some BMPs are required on lands owned by Alabama Power within the project boundary and others are strongly encouraged on privately owned shoreline property.

continued

Riprap is the sloped piling of rocks 4-6 inches in diameter and is recommended for most shoreline stabilization projects.

## Shoreline Best Management Practices

from page 7

### Recommended BMPs for Shoreline Property Owners

Alabama Power strongly recommends shoreline property owners establish a minimum 15-foot natural vegetation buffer or similar BMP on their lands adjacent to the reservoir shorelines. The natural vegetation provided by these buffer strips – and those that exceed the 15-foot minimum – enhance available food and cover for wildlife species, provide links between shoreline habitats and protect near-shore environments.

These near-shore environments provide important breeding and nursery areas for numerous fish and amphibian species and are utilized for feeding and cover by species such as muskrat, beaver, wading birds and waterfowl. At a microhabitat level, the accumulated leaf litter, pine needle duff and coarse woody debris (fallen logs, etc.) in these vegetated buffers provide important habitat for many other species.

### Vegetation Management as a BMP

If your property needs trees or plants, make sure to select and plant the vegetation most appropriate for your location. Native plants and shrubs that enhance the shoreline include button bush, tag alder, deciduous holly, sweet gum, maple (all varieties), yellow poplar, oak (all varieties), pine (all varieties), bald cypress, sycamore, weeping willow, river birch, native azalea, fern, oakleaf hydrangea, Carolina jasmine and sweet shrubs (Clianthus flondus). More than 200 native plants are commonly found on lands surrounding Alabama Power reservoirs.

## Best Management Practices

- Plant native trees, shrubs and flowers for landscaping and gardens to reduce watering as well as chemical and pesticide use.
- Preserve or establish a naturally managed vegetative filter strip along the shoreline to keep clearing of native trees and vegetation to a minimum. Alabama Power recommends a buffer set back of at least 15 feet measured horizontal from the top of the pool elevation.
- Plant a low-maintenance, slow-growing grass that is recommended for your soil conditions and climate.
- Maintain the grass as high as possible to shade out weeds and improve rooting so less fertilizing and watering are required.
- Avoid dumping leaves or yard debris on or near the shoreline.
- Use permeable paving materials and reduce the amount of impervious surfaces, particularly driveways, sideways, walkways and parking areas.
- Avoid or minimize the use of pesticides, insecticides and herbicides whenever possible.
- Dispose of vehicle fluids, paints or household chemicals as indicated on their respective labels. Do not deposit these products into storm drains, project waters or onto the ground.
- Use soap sparingly when washing your car. Wash cars on a grassy area so the ground can filter the water naturally. Use a hose nozzle with a trigger to save water and pour your bucket of used soapy water down the sink and not in the street.
- Avoid applying any fertilizer. Fertilizer use can be avoided by using native vegetation in a landscape.
- If you must apply fertilizers or pesticides, apply them according to the label and never before rain or snow is forecast. Use only EPA-approved pesticides.
- Maintain septic tanks and drain fields according to the guidelines and/or regulations established by the local regulatory authority.
- Discourage livestock from entering project waters or tributaries.
- Create and maintain a rain garden in the landscape to naturally filter runoff.
- Deposit excavated materials in an upland area and properly contain them to prevent them from entering the waterway, adjacent wetlands or bottomland hardwoods through erosion and sedimentation.

- Place riprap along the base of existing seawalls.
- Maintain natural drainage to the maximum extent possible and do not direct concentrated runoff directly into the reservoir.
- Divert rain gutters/drain pipes and other sources of household runoff, including driveways, to unpaved areas where water can soak into the ground and be naturally filtered before reaching the reservoir.
- Put yard debris and biological waste in a compost pile above the Alabama Power flood easement away from the shoreline.
- Avoid excessive watering of lawns. Water either in the morning and/or in evening.
- Do not apply pesticides directly to the water. Contact Alabama Power at 1-800-LAKES-11 for aquatic vegetation concerns.

# Examples of BMPs in Construction

## Silt Fence

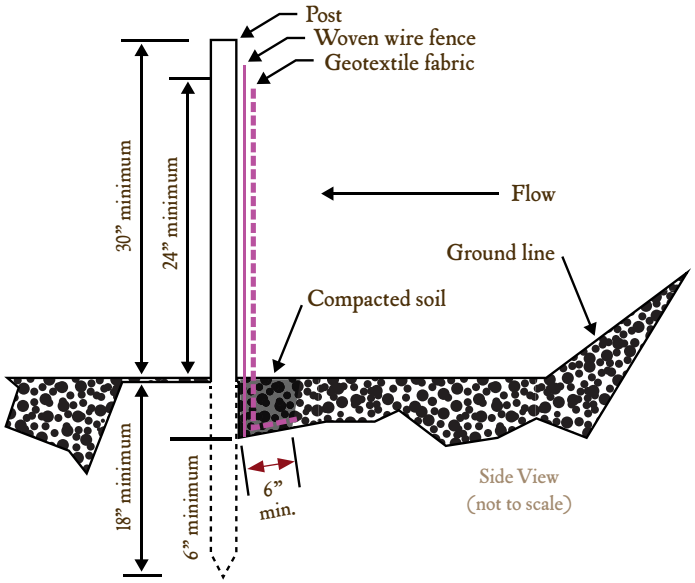
A silt fence is a temporary structure used to reduce the quantity of sediment moving downslope on a landscape. It is made of a permeable fabric to filter sediment that is trenched into the ground and attached to supporting posts.

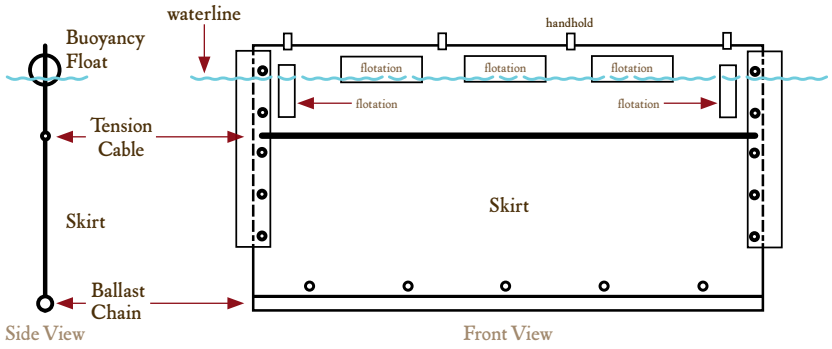
### Installation

Step 1: Dig a 6-inch trench the length of the silt fence along the contour.
Step 2: Place the bottom 12 inches of the silt fence in the trench, keying the bottom 6 inches toward the up, gradient slope.
Step 3: Ensure the trench is completely backfilled and the bottom of the fence is secure in the ground for the entire length of the installation.
Step 4: Stakes should be spaced at a maximum 10 feet apart and driven 18 inches into the ground. Securely fasten the wire backing and silt fence to the stakes.

### Maintenance

Step 1: Inspect sediment fences at least once a week and after each significant rain event.
Step 2: Make required repairs immediately.
Step 3: Should the silt fence fabric collapse, tear, decompose or become ineffective, replace it promptly.
Step 4: Remove sediment deposits when they reach a depth of 15 inches or half the height of the fence as installed to provide adequate storage volume for the next rain and to reduce pressure on the fence.




## Silt Curtain

A silt curtain is a flexible barrier that hangs down from the water surface. The system uses a series of floats on the surface and a ballast chain or anchors along the bottom. They are generally most effective in relatively shallow undisturbed water.

# Examples of BMPs in Construction continued

## Erosion Control Seed and Mulch

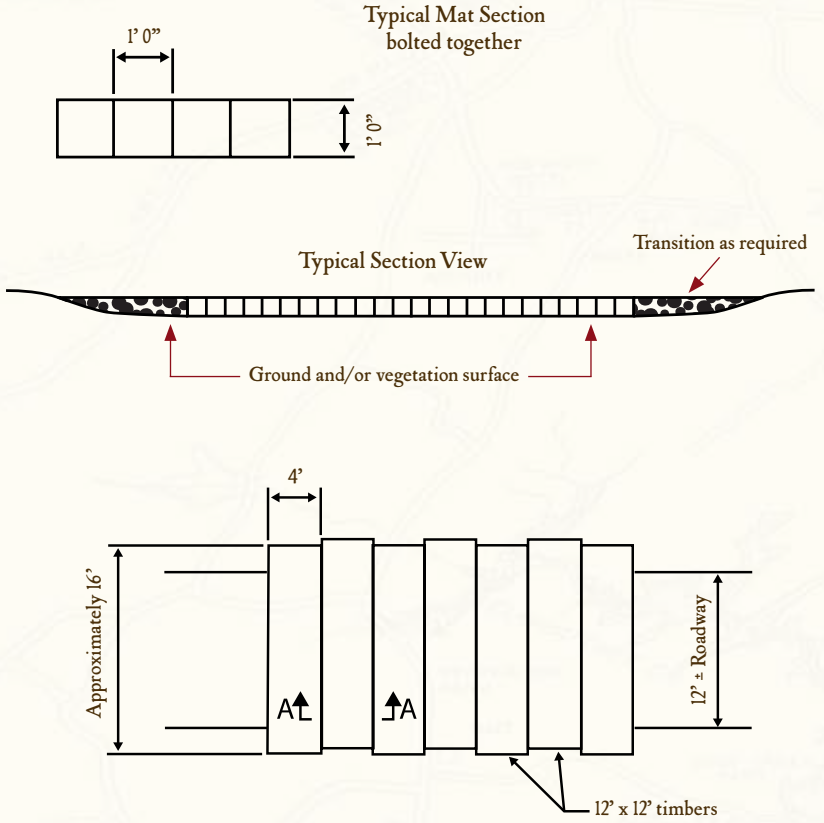
Permanent seeding establishes perennial vegetation on disturbed areas. This permanent vegetation provides economical long-term erosion control and helps prevent sediment from leaving the site. This practice is used when vegetation is desired and appropriate to permanently stabilize the soil.

Mulching is the application of plant residues, such as straw or other suitable materials, to the soil surface. Mulch protects the soil surface from the erosive force of raindrop impact and reduces the velocity of overland flow. It helps seedlings germinate and grow by conserving moisture, protecting against temperature extremes and controlling weeds. Mulch also maintains the infiltration capacity of the soil. Mulch can be applied to seeded areas to help establish plant cover. It can also be used in unseeded areas to protect against erosion over the winter or until final grading and shaping can be accomplished, except in areas with concentrated flow.

Site preparation includes grading, if needed, and seedbed preparation and fertilizing, liming and seeding. Straw is the most commonly used material in conjunction with seeding. Wheat straw is the mostly commonly used straw, and can be spread by hand or with a mulch blower. If the site is susceptible to wind, the straw should be tacked down with a tackifier, a crimper or a disk to prevent seed loss.

### Maintenance

Step 1: Inspect all mulches periodically and after rainstorms to check for rill erosion, dislocation or failure.
Step 2: Where erosion is observed, apply additional mulch. If washout has occurred, repair the slope grade, reseed and reinstall mulch.
Step 3: Continue inspections until vegetation is firmly established.




## Construction Mat

Construction mats are utilized as temporary crossings for work to be performed in wetlands and to spread equipment weight over a larger, less concentrated base. Mats may be made of wood, plastic, high density polyethylene (HDPE) or composite material. Mats will be installed using a forklift or heavy equipment in a sequential manner so that a road/pad is created as equipment moves through a wetland area. Removal is performed in the same manner in a reverse sequence.

# Examples of BMPs in Construction from page 10

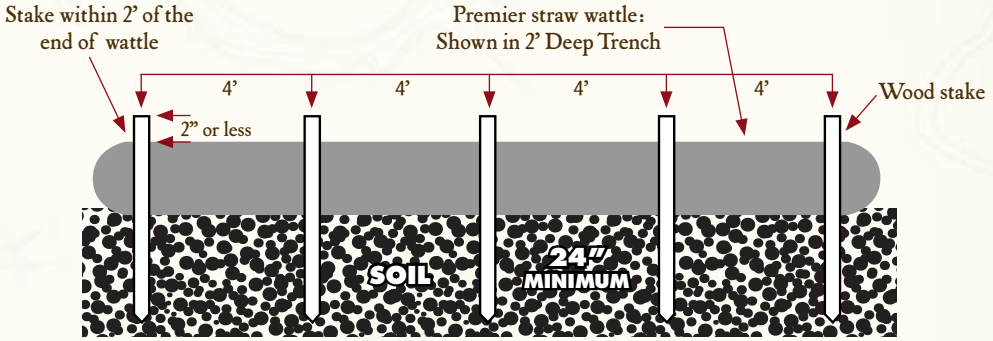
## Wattle

A wattle check dam is a sediment barrier that is easily installed around drainage ways to slow the flow of water. In areas of concentrated flow, place the wattle perpendicular to the flow and stake the wattle in place utilizing 2 foot by 2 foot wooden stakes. Ensure there is no open pathway under the wattle.

### Maintenance

Inspect the wattle daily when work is ongoing in the area and after each qualifying rainfall event. Check for undermining and/or overtopping by stormwater flows. Remove displaced silt and place it upland on the right-of-way, spread and grass once it reaches one half of the wattle diameter.

### Staking Pattern Guide




Examples of permitted activities in this guide are not comprehensive. If you are planning any shoreline construction or improvement projects, please contact your local Alabama Power Shoreline Management office before beginning.

| Lake Name | Local Office Number |
|---|---|
| Weiss | 256-927-2597 |
| Neely Henry | 205-472-0481 |
| Logan Martin | 205-472-0481 |
| Lay | 205-755-4420 |
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| Smith | 205-384-7385 |

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PRESERVING & CONSERVING ALABAMA'S HYDRO SYSTEMS SINCE 1914

## Shoreline Management

While this guide provides lake residents and stakeholders a basic understanding of Alabama Power's reservoirs, recreational facilities, permitting procedures and BMPs, there is no better resource for understanding the company's comprehensive policies, license requirements and the local, state and federal regulations under which it operates, than the shoreline managers at each reservoir's Shoreline Management office. To learn more about recreational sites, permitting and best management practices, call your local Alabama Power Shoreline Management office at the numbers below or visit www.alabamapower.com/community/lakes.

## Special Thanks

Examples of BMPs used in construction were provided in part by the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas created by the Alabama Soil and Water Conservation Committee. To reference the complete handbook, visit http://swcc.alabama.gov/pages/erosion_control.aspx?sm=b_b.

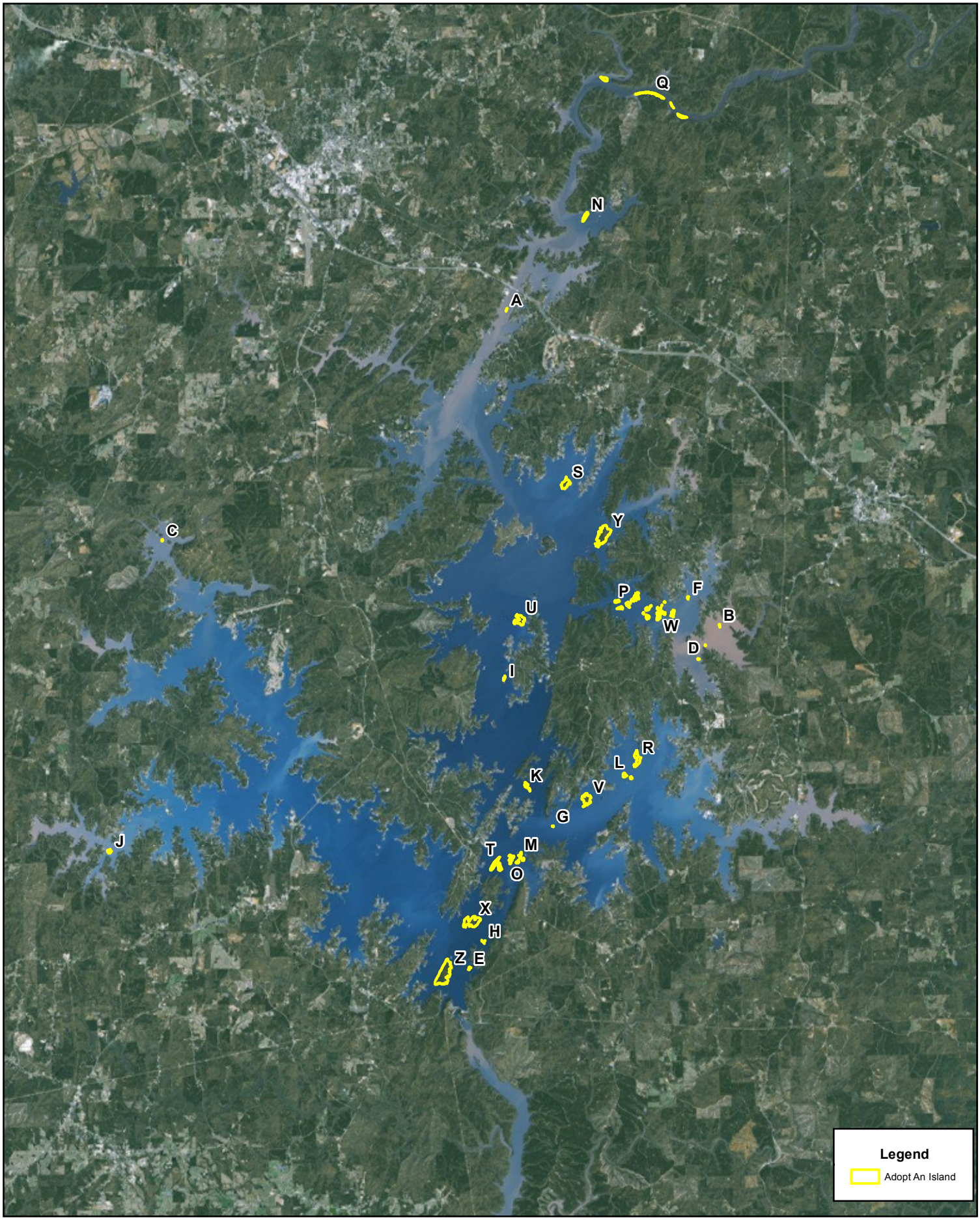
| Lake Name | Local Office Number |
|---|---|
| Weiss | 256-927-2597 |
| Neely Henry | 205-472-0481 |
| Logan Martin | 205-472-0481 |
| Lay | 205-755-4420 |
| Mitchell | 205-755-4420 |
| Jordan/Bouldin | 205-755-4420 |
| Harris | 256-396-5093 |
| Martin | 256-825-0053 |
| Yates | 256-825-0053 |
| Thurlow | 256-825-0053 |
| Smith | 205-384-7385 |

Lake Mitchell, early 1950s

# APPENDIX D

# "ADOPT AN ISLAND" MAPS

# Adopt An Island Program

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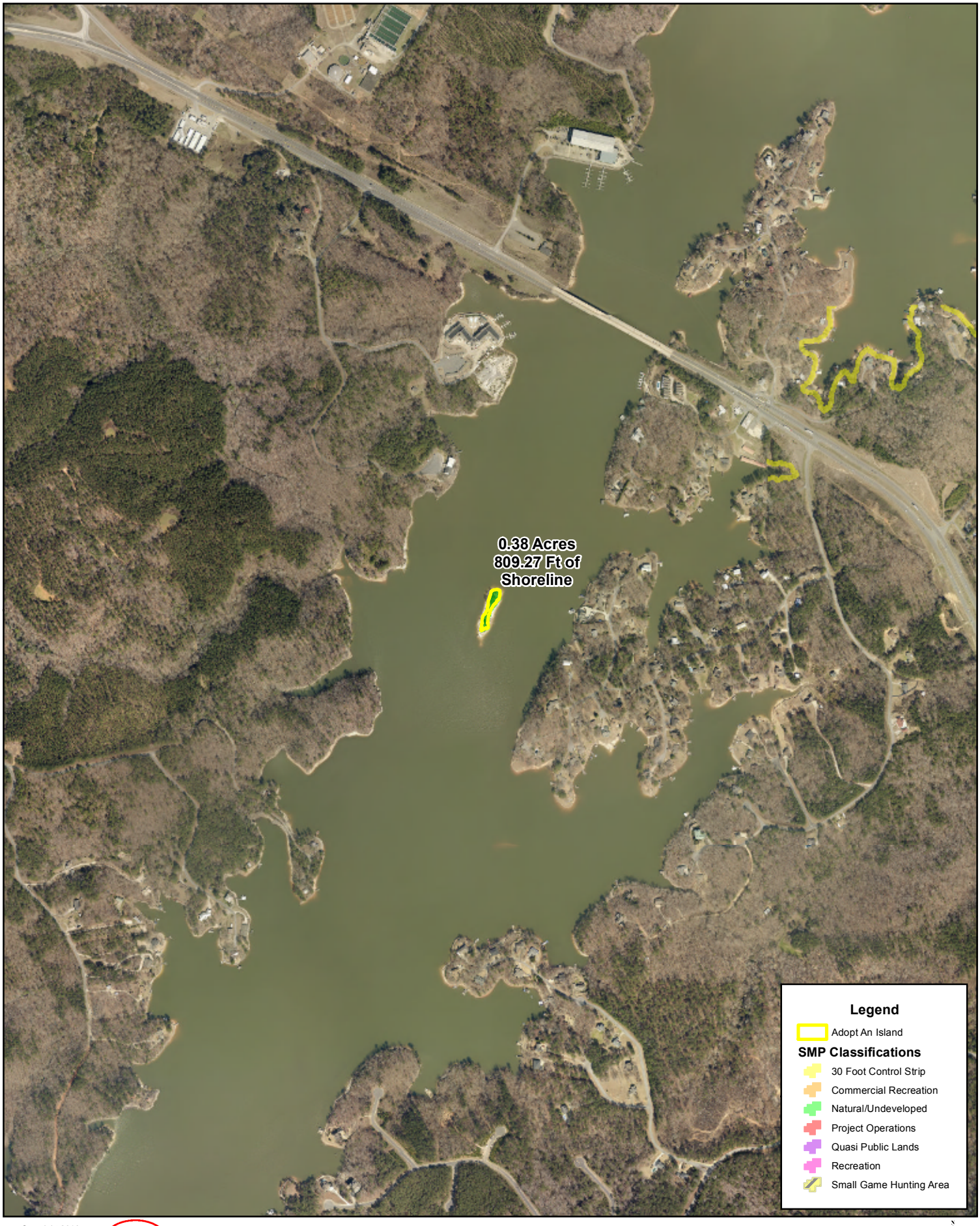
Alabama Power SHORELINE MANAGEMENT

2 1 0 2 4 6 8 Miles

# Adopt An Island Program -- Island A

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750 375 0 750 1,500 2,250 3,000 Feet

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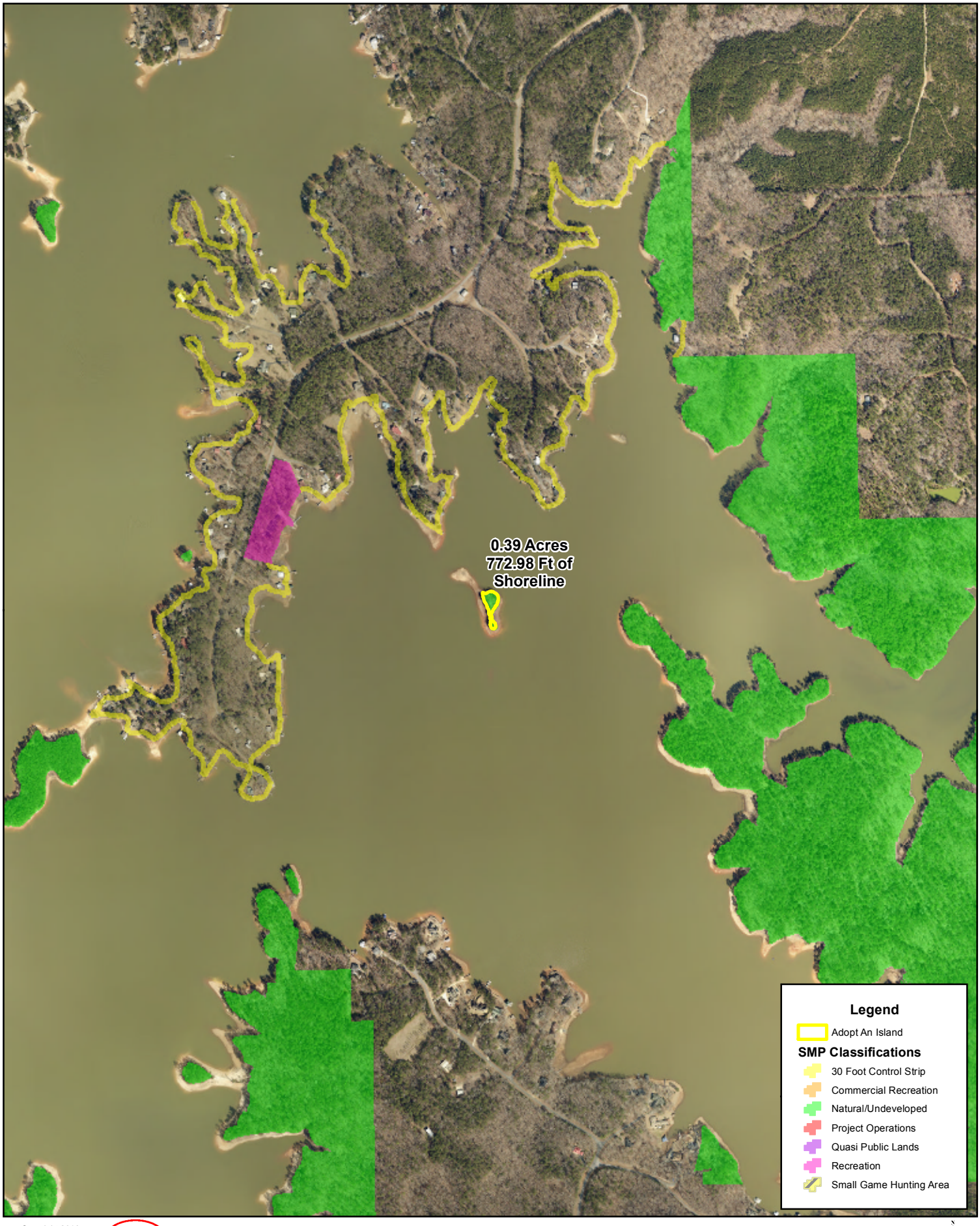


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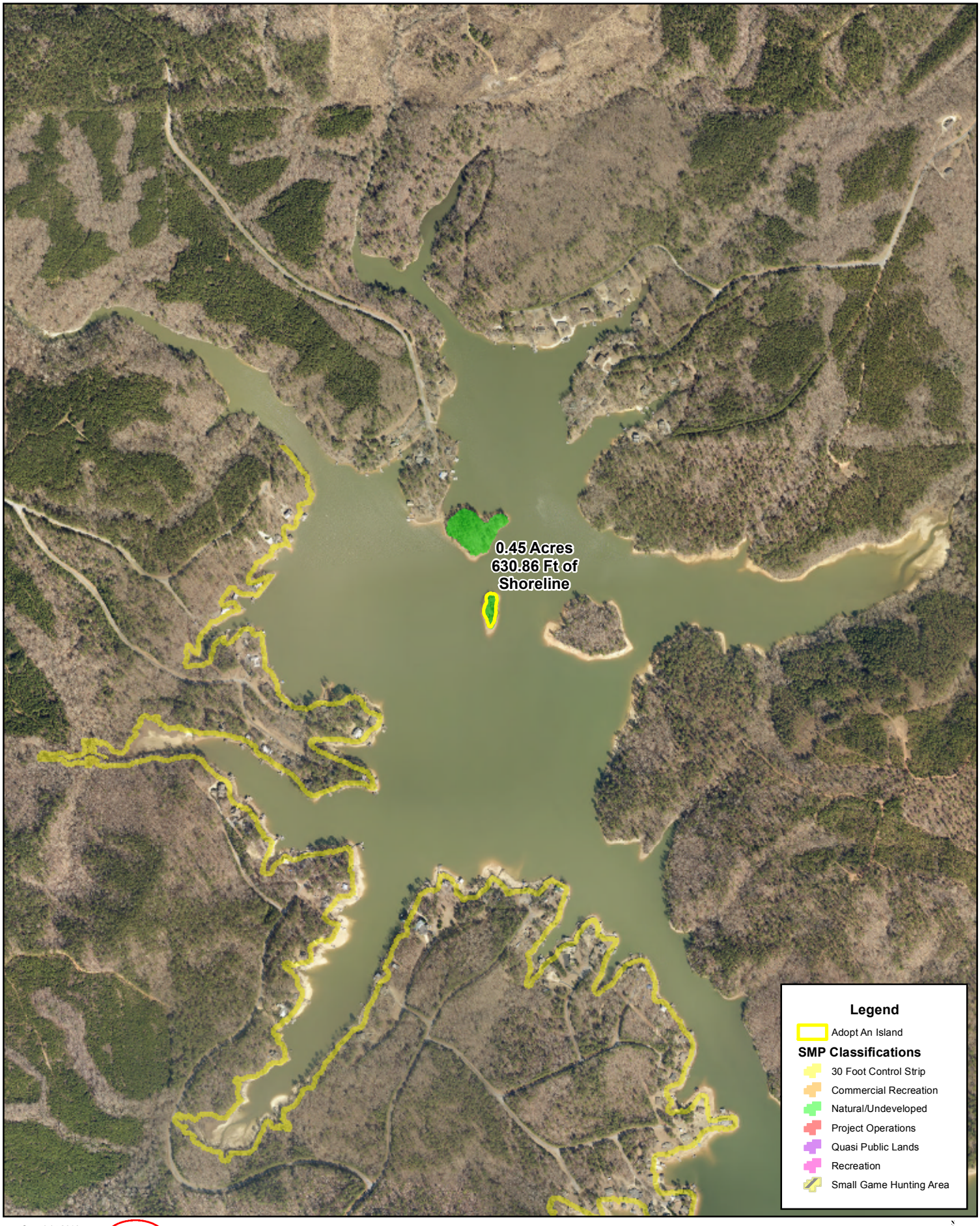


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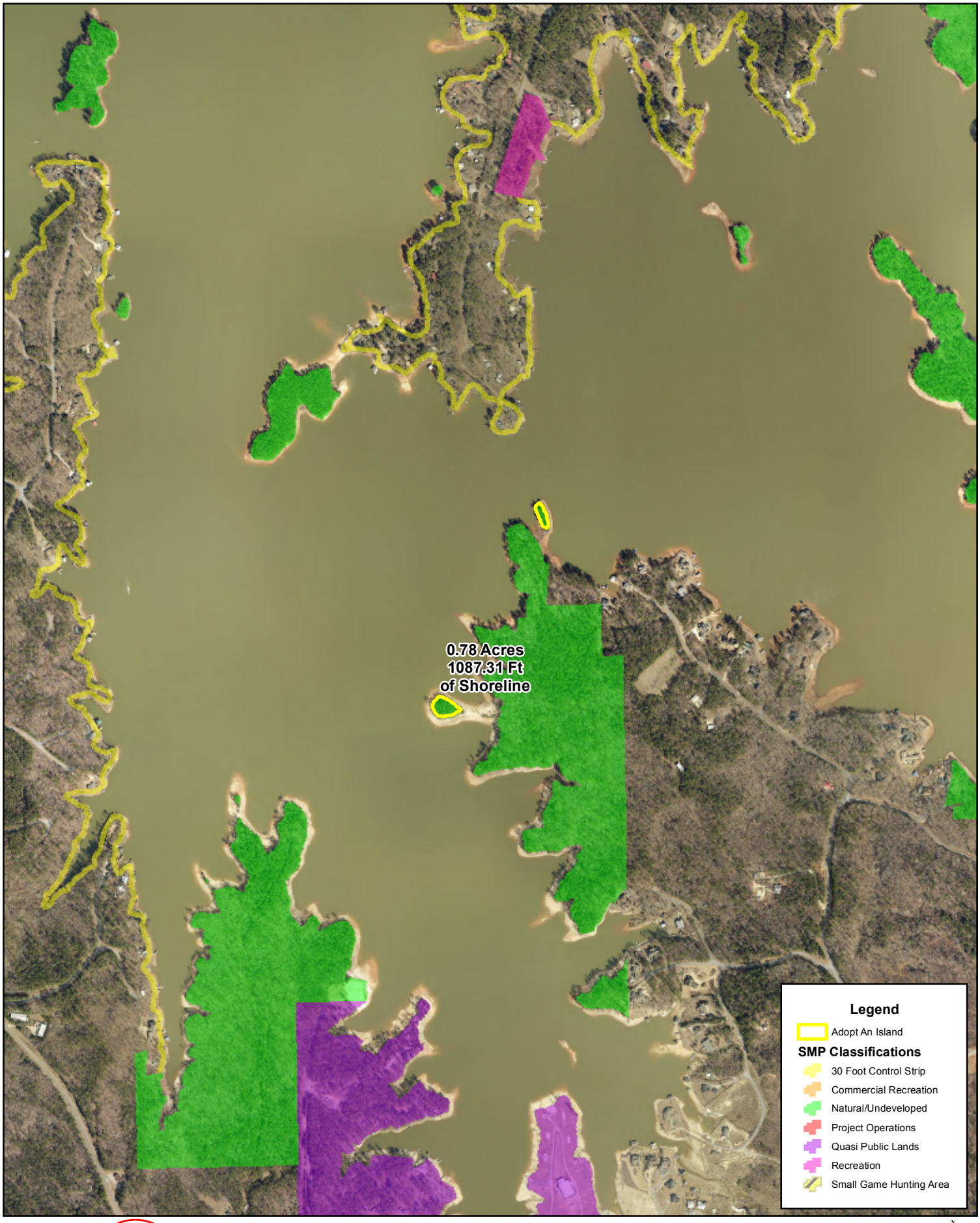
# Adopt An Island Program -- Island D

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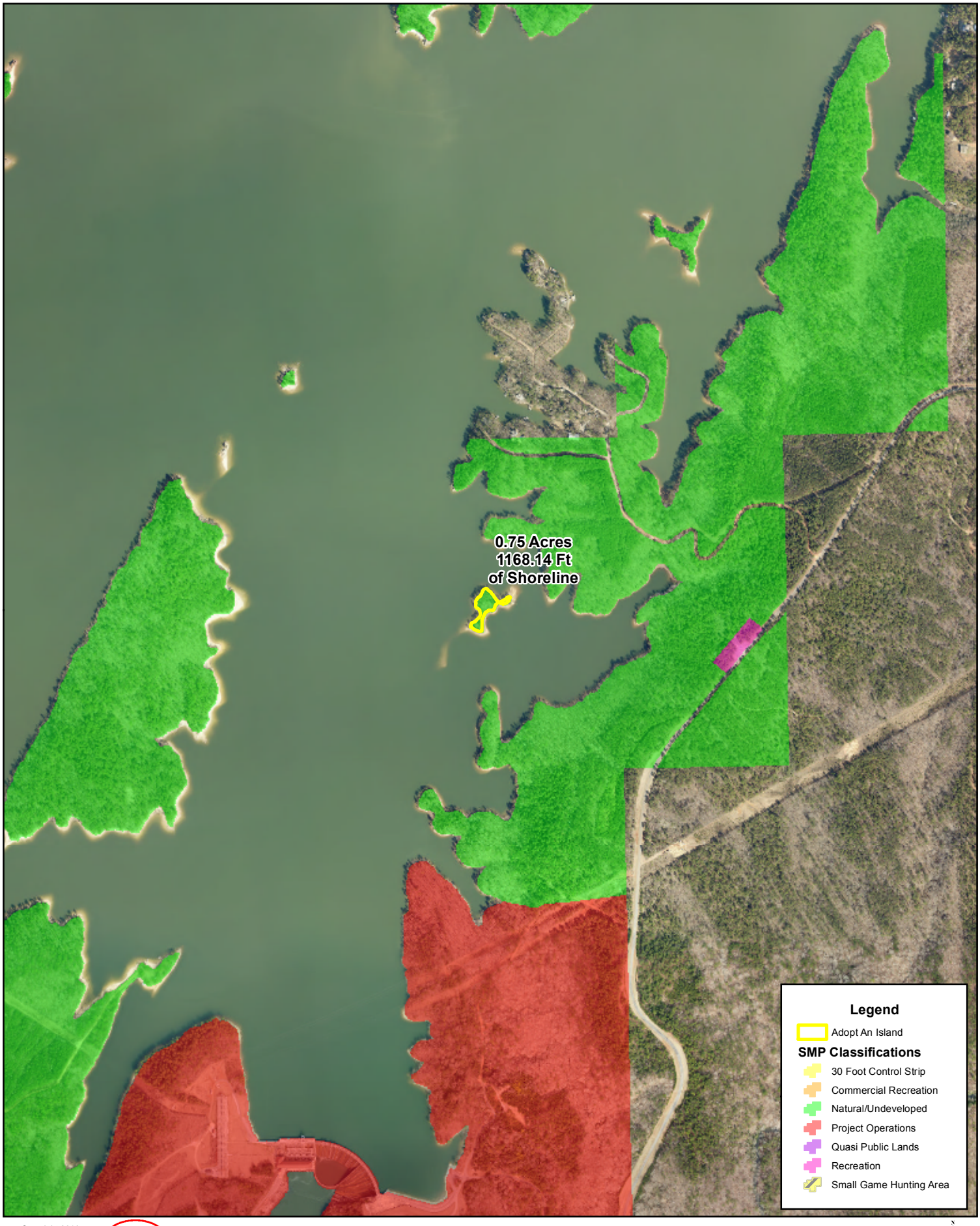
# Adopt An Island Program -- Island E

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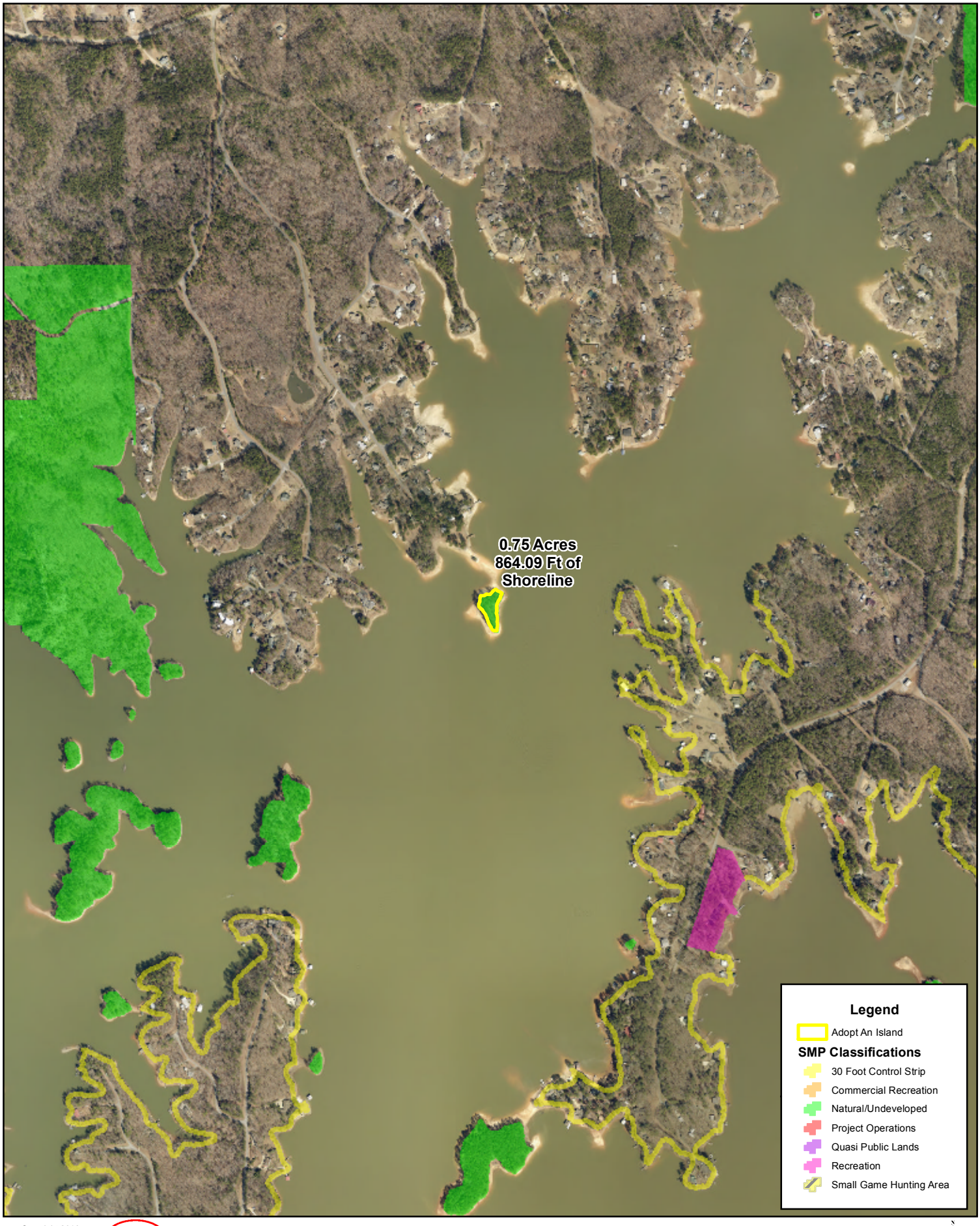
# Adopt An Island Program -- Island F

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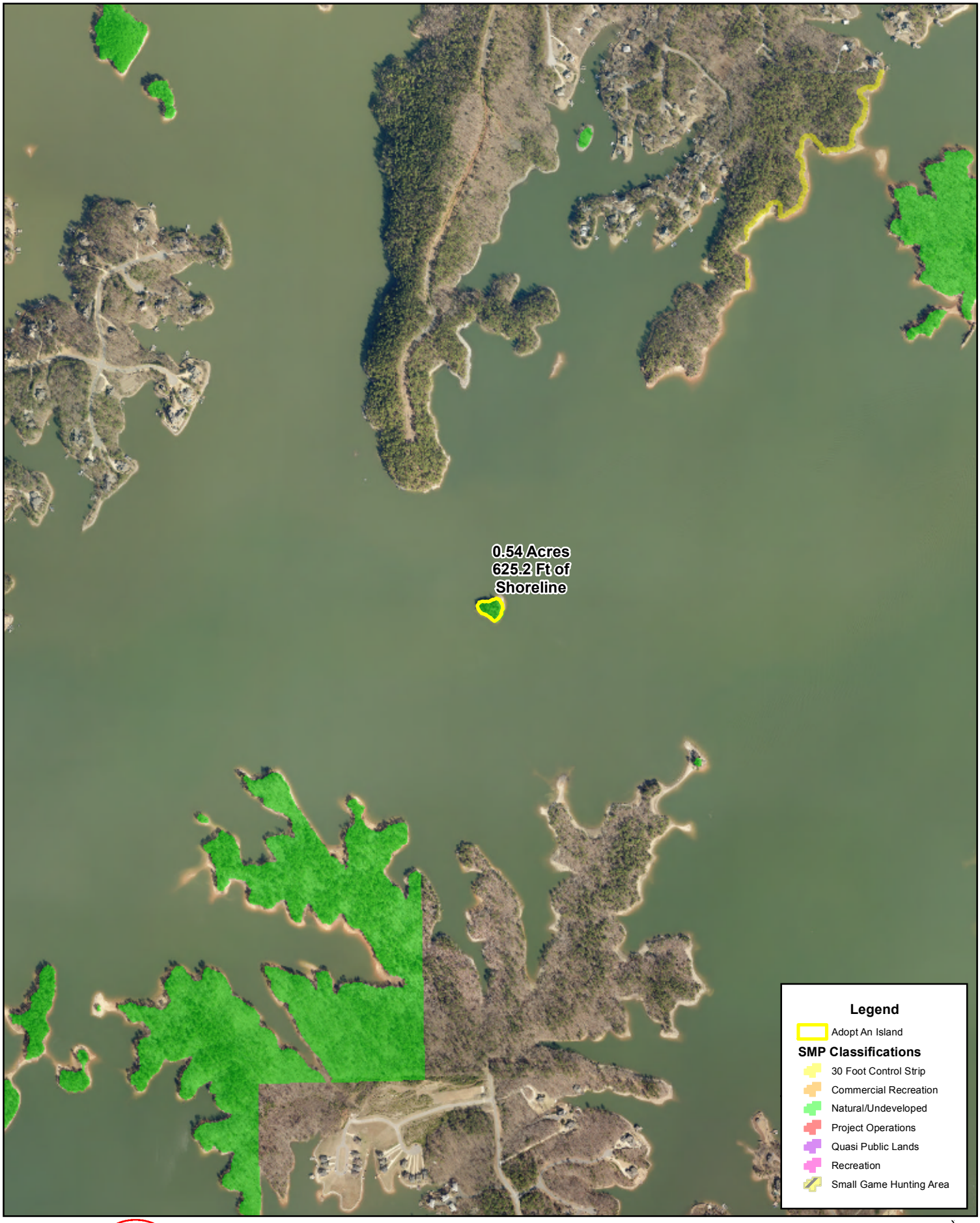


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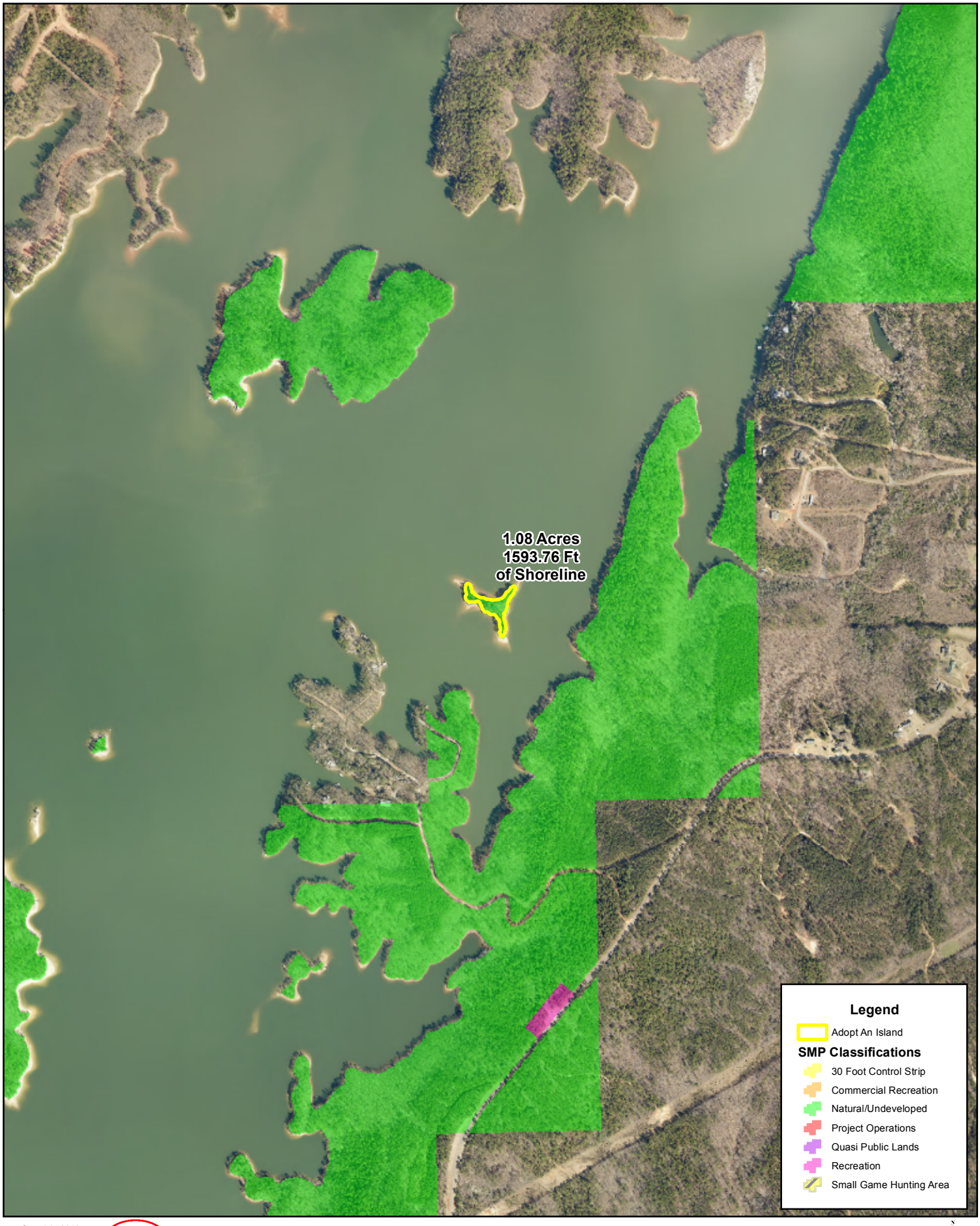
# Adopt An Island Program -- Island H

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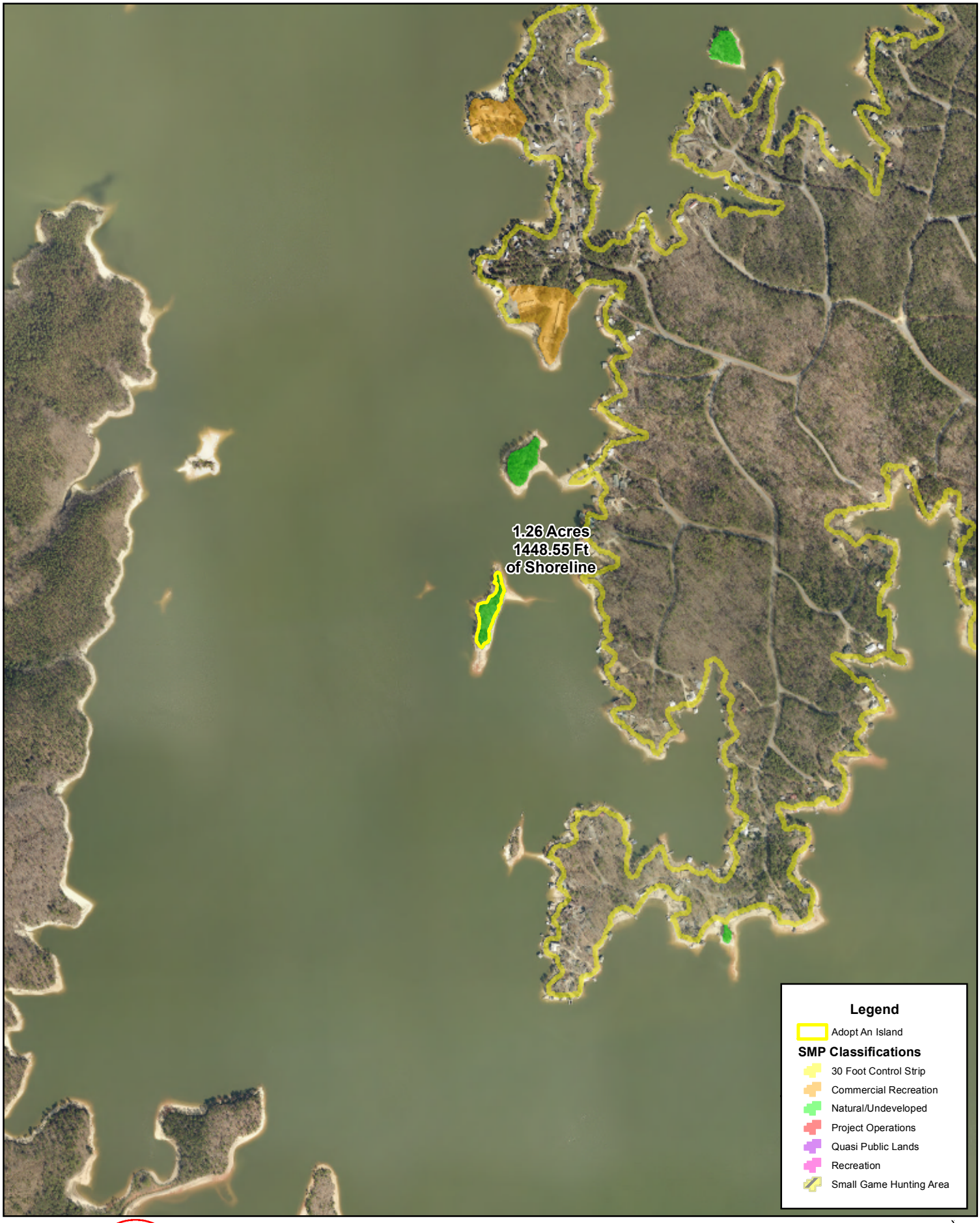
# Adopt An Island Program -- Island I

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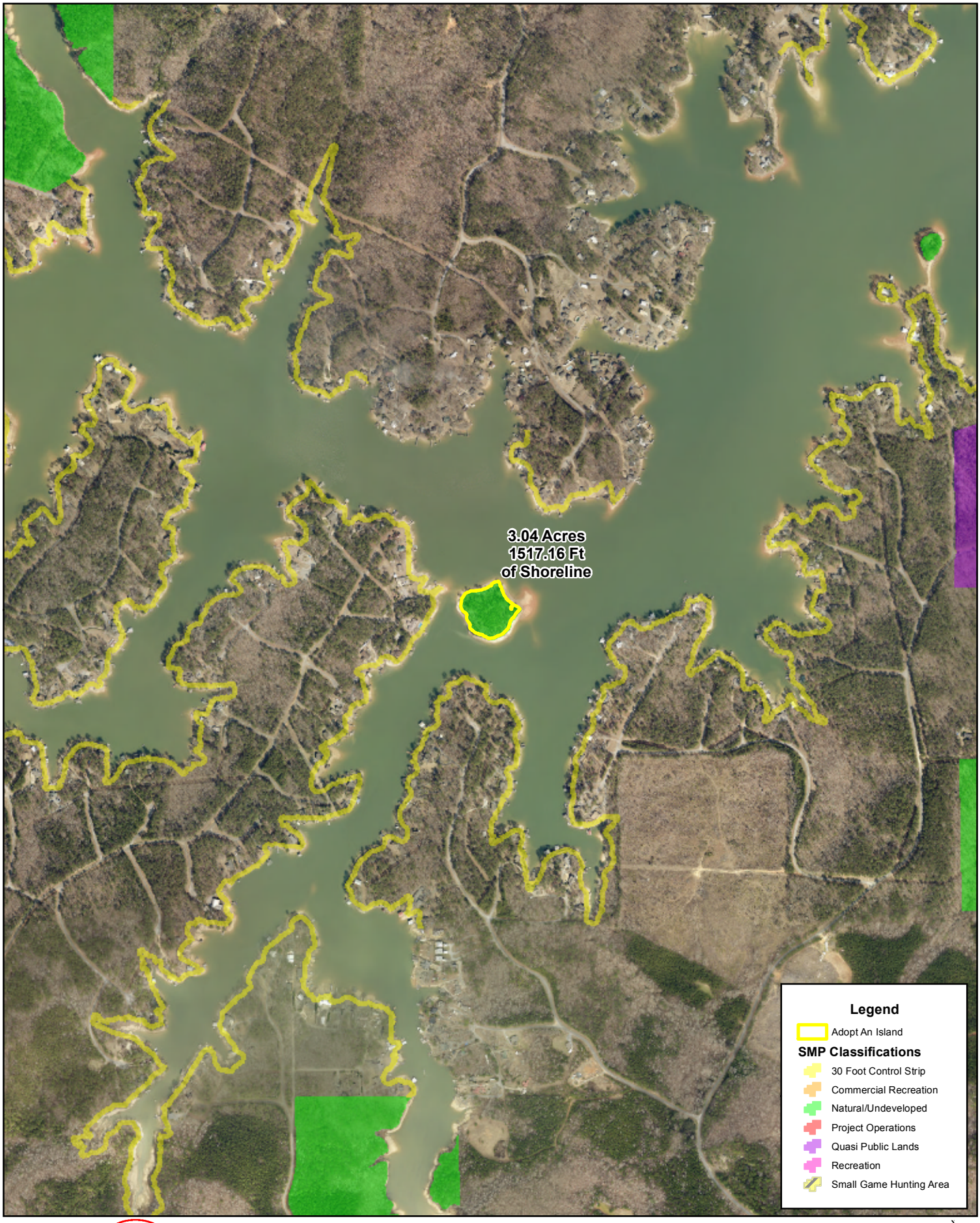


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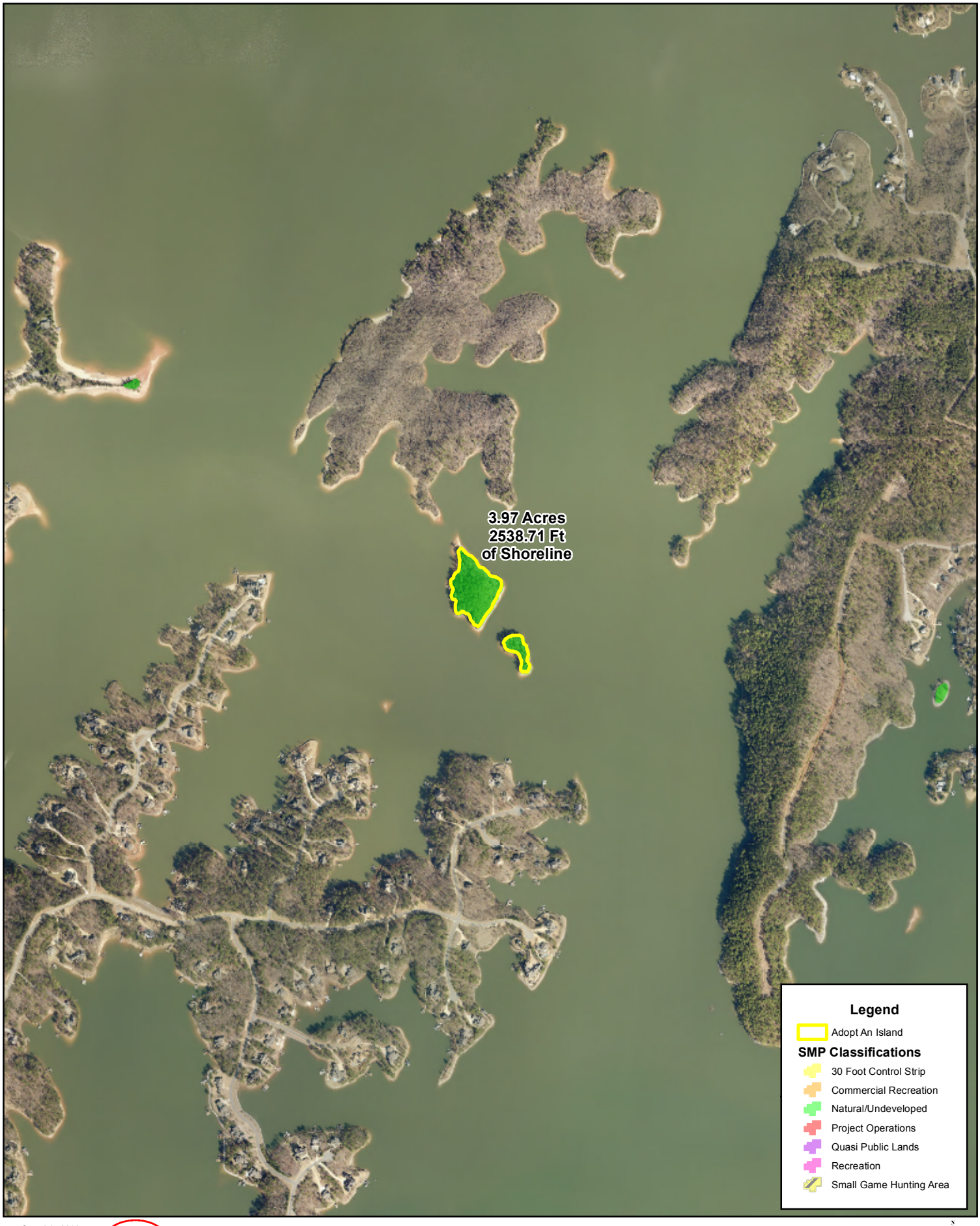
# Adopt An Island Program -- Island K

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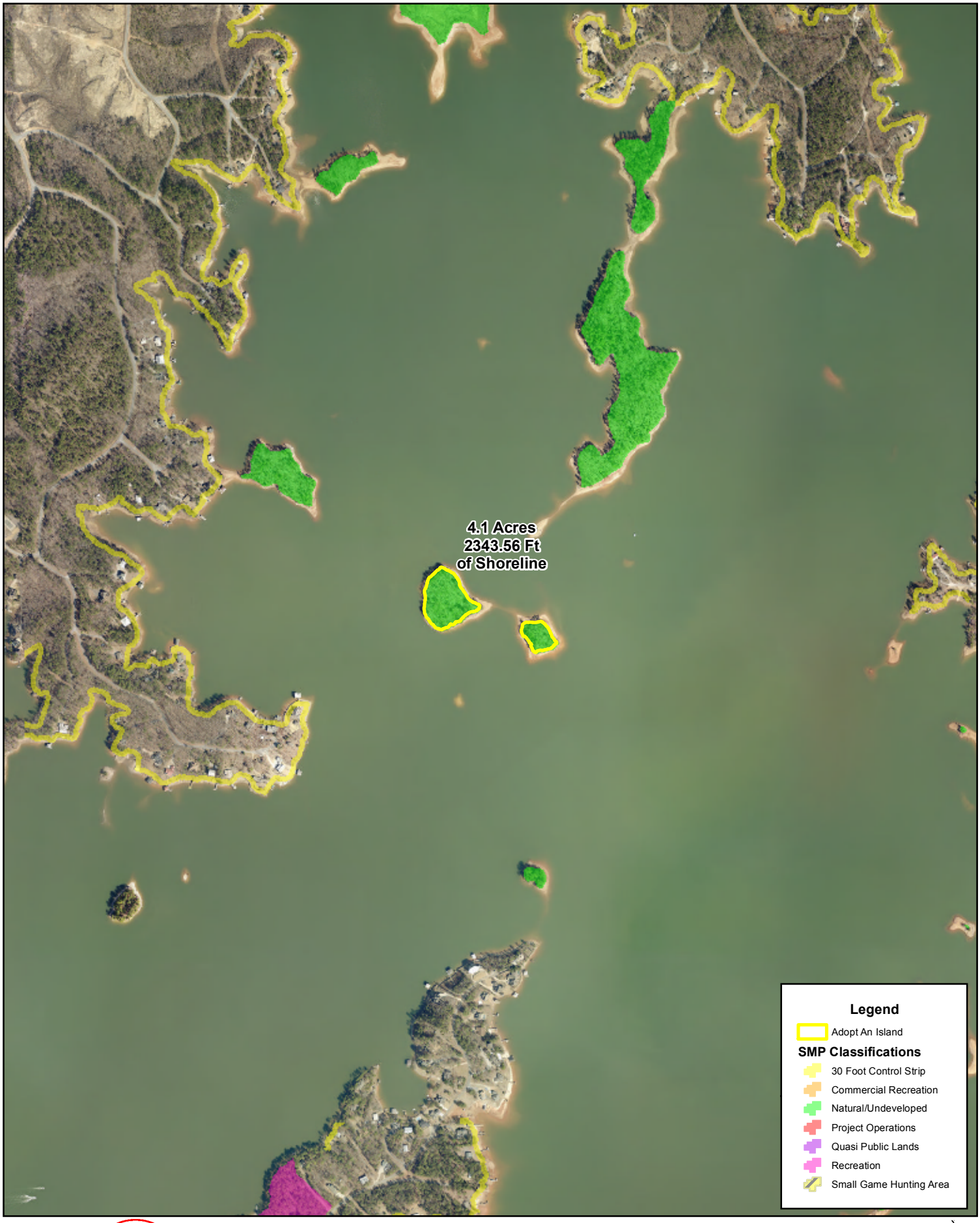


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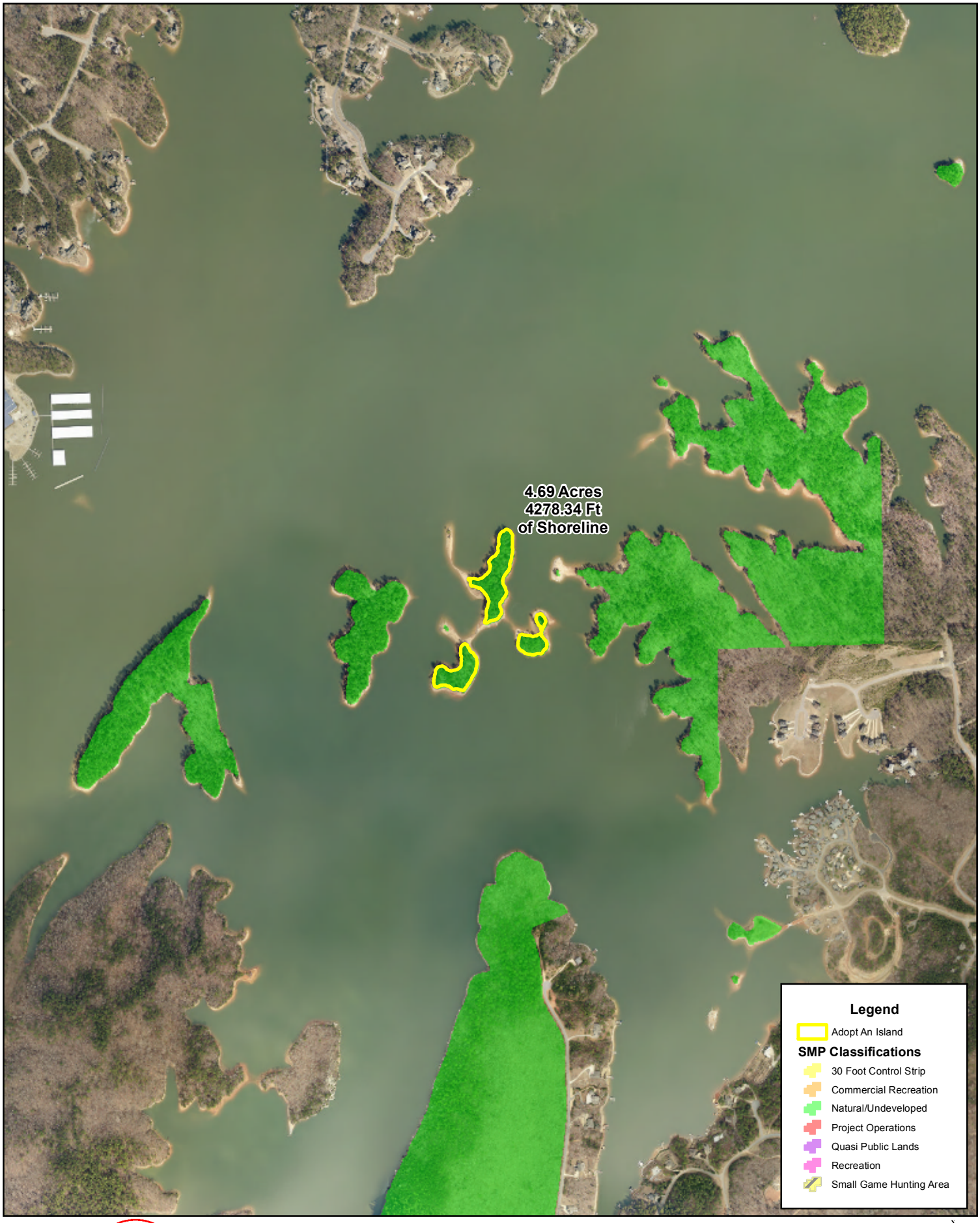
# Adopt An Island Program -- Island M

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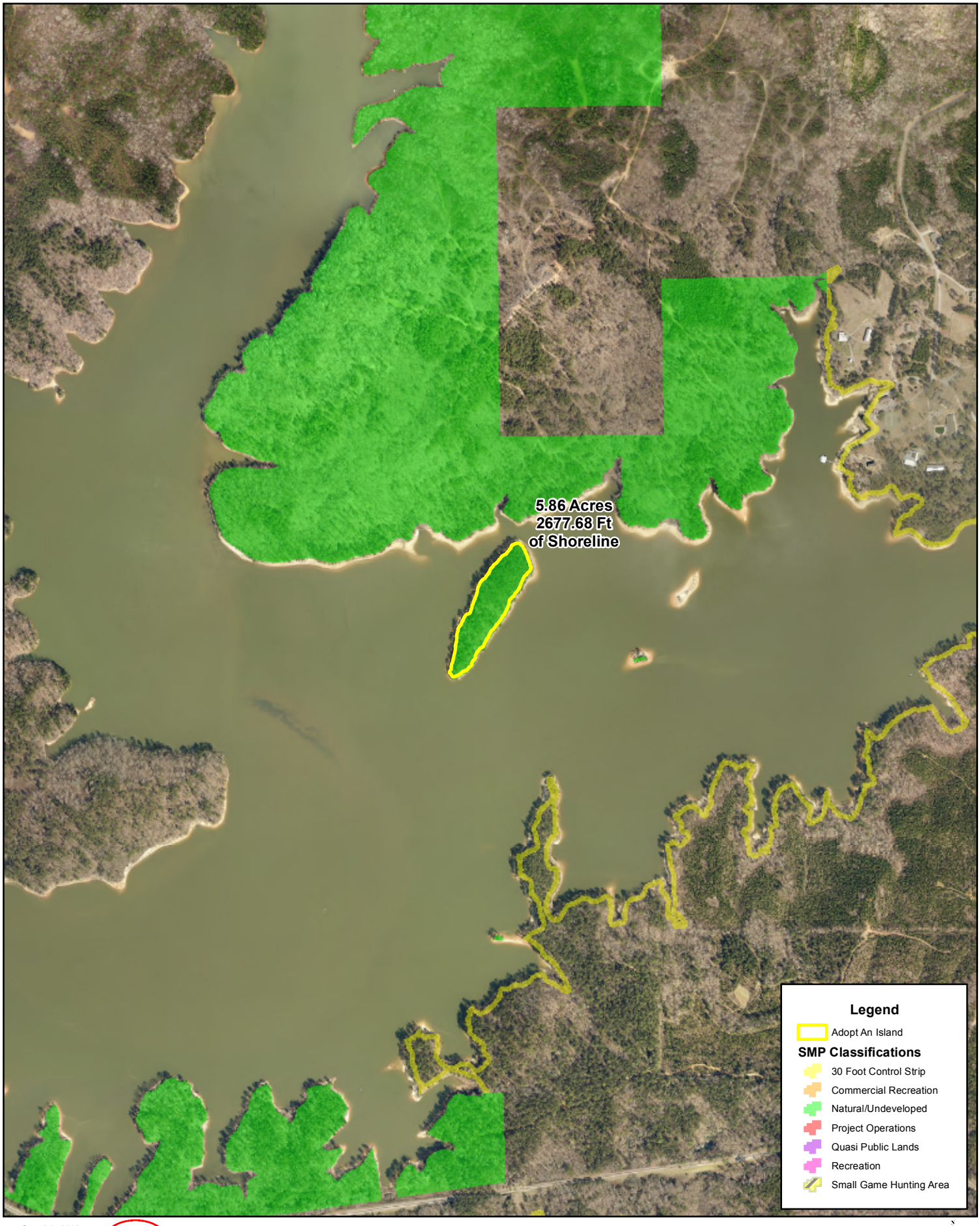
# Adopt An Island Program -- Island N

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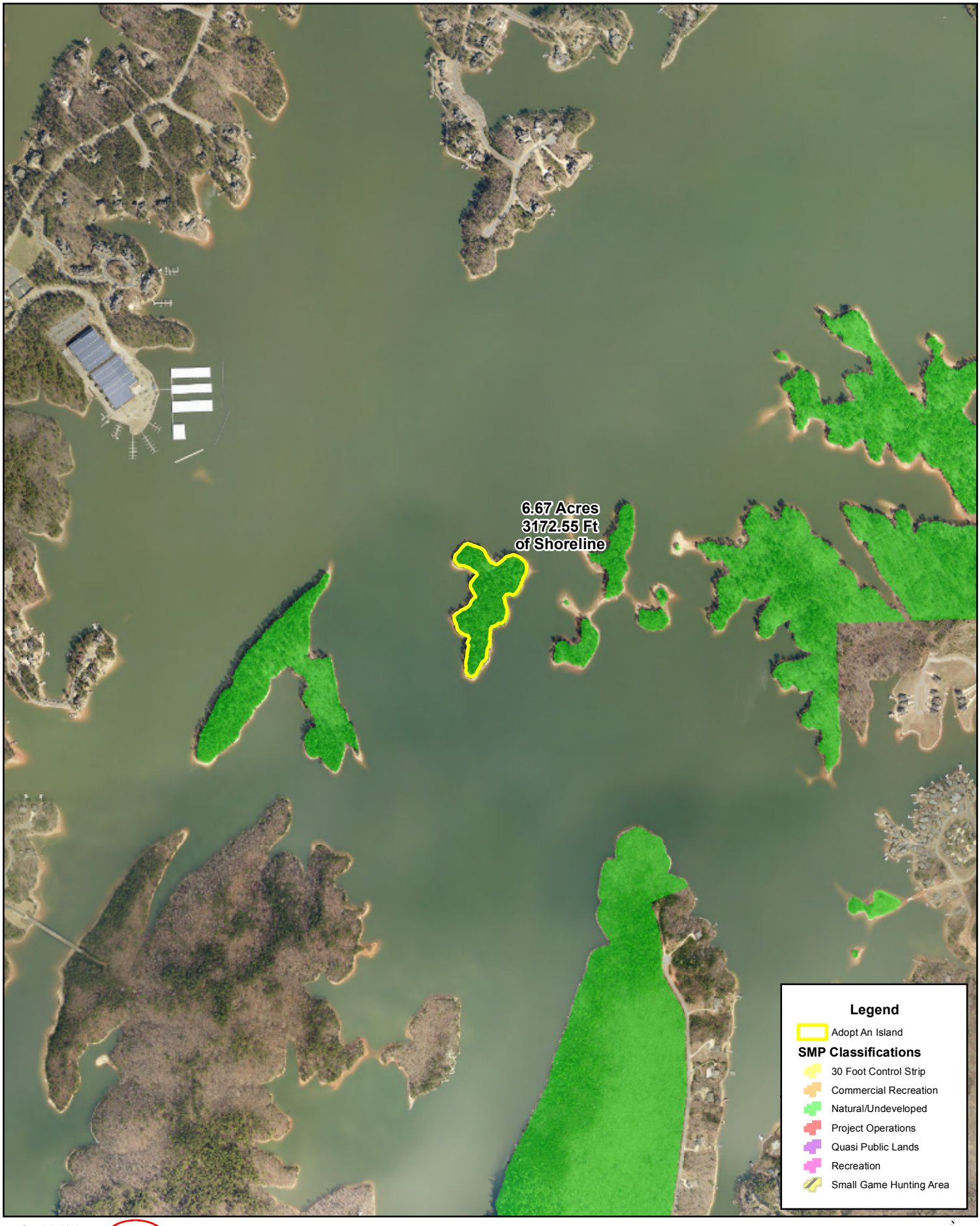
# Adopt An Island Program -- Island O

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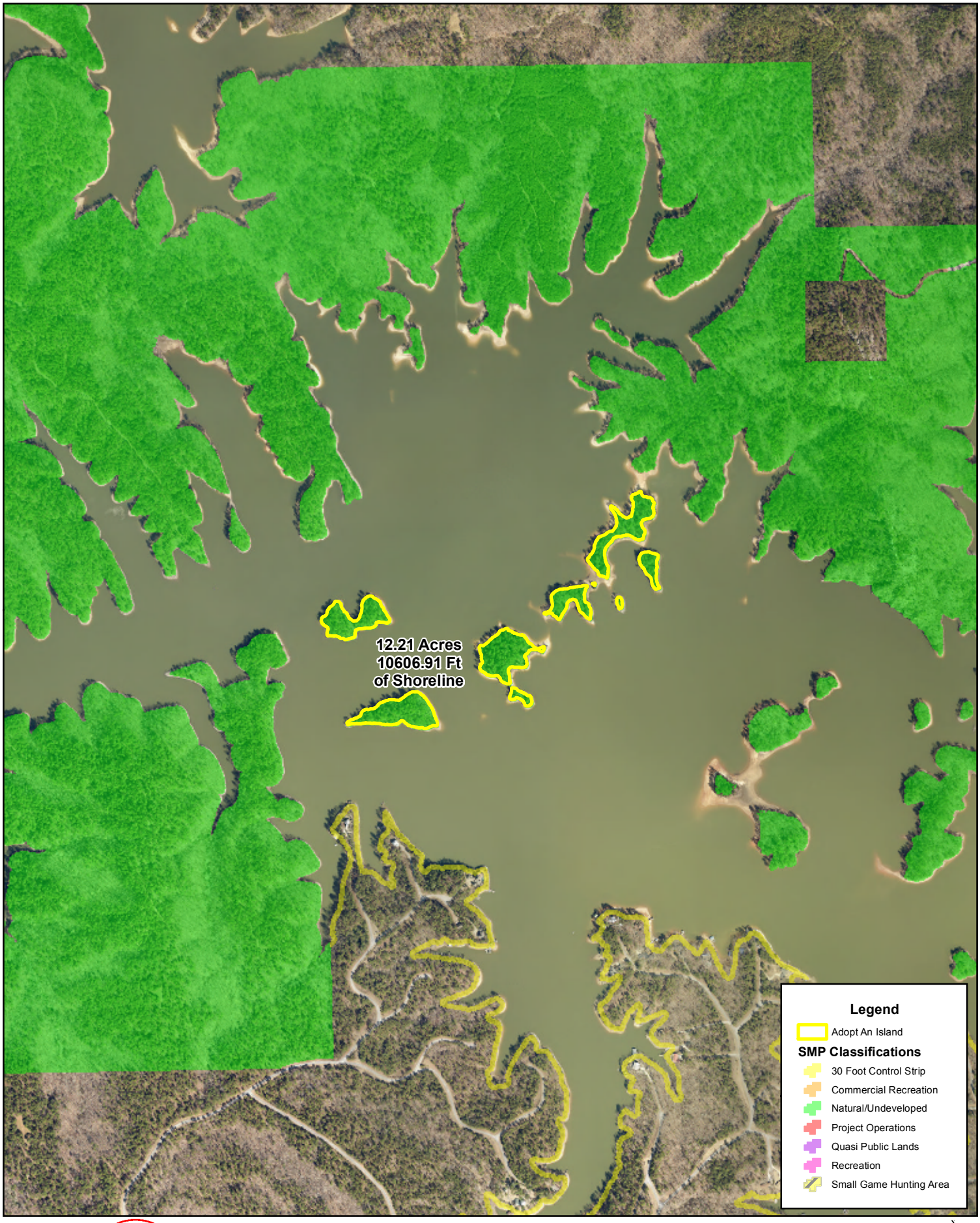


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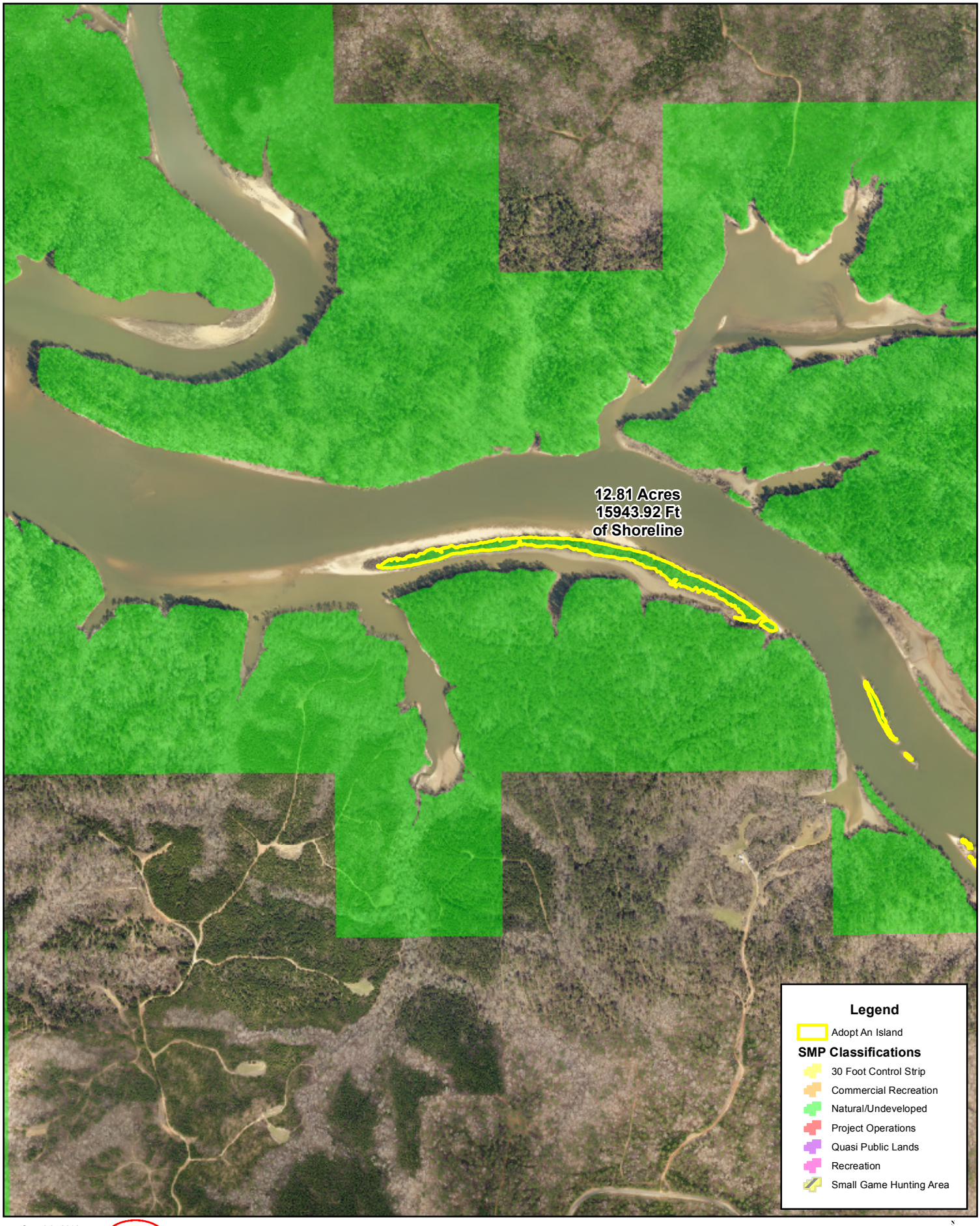
# Adopt An Island Program -- Island Q

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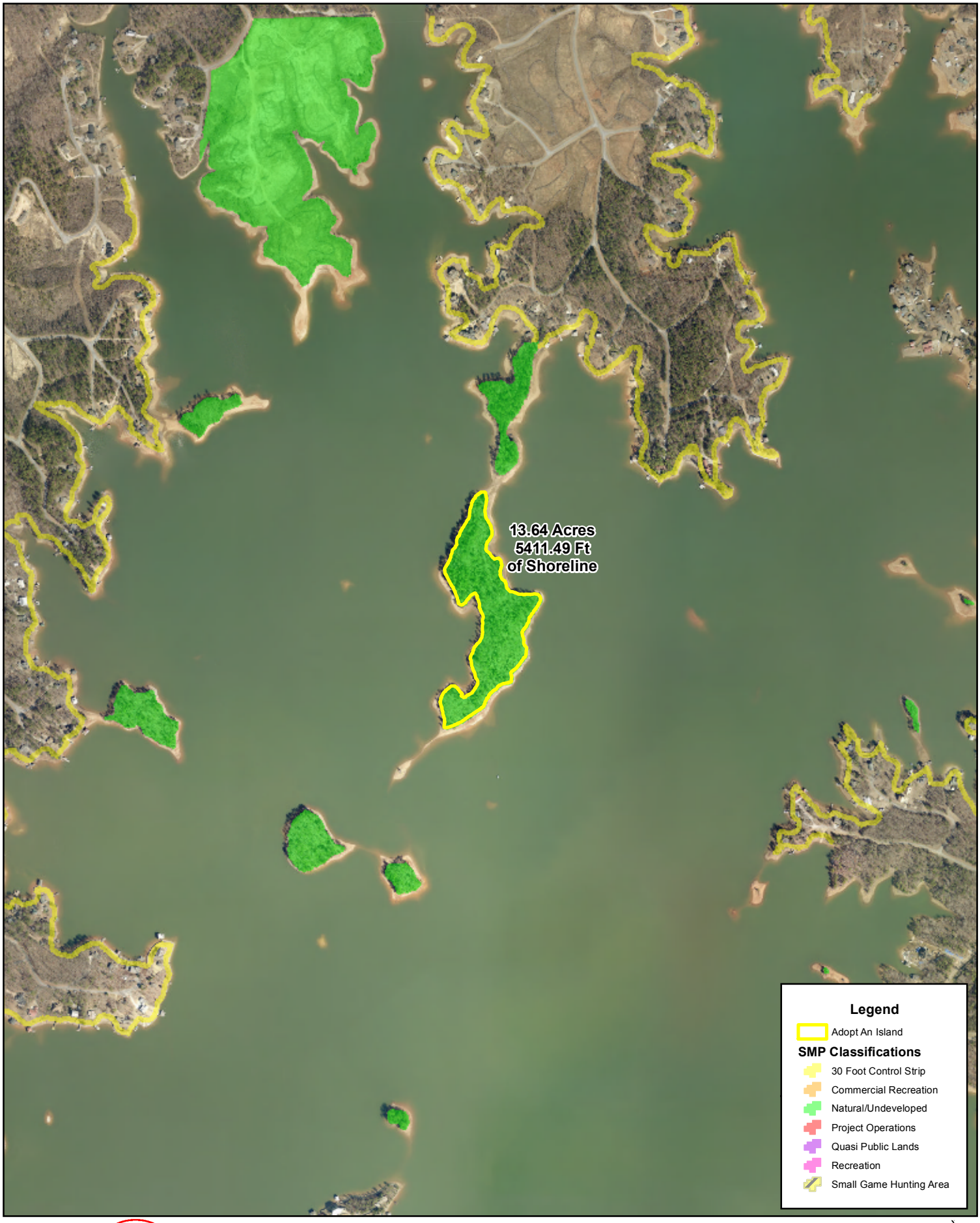
# Adopt An Island Program -- Island R

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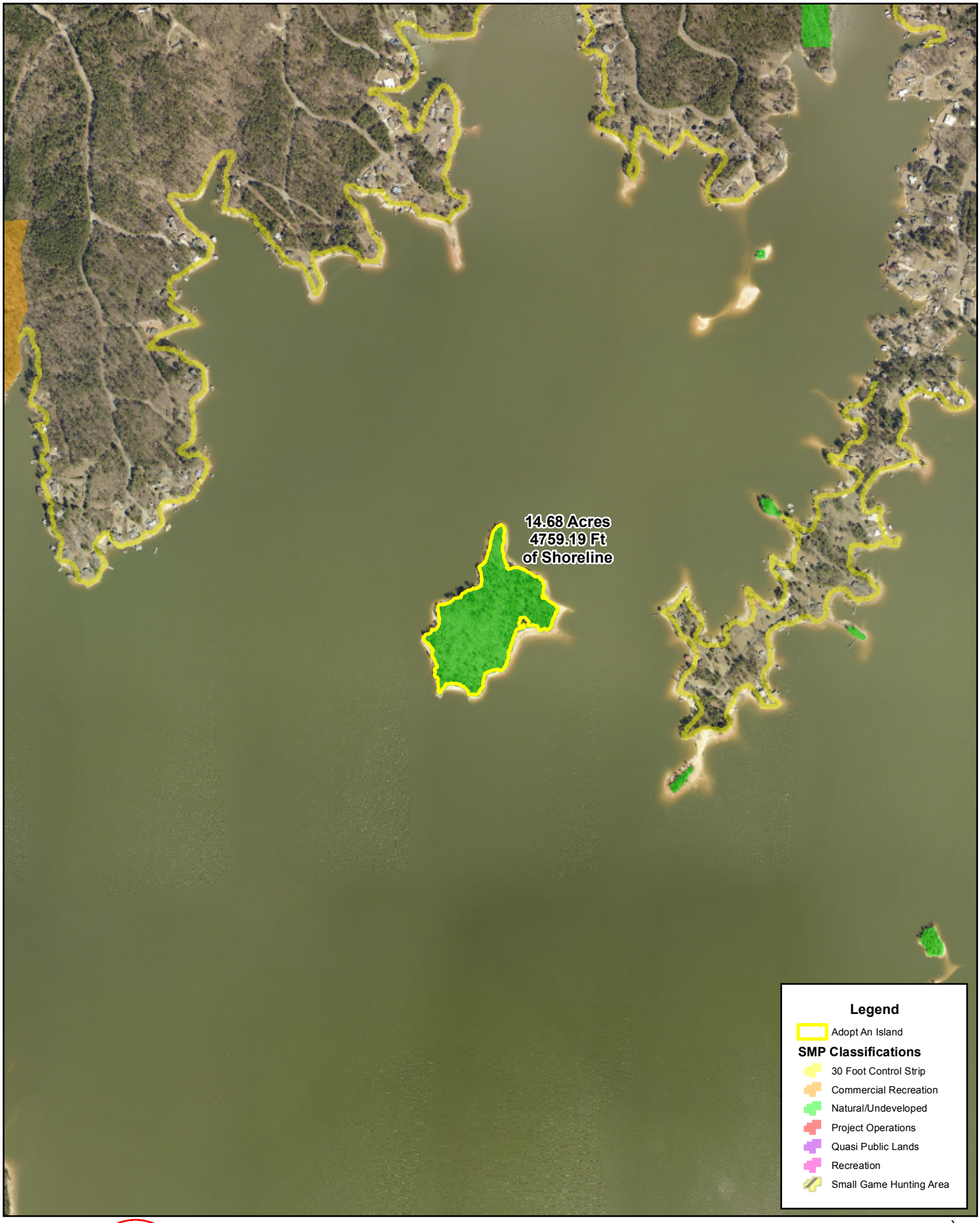
# Adopt An Island Program -- Island S

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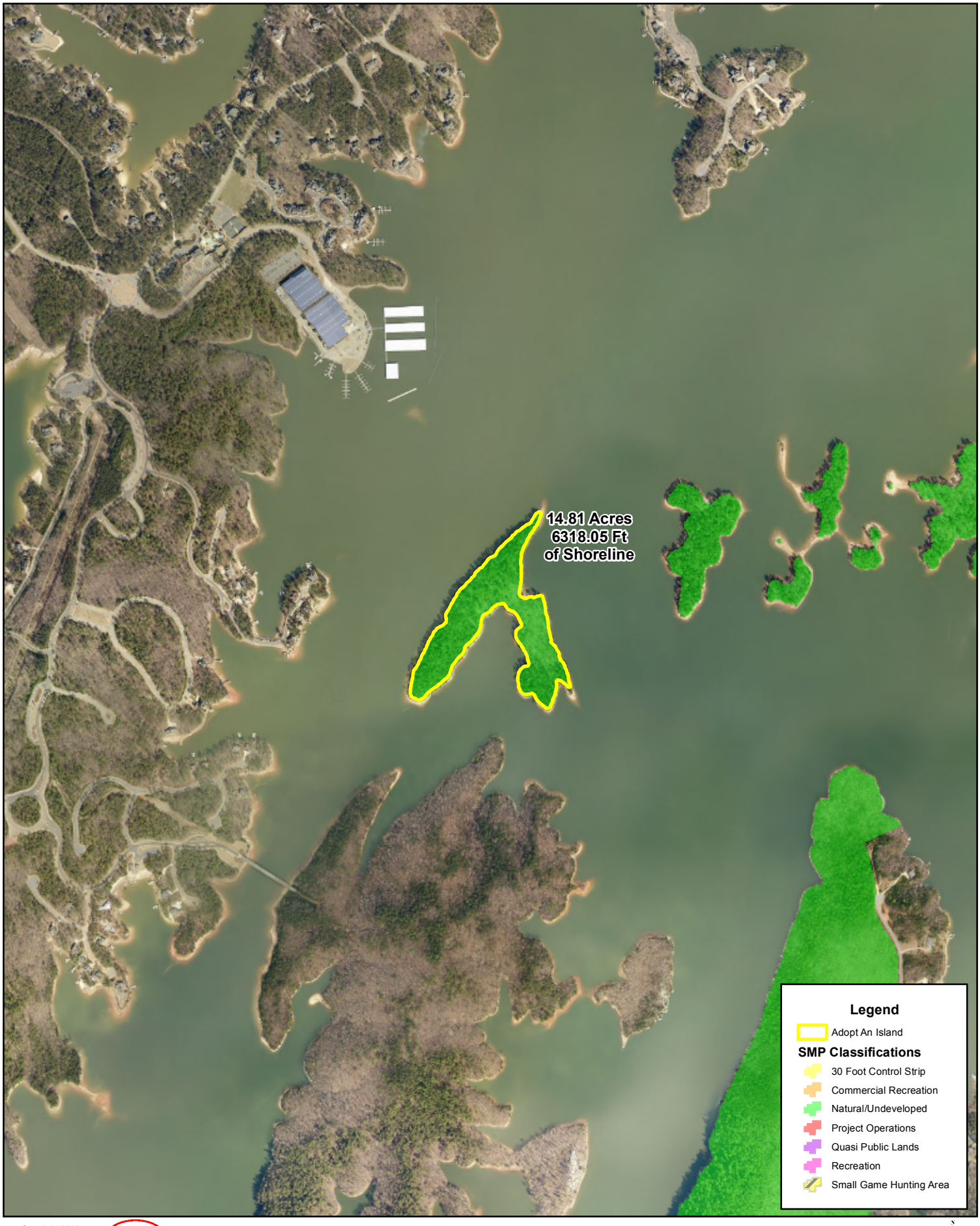


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# Adopt An Island Program -- Island U


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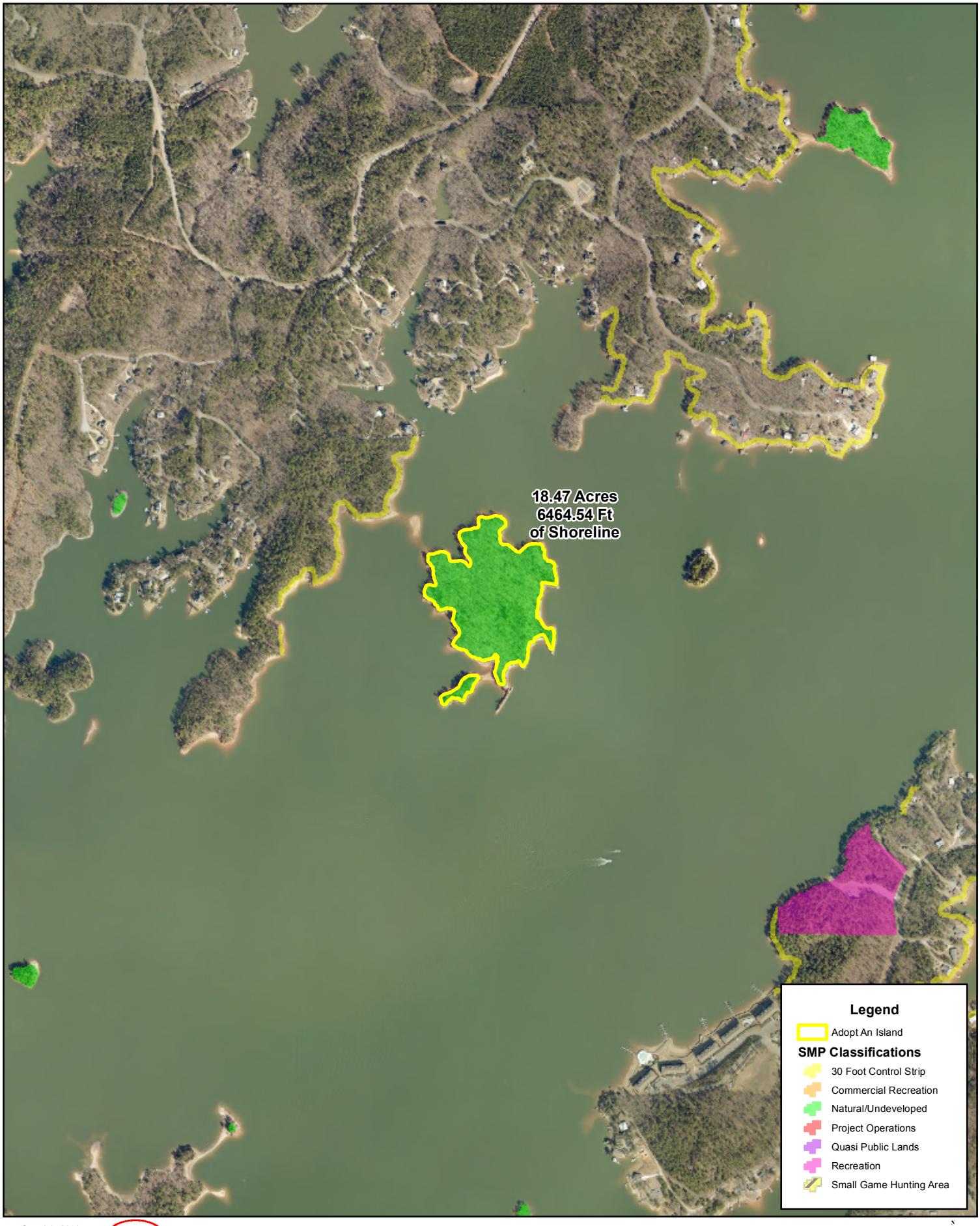
# Adopt An Island Program -- Island V

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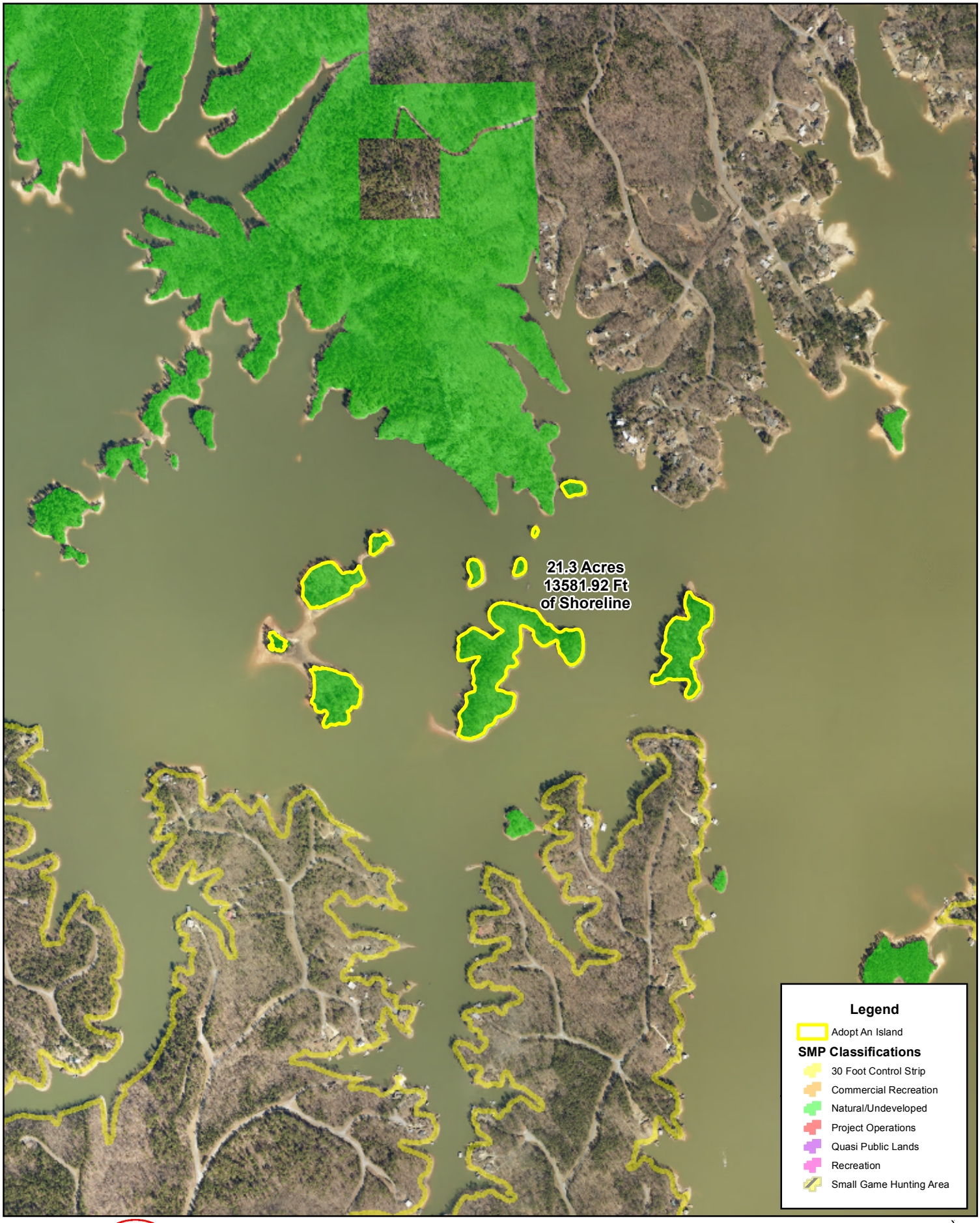
# Adopt An Island Program -- Island W

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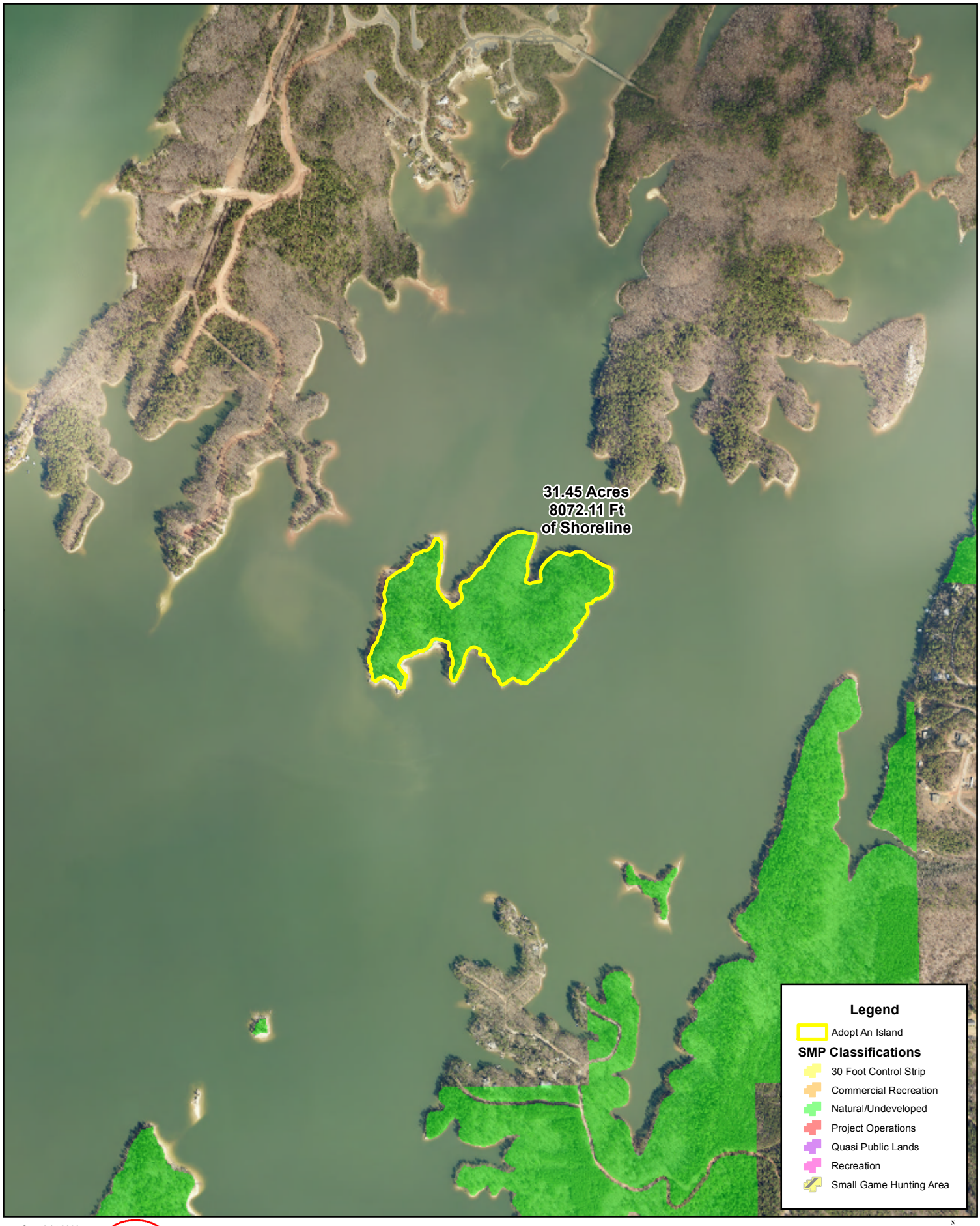
# Adopt An Island Program -- Island X

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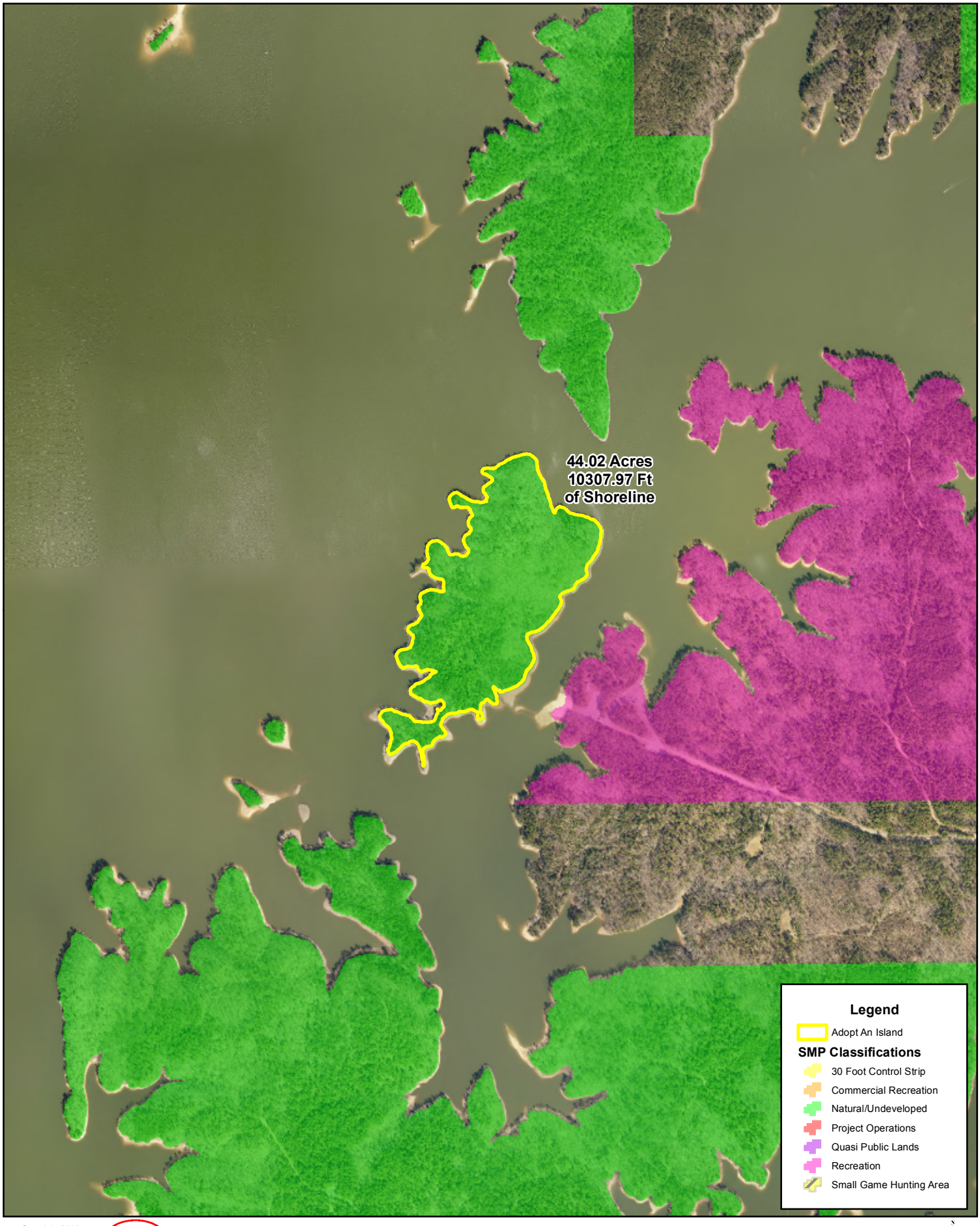


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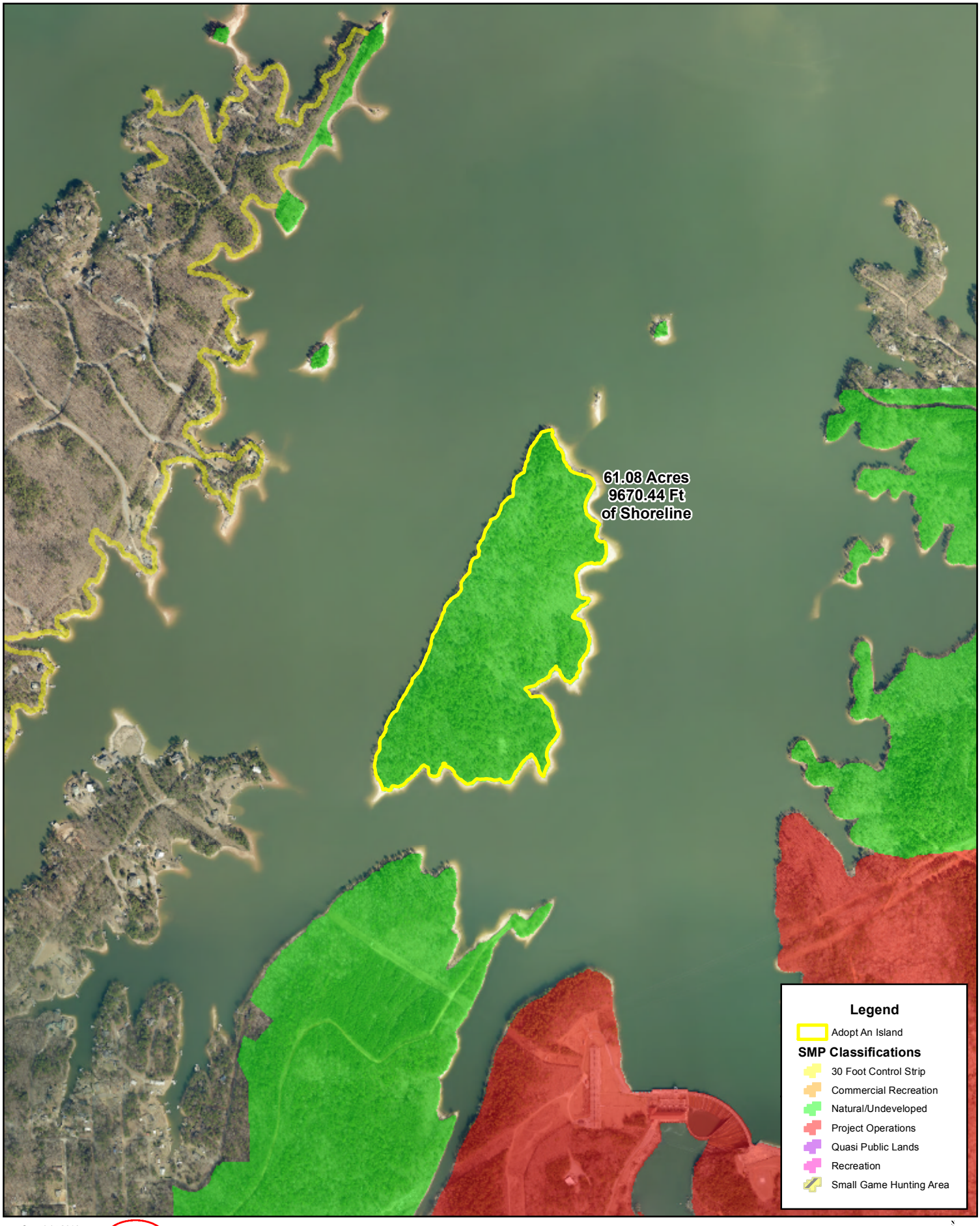
# Adopt An Island Program -- Island Z

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# APPENDIX E

## *ADULT STRIPED BASS HABITAT USE AND THE EFFECTS OF CATCH AND RELEASE ANGLING DURING THE SUMMER IN LAKE MARTIN, ALABAMA*

# Adult striped bass habitat use and the effects of catch and release angling during the summer in Lake Martin, Alabama

Final Report

Submitted to:

James F. Crew

Alabama Power Company

By

Steven M. Sammons, Ph.D.

Department of Fisheries and Allied Aquacultures

Auburn University, AL 36849

September 27, 2010

## Executive Summary

Lake Martin is a large, oligo-mesotrophic tributary storage reservoir on the Tallapoosa River in east-central Alabama. Since 1978, Gulf-strain striped bass have been stocked into Lake Martin on an annual basis by Alabama Department of Conservation and Natural Resources (ADCNR). Following the development of this fishery, periodic summer mortalities of adult striped bass have been reported on Lake Martin, the most recent of which occurred in late August to mid September during 1991, 1994, and 2001 and consisted primarily of fish > 5 kg. The causes of these mortalities are not known but are most likely related to availability of summer habitat for adult striped bass. Angling pressure for these fish is also high during summer in the lower reservoir, but it is not known what affect these activities may have on the observed summer mortalities of striped bass in Lake Martin. Therefore, the objectives of this study were to determine: 1) summertime movement and habitat use of adult striped bass, 2) the approximate volume of striped bass habitat present in Lake Martin during summer, and 3) the hooking mortality and behavior of adult striped bass angled during summer.

Thirty striped bass $\geq$ 4 kg were implanted with 25-g radio tags fitted with a mortality sensor and 22-g, temperature-sensitive ultrasonic tags in March and April 2009. Fish were tracked approximately every 14 d in April and May, and were located once a week from June until the end of September to identify summer habitat use. During this summer period, fish were also tracked every 4 hours over a 24-hour period twice a month for a total of eight 24-h tracking periods to determine diel movements and habitat use.

To estimate striped bass habitat availability, temperature and dissolved oxygen profiles were collected every two weeks from July-September at 2-km intervals in the main river

channels of the Tallapoosa River, Kowaliga Creek and Blue Creek arms of Lake Martin. Quality striped bass habitat was defined as water with temperatures < 21.3 degrees C and dissolved oxygen concentrations > 2.6 mg/L; whereas, marginal striped bass habitat was defined as water with temperatures between 21.3-25 degrees C and dissolved oxygen concentrations between 1.7-2.6 mg/L. Data from a digitized map of Lake Martin were used to create a hypsographic curve, and volumes were calculated for every 1-m strata of water. These volumes were then used to estimate volumes of striped bass habitat during the summer.

To estimate catch and release mortality, striped bass were angled from the lower section of Lake Martin during the summer 2009, using typical methods used by striped bass anglers. Striped bass were tagged with a retrievable ultrasonic tag and float assembly using temperature-sensitive ultrasonic tags attached to each fish using synthetic absorbable suture; through the dorsal musculature anterior to the dorsal fin. Tagged striped bass were located on three consecutive days following their release. Fish that showed no movement and whose tag pulse interval was consistent with the temperature at the reservoir bottom were considered dead.

Striped bass habitat availability in Lake Martin was characterized by rapid seasonal changes during this six-month period, resulting in definite changes in striped bass behavior, movement, and habitat use. These fish ranged widely throughout Lake Martin in spring and early summer, but as habitat became depleted, they began congregating downstream. This downstream shift was associated with lower movement rates and use of greater depths, higher temperatures, and lower dissolved oxygen concentrations. However, once striped bass habitat was eliminated in September, the fish moved above the thermocline and again ranged widely, exhibiting the highest movement rates found during the study.

We found no evidence of thermal refugia via springs during our tracking on Lake Martin, and it appeared that striped bass in Lake Martin typically remain in the reservoir and use the hypolimnetic waters for summer refuge. Behavior of striped bass displayed consistent patterns throughout the 24-h period. Fish were most active during the day, when they also typically used deeper water depths. Fish using the hypolimnion during the day would move up to the vicinity of the thermocline at dusk, where they would remain throughout the night and into the dawn period, moving back down to the hypolimnion only after the dawn period was over. Some striped bass may be foraging in the vicinity of the thermocline at night and moving deeper during the day to thermoregulate in cooler waters, while others maintain position near the thermocline throughout the 24-h period. Striped bass in Lake Martin were sometimes found to be using surprisingly high temperatures and low dissolved oxygen concentrations, even during periods when large volumes of habitat were still available in the reservoir. The striped bass found in Lake Martin are Gulf-strain fish, which may be better, adapted to higher temperatures and lower dissolved oxygen concentrations than Atlantic-strain fish.

Virtually the entire reservoir volume was available for striped bass in April and May; however, striped bass habitat dropped precipitously from late May until mid-June, when both quality and total habitat availability leveled off until early and late July, respectively, when availability of both habitat types rapidly decreased. All quality striped bass habitat was eliminated in the reservoir by August 18, and marginal habitat continued to decrease until there was no striped bass habitat remaining in Lake Martin by September 16. However, soon after that date the reservoir began to destratify and marginal habitat availability rapidly increased, but quality habitat was not observed in the reservoir again from August 18 to the end of sampling on

October 1.

Difficulties in obtaining help from local striped bass anglers and low catch rates of striped bass resulted in only one successful catch and release mortality sample. Five striped bass were successfully angled and tagged on July 16, 2010. Of those five fish, one was dead at boatside, two died within 5 minutes of tagging, and the last two were found dead the next day. Although the data were scarce, the fact that 100% of the angled and tagged fish died within 24 h may justify concerns over how this source of mortality is structuring the striped bass population in Lake Martin. Further work is warranted to examine the amount of striped bass angling that takes place on Lake Martin during the summer, the number of fish caught, and the percentage of released fish that do not survive the experience.

Compared to many reservoirs in the southeastern U.S., Lake Martin supports a large volume of striped bass habitat throughout much of the year, likely owing to the size, depth, and relative infertility of the reservoir. However, this study has demonstrated that striped bass habitat availability is subject to drastic seasonal changes even in reservoirs that appear to provide good opportunities for quality striped bass fisheries such as Lake Martin. The rapid change observed in striped bass habitat may be attributed to unusually high amounts of precipitation that fell in the drainage basin of the reservoir in 2009, which caused the dam to generate large volumes of water to maintain reservoir levels near full-pool levels. During these events, cool hypolimnetic waters are discharged through the dam and replaced with warm epilimnetic waters, resulting in large changes in habitat availability. Also, frequent rain events can flush nutrients downstream and off shoreline habitats such as lawns and flower beds from lakeside homes, which can artificially increase nutrient levels and primary production in the reservoir, causing

more rapid depletion of oxygen through decomposition. During summers with average or below rainfall, striped bass habitat availability in Lake Martin is likely more stable, reducing chances of large mortality events of striped bass. In 2009 a large rain event in mid September resulted in a corresponding loss of the remainder of the striped bass habitat in the reservoir. However, this event was followed by a period of below-average temperatures, restoring some marginal habitat conditions to striped bass by the end of September. Given the irregular history of striped bass die-offs in Lake Martin, it seems that they may be associated with a rare combination of high rainfall events followed by long periods of above-average temperatures. However, if reservoir water quality changes in the future, either becoming warmer or more productive, the frequency and magnitude of these events may increase. Thus measures should be taken to maintain water quality in Lake Martin at current levels to protect against catastrophic die-offs of large striped bass in the future. Similarly, any changes made to the operation of Lake Martin as part of relicensing should be evaluated for their effects on future water quality that may alter striped bass habitat availability.

## Introduction

Originally restricted to marine and estuarine systems, striped bass *Morone saxatilis* have become important sportfish in many reservoir systems across the southeastern U.S. (Coutant 1987; Jackson and Hightower 2001; Young and Isely 2002). Striped bass are active, pelagic piscivores that commonly reach a large size (> 15 kg) and prey on other pelagic fishes such as clupeids (Axon and Whitehurst 1985). However, many populations of striped bass are limited by the amount of cool, oxygenated water found in reservoir systems during summer (Coutant 1985; Young and Isely 2002; Bettoli 2005). Summer mortality of adult striped bass ($\geq$ 5 kg) has been linked to poor environmental conditions that lead to lower body condition, increased disease, and ultimately death (Coutant 1985; Matthews 1985; Moss 1985; Braschler et al. 1989). Summer mortality of striped bass is more severe in larger fish, since temperature preference and thermal tolerance typically decreases as the fish age (Coutant 1985; Matthews 1985). Thus, availability of suitable summertime water temperature and dissolved oxygen concentrations are likely the most important limiting factors governing the ability of a reservoir to support a trophy fishery for striped bass (Axon and Whitehurst 1985).

Temperatures exceeding 25 degrees C and dissolved oxygen concentrations below 2 mg/L are considered to be unusable habitat for adult striped bass (Coutant and Carroll 1980; Coutant 1985). Field studies of telemetered striped bass have shown that adult fish commonly use waters that are < 20 degrees C and have dissolved oxygen concentrations $\geq$ 4 mg/L (Coutant 1985; Bettoli 2005). When these temperatures and dissolved oxygen levels are readily available, striped bass will range widely while feeding on pelagic prey (Bettoli 2005; Moss et al. 2005). However, as summer progresses and water temperatures warm, striped bass are commonly

restricted to narrow bands of oxygenated water near the thermocline, or in thermal refuges such as springs (Coutant and Carroll 1980; Combs and Peltz 1982; Moss 1985; Hampton et al. 1988; Braschler et al. 1989; Wilkerson and Fisher 1997; Moss et al. 2005). Striped bass can persist in suboptimal conditions for periods up to 4-5 weeks (Hampton et al. 1988; Jackson and Hightower 2001; Young and Isely 2001). However, if conditions worsen or persist longer, striped bass can suffer large die-offs (Coutant 1985; Matthews 1985).

Oxygen is a non-renewable resource in the cool, deep waters of reservoirs during summer, and availability of this vital summertime habitat for adult striped bass can be governed by several factors. Hydropower generation provides abnormally cool water downstream of the dam (possibly providing a thermal refuge for fishes in that system), while depleting the lower strata of waters in the reservoir behind the dam (Cole and Hannan 1990). Increases in nutrient inputs either from upstream sources or from lakeshore development may increase the depletion of dissolved oxygen from the lower water strata through increased respiration or decay (Coutant 1987). Obviously, all of these factors can and often do occur simultaneously, thus affecting the volume of available summertime habitat in unpredictable ways. Coutant (1987) stated that water resource managers should specifically identify the water temperatures and dissolved oxygen concentrations required by the species of interest in each water body. Zones that meet the requirements of these species should be quantified and maintained, especially when these zones are constricted during critical periods. To date, little attempt has been made to quantify the available summer habitat of striped bass in reservoir systems, or to examine how reservoir operation or other factors may affect that quantity.

Angling mortality can also be an important component of striped bass total annual mortality. Hooking mortality of freshwater fishes, including striped bass, is often greater during summer months when water temperatures are high (Tomasso et al. 1996; Wilde et al. 2000). Striped bass show signs of physiological stress when angled; often these effects are greater during summer, leading to greater mortality (Tomasso et al. 1996). Summer water temperatures in southeastern reservoirs are commonly greater than 25 degrees C, and often approach lethal temperatures for adult striped bass (Coutant 1985; Bettoli and Osborne 1998). Studies have found catch and release mortality of angled striped bass was commonly < 50-80% during the summer in southeastern reservoirs (Bettioli and Osborne 1998; Bettinger et al. 2005).

Lake Martin is a large (16,188 ha) oligo-mesotrophic tributary storage reservoir on the Tallapoosa River in east-central Alabama. Reaching depths in excess of 45 m, Lake Martin typically stratifies in May and remains strongly stratified until November in most years (D. Bayne, Auburn University, personal communication). Since 1978, Gulf-strain striped bass have been stocked into Lake Martin on an annual basis by Alabama Department of Conservation and Natural Resources (ADCNR). Soon after these stockings began, a quality fishery for striped bass developed, with anglers catching numerous fish > 10 kg annually (N. Nichols, ADCNR, personal communication). However, following the development of this fishery, periodic summer mortalities of adult striped bass have been reported on Lake Martin (Alabama Power Company [APC] 2008). The most recent of these mortalities occurred in late August to mid September during 1991, 1994, and 2001, typically occurred in the lower section of the reservoir near the dam, and consisted primarily of fish > 5 kg (J. Lochamy, APC, personal communication). The causes of these mortalities are not known but are most likely related to availability of summer

habitat for adult striped bass (APC 2008). Angling pressure for these fish is also high during summer in the lower reservoir, but it is not known what affect these activities may have on the observed summer mortalities of striped bass in Lake Martin (N. Nichols, ADCNR, personal communication). Therefore, the objectives of this study were to: 1) determine movement and habitat use of adult striped bass in Lake Martin during summer, 2) determine the approximate volume of suitable striped bass habitat present in Lake Martin during summer and examine possible factors affecting this volume, and 3) determine the hooking mortality and behavior of adult striped bass angled during summer in Lake Martin.

## Methods

*Striped Bass Telemetry*

In March and April 2009, 30 striped bass $\geq$ 4 kg were collected using a boom-mounted electrofishing boat and long lines baited with goldfish *Crassius auratus* (Moss et al. 2005). These fish were implanted with 25-g radio tags (Advanced Telemetry Systems, Inc., model F1850) and 22-g ultrasonic tags (Sonotronics, Inc., model CTT-83-3I) following the procedures of Maceina et al. (1999). These tag sizes followed the recommendation of Winter (1996) of not implanting a tag greater than 2% of body weight in order that behavior and movement would not be affected. The radio tags had a life expectancy of 1086 d and were fitted with a mortality sensor. If these tags were motionless for at least 24 h due to death or expulsion, then the signal rate increased from 50 to 100 pulses per second. The ultrasonic tags had a life expectancy of 36 months and were temperature sensitive; transmitted pulses were dependent on the surrounding temperature (Bettoli and Osborne 1998). The relationship between pulse rate and water

temperature was modeled for each tag to ensure the correct temperature was determined.

Fish were tracked approximately every 14 d beginning two weeks after tag insertion, to allow fish time to recover from surgery. From June until the end of September, fish were located once a week to identify summer habitat use. During this summer period, fish were tracked over a 24-h period twice a month for a total of eight 24-h tracking periods. During those tracking events, up to 9 fish were selected randomly and found every 4 h for 24 h to assess diel movements and habitat changes. During each tracking period, the precise location (within 5 m) of each fish was mapped using GPS, and the pulse rate from the sonic tag was recorded. Temperature and dissolved oxygen profiles were taken from the general location where fish were found in order to identify the depths and dissolved oxygen concentrations fish were utilizing when located.

Daily movements were calculated for each fish by dividing the distance moved between locations by the amount of time elapsed (in d) between locations (Wilkerson and Fisher 1997; Sammons et al. 2003). Fish movements were compared among months using a mixed-model ANOVA using individual fish as the sampling unit to avoid pseudoreplication (Sammons et al. 2003; White and Rogers 2007). Water temperatures, dissolved oxygen concentrations, and depths used by telemetered fish were compared among months using mixed-model ANOVAs as described above. All values were transformed by the natural logarithm to stabilize variances; significance for all statistical tests was set at $P \leq 0.10$.

Diel movements were calculated for each fish from the 24-h tracking data by dividing the distance moved between locations by the amount of time elapsed (in h) between locations (Snedden et al. 1999; Sammons and Maceina 2005). Locations were assigned to one of four diel

time periods: dawn (2 h before and after sunrise), dusk (2 h before and after sunset), day, and night (Snedden et al. 1999; Sammons and Maceina 2005). Movements were assigned to the time period in which the majority of the time between locations occurred. Differences in diel movement, temperature, dissolved oxygen, and depth use were assessed among months and diel periods using mixed-model ANOVAs as described above (SAS Institute 2003). Similar to the weekly data, all diel values were transformed by the natural logarithm to stabilize variances; significance for all statistical tests was set at $P \leq 0.10$.

Relations among temperature, dissolved oxygen, fish locations, depth use, fish length, and diel and daily movement were explored using Pearson correlations (SAS Institute 2003). Movement, depth, temperature, and dissolved oxygen use was divided into three time periods: April-May, June-July, and August-September, and compared to striped bass length to explore whether fish size had any effect on movement or habitat use as the summer progressed and physicochemical conditions changed in Lake Martin.

*Striped Bass Habitat Availability*

Temperature and dissolved oxygen profiles were collected every 2 weeks from July-September in the main river channels of the Tallapoosa River, Kowaliga Creek and Blue Creek arms of Lake Martin. Profiles were taken approximately every 2 km from the dam to the farthest upstream point where striped bass habitat existed. Striped bass habitat characteristics were estimated by examination of temperatures and depths of tagged striped bass in the telemetry portion of this study. Quality habitat was considered to be water with temperatures and dissolved oxygen concentrations containing $\geq$ 75% of the striped bass locations in June, July,

and August, when the reservoir was stratified and a wide range of temperatures and dissolved oxygen was available to the fish. Marginal habitat was considered to be water with temperatures and dissolved oxygen levels containing an additional 20% of the striped bass locations between June-August. Thus total striped bass habitat was defined as water with temperatures and dissolved oxygen combinations that contained 95% of the striped bass locations during June-August.

Work on this section of the project was greatly hindered by the inability to locate a public-access digital bathymetric map of Lake Martin, which was expected to be the basis of our analyses. However, a topographic map of the Lake Martin area created prior to reservoir formation was finally located and digitized into Arcview GIS. Data from this map were used to create a hypsographic curve for Lake Martin, and volumes were calculated for every 1-m strata of water (assuming full pool elevation) using the equation in Cole (1983):

$$V_{z_x - z_{x-1}} = \frac{1}{3}\left(A_{z_{x-1}} + A_{z_x} + \sqrt{A_{z_x} \times A_{z_{x-1}}}\right)\left(z_x - z_{x-1}\right)$$

where V = volume, z = depth, x = strata, and A = area of depth strata. These volumes were used to estimate volumes of striped bass habitat during the summer based on our temperature and dissolved oxygen profile stations.

*Striped Bass Angling Mortality*

Striped bass were angled from the lower section of Lake Martin during the summer 2009, using typical methods used by striped bass anglers. Landing times and handling times were recorded for each fish caught, as well as surface temperature, air temperature, and terminal gears

(Bettoli and Osborne 1998). We attempted to land fish quickly to minimize physiological stress caused by angling (Tomasso et al. 1996). Only striped bass $\geq$ 1 kg were retained for these experiments; smaller fish were released immediately.

Striped bass $\geq$ 1 kg were measured (total length) and tagged with a retrievable ultrasonic tag and float assembly as described in Osborne and Bettoli (1995). Temperature-sensitive ultrasonic tags (Sonotronics, Inc., model CTT-83E) were fitted with cylindrical acrylic float that exerted approximately 8 g of positive buoyancy; the total length of this assembly did not exceed 300 mm and had a cross-sectional area of approximately 2 $cm^2$. Tags were attached to each fish using synthetic absorbable suture; the assembly was attached to the dorsal musculature anterior to the dorsal fin so that it laid along the upper flank of each fish. Tagging procedures generally took < 90 s, and following transmitter attachment, each fish was released into the reservoir. Tagged striped bass were located on three consecutive days following their release. Fish that showed no movement and whose tag pulse interval was consistent with the temperature at the reservoir bottom were considered dead (Bettoli and Osborne 1998).

## Results

*Striped Bass Telemetry*

Tagged striped bass ranged from 740-1063 mm and 4.78-17.0 kg and were tracked over a 200-d period (Table 1). The majority of the fish were collected in April around the Irwin Shoals area at the headwaters of Lake Martin on the Tallapoosa River by electrofishing (Figure 1). Ten striped bass were collected in March using long lines and gill nets from the Woods Island area of Lake Martin (Figure 1). Two fish were never found after tagging, one fish was harvested by an angler, and two others died from unknown causes; the rest were alive by the end of the tracking period (Table 1). One fish (tag #86) was located 9 d after tagging and was never relocated, and contact was lost with one fish in June, one fish in July, and four fish in August; however, these fish may have evaded our tracking scheme and may still persist in the reservoir.

*Movement and spatial distribution* - All tagged striped bass that were relocated at least once were found in Lake Martin except for one (#85), which was tagged in the Irwin Shoals area of Lake Martin on April 6, 2010 and was located by plane on June 2, 2010 approximately 62 km upstream in the Tallapoosa River near Wadley, Alabama (Figure 1). That fish was next relocated on June 26, 2010 around the Blue Creek arm of Lake Martin, some 85 km downstream of its last known location. Afterwards, the fish remained in the lower area of the reservoir and was last located on August 26, 2010 (Table 1).

Although some striped bass remained in the upper headwaters of Lake Martin in April, fish began distributing themselves around the reservoir soon after tagging, and by May, most of them were located below the Highway 280 bridge (Figure 2). While the majority of the striped

bass were located in the lower half of Lake Martin, some fish remained surprisingly far upstream as late as mid-August, persisting in small layers of cool water with barely acceptable dissolved oxygen concentrations found near the bottom. However, an overall trend of shifting downstream was evident as the summer progressed (Figure 2). In September fish again ranged widely once striped bass habitat was eliminated and fish were once again located above the Highway 280 bridge (Figure 2). There was no evidence of fish persisting in thermal refuges up in any of the tributary arms, and we did not detect any thermal refuges during our surveys.

Striped bass were highly mobile in Lake Martin, often exhibiting displacements in excess of 10 km between weekly locations. Striped bass daily movement followed a similar pattern during most months of the study, with most fish exhibiting movement rates < 500 m/d (Figure 3). However, movement sharply increased in September, when almost half the movement rates exceeded 500 m/d. Mean movement was highly variable among fish, but movement rates were greater in September than in July or August (Table 2; $F = 3.19$; $df = 5, 75$; $P = 0.0115$), as evidenced by the distributional maps in Figure 2. Striped bass movement was inversely related to the depth of the fish ($r = -0.56$; $P = 0.0026$) and increased as dissolved oxygen concentrations increased ($r = 0.56$; $P = 0.0031$), but was unrelated to fish length ($P = 0.64$). Striped bass movement in April and May was positively related to temperature ($r = 0.46$; $P = 0.0299$), but was unrelated to dissolved oxygen, depth, or total length of the fish ($P \geq 0.32$). Striped bass movement in June and July was unrelated to any of the variables examined ($P \geq 0.12$). In contrast, August and September movement was greater as fish size increased ($r = 0.39$; $P = 0.0954$), and movement was also inversely related to fish depth ($r = -0.48$; $P = 0.0380$). Mean

monthly striped bass movement was not related to the amount of quality or total habitat available ($P \geq 0.30$).

*Habitat Use* - In the two months following tagging, striped bass used relatively shallow waters, commonly found in water < 3 m (Figure 4). Striped bass began moving deeper in June as the reservoir water temperatures increased; this behavior continued until September, when depths of tagged fish abruptly decreased. As the summer progressed, striped bass depth distributions began displaying bimodality, with one group found near the thermocline and another found in the hypolimnion (Figure 4). This bimodal distribution continued into September, but shifted up in the water column, with one group using the epilimnion and another found near the thermocline. Accordingly, mean depth of these animals was greatest in June, July, August, and September, and shallowest in April and May (Table 2; $F = 31.08$; $df = 5, 86$; $P < 0.0001$). Depth use was not related to striped bass length for any time period ($P \geq 0.15$). Mean monthly depth of striped bass increased as the amount of quality habitat available in Lake Martin declined ($r = -0.75$; $P = 0.0841$); however, there was no relation between mean depth and the total amount of habitat available ($P = 0.20$).

Temperature use of tagged striped bass was consistent April-July; however, the temperature of peak use steadily increased each month (Figure 5). Similar to the depth data, temperature use was bimodal in August, with fish use centered at 16 and 26 degrees C. Unlike the depth data, bimodality was not evident in September, where all but one fish was found in temperatures exceeding 21 degrees C (Figure 5). Mean temperature used by tagged striped bass was highest in September and lowest in April, May, and June (Table 2; $F = 22.49$; $df = 5, 86$; $P <$

0.0001). Use of dissolved oxygen concentrations by tagged striped bass followed the opposite pattern than temperature use from May to August, with dissolved oxygen concentrations of peak use declining each month (Figure 6). Concordant with the temperature and depth data, dissolved oxygen concentrations used by striped bass in July displayed a bimodal distribution; however, in August this had changed to a single mode, with 30% of striped bass locations found in dissolved oxygen concentrations < 2 mg/L. In September, striped bass were found using a wide range of dissolved oxygen concentrations. Not surprisingly, mean dissolved oxygen concentrations used by these fish were highest in April and May and lowest in August (Table 2; $F = 29.48$; $df = 5, 86$; $P < 0.0001$). Neither mean temperature nor mean dissolved oxygen use was related to striped bass total length for any time period ($P \geq 0.14$). Mean temperature used by striped bass each month increased as the amount of quality habitat ($r = -0.81$; $P = 0.0506$) and total habitat ($r = -0.86$; $P = 0.0299$) declined. In contrast, mean dissolved oxygen concentrations used by striped bass each month decreased as the amount of quality ($r = 0.74$; $P = 0.0911$) and total habitat ($r = 0.84$; $P = 0.0355$).

When considered together, patterns of temperature and dissolved oxygen use by striped bass displayed markedly different patterns throughout the study. In April and May, fish were usually found in dissolved oxygen concentration above 6 mg/L, but used a wide range of temperatures, especially in May (Figure 7). Once stratification was well established in Lake Martin, these fish began using lower dissolved oxygen concentrations and were generally found in water temperatures < 23 C. However, as summer progressed these fish generally split into two groups. One group used temperatures < 20 C and dissolved oxygen concentrations < 3 mg/L and another one was most often found in water temperatures centered at 25 C and dissolved oxygen

concentrations ranging from 1-6 mg/L (Figure 7). In September almost all fish were found in temperatures centered around 25 C with dissolved oxygen concentrations ranging from near 0 to 8 mg/L.

Weekly use of temperature, dissolved oxygen, and depth by striped bass followed similar patterns to those found in the monthly analysis. Mean weekly temperatures were relatively constant through time and were generally in the lower 50% of available temperatures found in the reservoir, until late August and September, when temperature used by these animals increased greatly (Figure 8). In contrast, mean weekly dissolved oxygen concentrations used by striped bass declined as the summer progressed, and were generally within 25-50% of the median dissolved oxygen concentrations available in the reservoir. Mean depth use also declined through time; however once hypoxic and anoxic conditions were found in Lake Martin, depth use was relatively constant until August and September, when striped bass depths initially increased, then decreased as fish responded to the changing physicochemical environment found in the reservoir during that time (Figure 8).

*Diel Movement and Habitat Use* - Mean diel movement of striped bass was not different among June, July, August, and September ($F = 1.59$; $df = 3, 168$; $P = 0.1218$), and movement distributions were also similar among those months (Figure 9). However, striped bass clearly exhibited diurnal behavior, with higher mean movement observed during dawn and day than during dusk and night (Table 3; $F = 7.75$; $df = 3, 168$; $P < 0.0001$). Movement distributions among the four diel periods demonstrated that the greatest percentage of movements > 500 m/h occurred during the day, followed by dawn (Figure 10). Striped bass diel movement during dusk

and night was characterized by few movements > 300 m/h. Mean diel movement was unrelated to striped bass length in all time periods examined ($P \geq 0.22$), nor was it related to temperature, dissolved oxygen, or depth used by the fish ($P \geq 0.17$).

Depth distribution of striped bass was similar among dawn, dusk, and night periods; however, fish were commonly found in water deeper than 20 m during the day (Figure 11). Some fish appeared to move above the thermocline during the night, but the majority of fish were found near the thermocline in all diel periods. Mean depth of striped bass was greatest during the day and shallowest during dusk and night period (Table 3; $F = 30.32$; $df = 3, 216$; $P < 0.0001$). Similar to depth, temperature distributions at striped bass locations were very similar among dawn, dusk, and night periods (Figure 12). Fish were only found in temperatures < 15 degrees C during the day. The peak temperature use was 25-27 degrees C for all diel periods (Figure 12). Mean temperatures used by striped bass was greatest at night and least during the day, and was intermediate in both crepuscular periods (Table 3; $F = 215.68$; $df = 3, 216$; $P < 0.0001$). In contrast, dissolved oxygen use by striped bass showed no discernable patterns in distribution among the four diel periods (Figure 13), and mean dissolved oxygen concentrations at striped bass locations were not different among diel periods (Table 3; $F = 0.66$; $df = 3, 216$; $P = 0.5753$). Patterns of temperature and dissolved oxygen concentration use by striped bass did not appear to vary among the diel periods (Figure 14). Fish were generally found between 16-28 degrees C in all periods except day time, when some fish were found in water temperatures of 12-16 degrees C. Dissolved oxygen concentrations used by fish were wide ranging, from 1-8 mg/L, and were similar among diel periods.

*Summer Striped Bass Habitat Availability*

Based on the results of the telemetry study, 75% of striped bass locations from June-August were in temperatures < 21.3 degrees C and dissolved oxygen concentrations > 2.6 mg/L, and waters with these characteristics was considered to be quality striped bass habitat. Using the same data, 95% of striped bass locations were in temperatures $\leq$ 25 degrees C and dissolved oxygen concentrations $\geq$ 1.7 mg/L, and water meeting these criteria was considered to be the total habitat available for striped bass. Marginal habitat was thus defined as the difference between these two volumes. Estimates of striped bass volume were calculated using a hypographic curve based on a map of the basin prior to impoundment, therefore these estimates should be considered minimums, since no sedimentation effects on reservoir volume were accounted for.

Virtually the entire reservoir volume was available for striped bass in April and May, and in April this entire habitat was characterized as being quality habitat (Figure 15). After May, striped bass habitat dropped precipitously until mid-June, when both quality and total habitat availability leveled off until early and late July, respectively, when availability of both habitat types rapidly decreased. All quality striped bass habitat was eliminated in the reservoir by August 18, and marginal habitat continued to decrease until there was no striped bass habitat found in Lake Martin by September 16 (Figure 15). However, soon after that date the reservoir began destratifying and marginal habitat availability rapidly increased. Quality habitat was not observed in the reservoir from August 18 through October 1, when sampling ceased (Figure 15).

*Summer Hooking Mortality*

We experienced difficulty in obtaining help from professional fishing guides or local anglers for this portion of the study. Also, the anglers that did assist us had difficulty in locating and catching striped bass. Both of these factors combined made it extremely difficult for us to accomplish this objective and, after consultation with ADCNR and APC personnel, we decided to drop this objective from this study. However, five striped bass ranging from 620-952 mm total length were successfully angled and tagged on July 16, 2010. The surface water temperature was 30 degrees C and air temperatures ranged from 24-25 degrees C. Of those five fish, one was dead at boatside, two died within 5 minutes of tagging, and the last two were found dead the next day (Table 4). We made four other trips after this date and did not capture another striped bass.

## Discussion

Striped bass habitat availability in Lake Martin was characterized by rapid seasonal changes during this six-month period, resulting in definite changes in striped bass behavior, movement, and habitat use. Striped bass are active, mobile predators that are well known to range widely in search of prey (Jackson and Hightower 2001; Bettoli 2005). These fish ranged widely throughout Lake Martin in spring and early summer, but as habitat became depleted, they began congregating downstream, likely to take advantage of the greater habitat availability found there. This downstream shift was associated with lower movement rates and use of greater depths, higher temperatures, and lower dissolved oxygen concentrations. However, once striped bass habitat was eliminated in September, the fish moved above the thermocline and again ranged widely, exhibiting the highest movement rates found during the study. This was likely exploratory behavior, as fish searched for suitable habitat in the reservoir, but it could also have been a response to sudden release after months of restriction to habitat that was continually dwindling as the summer progressed.

The response of striped bass to decreasing summer habitat availability has been the subject of numerous studies over the years. Striped bass commonly undergo a "squeeze" during the summer, as they become trapped in limited thermal refugia between warm, oxygenated, epilimnetic waters and cool, anoxic or hypoxic, hypolimnetic waters (Coutant 1985; Matthews et al. 1985). When this occurs, striped bass commonly become crowded and are faced with limited food supplies, resulting in lower body condition and physiological stress (Coutant 1987). Often fish in some reservoirs are faced with a choice of living either in well-oxygenated waters significantly warmer than their temperature preferenda or in cool waters with hypoxic

conditions. If the situation persists too long, the result could be a summer mortality event, which has been observed in many reservoirs across the southeastern U.S. (Countant 1985; Matthews 1985).

As waters warm in the summer, striped bass commonly use deeper water in the lower portions of reservoirs for refuge (Combs and Peltz 1982; Hampton et al. 1988; Jackson and Hightower 2001; Moss et al. 2005), similar to what we observed in Lake Martin. However, if springs or upstream hypolimnetic discharges exist in the system, striped bass will use these for summer refugia if ambient conditions during the summer are unfavorable (Cheek et al. 1985; Moss 1985; Braschler et al. 1989; VanDenAvyle and Evans 1990; Wilkinson and Fisher 1997). We found no evidence of thermal refugia via springs during our tracking on Lake Martin, and only one fish was located upstream in the Tallapoosa River, where a hypolimnetic discharge exists below Harris Dam. However, that fish left the Tallapoosa River in June, long before striped bass habitat conditions began to deteriorate in Lake Martin. It appeared that striped bass in Lake Martin typically remain in the reservoir and use the hypolimnetic waters for summer refuge. As summer progressed, fish displayed dual strategies for persisting throughout the summer, with fish found either near the thermocline or deep in the hypolimnion. Use of either of these strategies did not appear to be size-dependent, as there was no relation between length of fish and depths used.

Diel movement of striped bass during the summer were more consistent among months than daily movements, and were characterized mostly by low to moderate movement by most fish with a few instances of greater movement. In contrast, behavior of striped bass displayed consistent patterns throughout the 24-h period. Fish were most active during the day, when they

also typically used deeper water depths. Interestingly, it appeared the fish using the hypolimnion during the day would move up to the vicinity of the thermocline at dusk, where they would remain throughout the night and into the dawn period, moving back down to the hypolimnion only after the dawn period was over. This further illustrated the fact that at least two strategies were used by striped bass to persist throughout the summer in Lake Martin. Some striped bass may be foraging in the vicinity of the thermocline at night and moving deeper during the day to thermoregulate in cooler waters, while others maintain position near the thermocline throughout the 24-h period. Vertical diel migrations have been observed for other fish species (Janssen and Brandt 1980; O'Brien et al. 1984), and our observations support Bettoli's (2005) findings that striped bass use a greater range of temperatures than what was typically accepted. Multiple survival strategies used by striped bass during summertime conditions have been demonstrated by other authors (Jackson and Hightower 2001; Young and Isely 2002); however, this is the first study to describe differing vertical distribution strategies by striped bass over a 24-h period, although this behavior has long been theorized to occur by biologists and anglers alike. Coutant (1985) observed that striped bass will not move into unsuitable epilimnetic waters to feed, even if forage was abundant. Likewise, no noticeable movement above the thermocline was observed during any diel period in Lake Martin.

Striped bass in Lake Martin were sometimes found to be using surprisingly high temperatures and low dissolved oxygen concentrations, even during periods when large volumes of habitat were still available in the reservoir. Striped bass were commonly observed upstream in the middle reaches of the Tallapoosa River, Kowaliga Creek, and Blue Creek arms of the reservoir in July and August. These fish were persisting in narrow bands of marginal striped

bass habitat found near the reservoir bottom; this habitat was typically characterized by dissolved oxygen concentrations < 2.5 mg/L. The fish continued to use these areas until the habitat literally vanished, despite the fact that a sizeable volume of water with higher dissolved oxygen concentrations and acceptable temperatures existed downstream in the reservoir, well within the demonstrated movement capabilities of these fish. Many studies have reported that striped bass avoid water with dissolved oxygen concentrations < 3 mg/L (Cheek et al. 1985; Coutant 1985; Matthews et al. 1985; Matthews et al. 1989); however, this was not observed in Lake Martin. Striped bass have been found to use suboptimal habitat (both temperature and dissolved oxygen concentrations) for periods up to 4-6 weeks (Zale et al. 1990; Van Horn et al. 1998; Jackson and Hightower 2001; Young and Isely 2002), but in most cases this only occurred after suitable striped bass habitat had disappeared from the system. This was not the case in Lake Martin, where 25% of the striped bass locations in July occurred in areas with dissolved oxygen concentrations < 3.0 mg/L or in water temperatures > 22 degrees C, when higher quality habitat was still available in the reservoir.

The striped bass found in Lake Martin are Gulf-strain fish, which originally occurred in Gulf Coast rivers and did not over-summer in the ocean like their Atlantic-strain counterparts. These fish may be better adapted to higher temperatures and lower dissolved oxygen concentrations than Atlantic-strain fish (Wooley and Crateau 1983; VanDenAvyle and Evans 1990). Most studies of striped bass habitat use have been conducted with Atlantic-strain fish, and results from these studies may not be directly comparable to systems with Gulf-strain fish, particularly in terms of temperature and dissolved oxygen requirements. Furthermore, the fish used during our study were all large adults (> 4 kg), which have been shown to have significantly

lower temperature preferenda than smaller fish (Coutant 1985). Few striped bass studies have used fish this large when determining habitat use in field studies, and no lab studies have been conducted with fish of this size. However, the study by Bettoli (2005) in Melton Hill Reservoir, Tennessee, was conducted on Atlantic-strain fish of similar sizes to the ones used in our study. Striped bass in that study selected for water temperatures of 17.5 degrees C during the summer and were never found above 24 degrees C. In contrast, 25% of the striped bass locations in Lake Martin in July and August were in water temperatures > 22 degrees C. These considerations deserve future study to more clearly define the habitat requirements of Gulf-strain striped bass.

Angling mortality can be an important component of total annual mortality in striped bass fisheries (Bettoli and Osborne 1998; Bettinger et al. 2005; Thompson et al. 2007). This is likely true in Lake Martin as well, although the results of this portion of the study can only be considered preliminary at best. Striped bass suffer acute physiological stress during the angling experience, and this stress is heightened under warm water conditions (Tomasso et al. 1996; Bettinger et al. 2005). Furthermore, fish captured and brought to the surface from the depths we observed them occupy are also likely to suffer from barotrauma, which has been shown to further increases stress and mortality in fishes (St John and Syers 2005; Gravel and Cooke 2008; Schreer et al. 2009). Although we only collected five striped bass during our angling sample, the fact that all five died within 24 h and three died within 5 minutes of release is enough to justify concerns over how this source of mortality is structuring the striped bass population in Lake Martin. Further work is warranted to examine the amount of striped bass angling that takes place on Lake Martin during the summer, the number of fish caught, and the percentage of released fish that do not survive the experience.

Habitat availability is a major limitation of striped bass fisheries across the southeastern U.S., and is often the main determinant of the quality of these fisheries in terms of numbers and size (Coutant 1987). Compared to many reservoirs in this region, Lake Martin supports a large volume of striped bass habitat throughout much of the year, likely owing to the size, depth, and relative infertility of the reservoir. However, this study has demonstrated that striped bass habitat availability is subject to drastic seasonal changes even in reservoirs that appear to provide good opportunities for quality striped bass fisheries such as Lake Martin. The rapid change in striped bass habitat may be attributed to unusually high amounts of precipitation that fell in the drainage basin of the reservoir in 2009, which caused the dam to generate large volumes of water through it to maintain reservoir levels near full-pool levels. During these events, cool hypolimnetic waters are discharged through the dam and replaced with warm epilimnetic waters, resulting in large changes in habitat availability (Cole and Hannan 1990). Also, frequent rain events can flush nutrients downstream and off shoreline habitats such as lawns and flower beds from lakeside homes, which can artificially increase nutrient levels and primary production in the reservoir, causing more rapid depletion of oxygen through decomposition (Coutant 1987).

Lake Martin has a history of irregular die-offs of large striped bass (APC 2008); however, in this study we only observed two mortalities that could not be attributed to anglers. Both occurred in August when striped bass habitat was almost eliminated, but we never observed any mortality of untagged fish during tracking surveys, and no die-offs were reported by anglers. It appeared that despite losing all striped bass habitat for a period of several weeks, striped bass were able to continue to persist into the fall. During summers with average or below average

rainfall, striped bass habitat availability in Lake Martin is likely more stable, reducing chances of large mortality events of striped bass. In 2009 a large rain event in mid September resulted in a corresponding loss of the remainder of the striped bass habitat in the reservoir. However, this event was followed by a period of below-average temperatures, and the reservoir was partially destratified by the end of September, restoring at least marginal habitat conditions to striped bass. However, if that rain event had been followed by warm, sunny conditions that persisted well into October, a mortality event would have been more likely. Given the irregular history of striped bass die-offs in Lake Martin, it seems that they may be associated with a rare combination of high rainfall events followed by long periods of above-average temperatures. However, if reservoir water quality changes in the future, either becoming warmer or more productive, the frequency and magnitude of these events may increase. Thus measures should be taken to maintain water quality in Lake Martin at current levels to protect against catastrophic die-offs of large striped bass in the future. Similarly, any changes made to the operation of Lake Martin as part of relicensing should be evaluated for their effects on future water quality that may alter striped bass habitat availability.

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Table 1. Length, weight, date tagged, last date located, days at large, number of locations, and fate of tagged fish by the end of telemetry sampling for tagged striped bass in Lake Martin, Alabama.

| Tag # | TL (mm) | Wt (g) | Date Tagged | Last Date Located | Days at Large | No. Locations | Fate |
|---|---|---|---|---|---|---|---|
| 47 | 823 | 5840 | 16 Mar 2009 | Never Located | - | - | Unknown |
| 48 | 785 | 5900 | 16 Mar 2009 | 01 Oct 2009 | 200 | 13 | Alive |
| 49 | 893 | 8420 | 16 Mar 2009 | 23 Sep 2009 | 192 | 12 | Alive |
| 50 | 831 | 6700 | 16 Mar 2009 | 28 Sep 2009 | 197 | 8 | Alive |
| 51 | 789 | 4780 | 16 Mar 2009 | 30 June 2009 | 107 | 6 | Alive |
| 52 | 774 | 5360 | 17 Mar 2009 | 10 Aug 2009 | 147 | 5 | Alive |
| 53 | 818 | 5680 | 17 Mar 2009 | 12 May 2009 | 70 | 2 | Harvested |
| 54 | 960 | N/A | 17 Mar 2009 | 27 Aug 2009 | 164 | 9 | Died |
| 55 | 784 | N/A | 17 Mar 2009 | 29 Sep 2009 | 197 | 6 | Alive |
| 56 | 825 | 8020 | 31 Mar 2009 | 29 Sep 2009 | 183 | 11 | Alive |
| 62 | 1012 | 14760 | 03 Apr 2009 | 28 Sep 2009 | 179 | 12 | Alive |
| 63 | 1040 | 15480 | 03 Apr 2009 | 29 Sep 2009 | 180 | 6 | Alive |
| 64 | 798 | 6660 | 03 Apr 2009 | Never Located | - | - | Unknown |
| 65 | 749 | 5360 | 06 Apr 2009 | 09 Sep 2009 | 157 | 9 | Alive |
| 66 | 751 | 5160 | 06 Apr 2009 | 23 Sep 2009 | 171 | 9 | Alive |
| 67 | 767 | 6450 | 03 Apr 2009 | 28 Sep 2009 | 179 | 10 | Alive |
| 68 | 784 | 5460 | 06 Apr 2009 | 10 Sep 2009 | 158 | 4 | Alive |
| 69 | 940 | 14300 | 06 Apr 2009 | 22 July 2009 | 108 | 5 | Alive |
| 70 | 1010 | 17040 | 06 Apr 2009 | 27 Aug 2009 | 144 | 10 | Alive |
| 71 | 1063 | 13340 | 14 Apr 2009 | 27 Aug 2009 | 136 | 6 | Died |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 77 | 820 | 7140 | 06 Apr 2009 | 28 Sep 2009 | 176 | 15 | Alive |
| 78 | 924 | 11580 | 14 Apr 2009 | 04 Sep 2009 | 144 | 8 | Alive |
| 79 | 1031 | 14260 | 14 Apr 2009 | 28 Sep 2009 | 168 | 1 | Alive |
| 80 | 781 | 5440 | 14 Apr 2009 | 09 Sep 2009 | 149 | 13 | Alive |
| 81 | 1021 | 12760 | 14 Apr 2009 | 28 Sep 2009 | 168 | 9 | Alive |
| 82 | 980 | 12220 | 14 Apr 2009 | 02 Oct 2009 | 172 | 10 | Alive |
| 83 | 740 | 5020 | 06 Apr 2009 | 23 Sep 2009 | 171 | 9 | Alive |
| 84 | 897 | 9400 | 06 Apr 2009 | 28 Aug 2009 | 145 | 4 | Alive |
| 85 | 795 | 6260 | 06 Apr 2009 | 26 Aug 2009 | 143 | 5 | Alive |
| 86 | 1001 | 14140 | 14 Apr 2009 | 22 Apr 2009 | 9 | 1 | Alive |

Table 2. Monthly mean depth, temperature, dissolved oxygen, and daily movement of tagged striped bass tracked weekly or biweekly over a six-month period in Lake Martin, Alabama, during 2009. Means with the same superscript were similar (Tukey's Test; $P > 0.10$), standard deviations in parentheses.

| | Depth (m) | Temperature (C) | Dissolved $O_2$ (mg/L) | Movement (m/d) |
|---|---|---|---|---|
| April | 3.3 $^{c}$ (3.8) | 16.7 $^{c}$ (0.9) | 6.4 $^{a}$ (0.4) | 665 $^{ab}$ (627) |
| May | 7.5 $^{b}$ (4.4) | 18.5 $^{c}$ (2.2) | 7.8 $^{a}$ (0.8) | 466 $^{ab}$ (400) |
| June | 14.9 $^{a}$ (4.7) | 18.2 $^{c}$ (2.3) | 4.3 $^{b}$ (1.4) | 523 $^{ab}$ (549) |
| July | 14.5 $^{a}$ (5.7) | 19.7 $^{b}$ (3.3) | 4.1 $^{b}$ (1.5) | 279 $^{b}$ (282) |
| August | 16.3 $^{a}$ (5.6) | 20.3 $^{b}$ (4.0) | 2.6 $^{c}$ (0.9) | 379 $^{b}$ (300) |
| September | 9.6 $^{a}$ (3.3) | 24.7 $^{a}$ (1.4) | 4.3 $^{b}$ (1.7) | 2039 $^{a}$ (1816) |

Table 3. Mean temperature, dissolved oxygen, depth, and movement of tagged striped bass over four diel periods in Lake Martin, Alabama, during June-September 2009. Means with the same superscript were similar (Tukey's Test; $P > 0.10$), standard deviations in parentheses. Mean dissolved oxygen concentrations at striped bass locations were similar among all diel periods.

| | Depth (m) | Temperature (C) | Dissolved $O_2$ (mg/L) | Movement (m/h) |
|---|---|---|---|---|
| Dawn | 13.9 $^{ab}$ (4.0) | 21.2 $^{bc}$ (4.2) | 4.3 (1.7) | 226 $^{a}$ (202) |
| Day | 14.9 $^{a}$ (6.2) | 20.6 $^{c}$ (4.3) | 3.9 (1.7) | 280 $^{a}$ (261) |
| Dusk | 12.7 $^{b}$ (3.5) | 21.6 $^{ab}$ (3.8) | 4.3 (1.6) | 108 $^{b}$ (126) |
| Night | 12.8 $^{b}$ (3.5) | 22.1 $^{a}$ (3.7) | 4.0 (1.7) | 98 $^{b}$ (92) |

Table 4. Total length (TL), landing time, handling time, and fate of five striped bass angled, tagged, and released on July 16, 2010 during the only successful hooking mortality sample of the study. Surface water temperature was 30 degrees C, and air temperatures ranged from 24-25 degrees C.

| TL (mm) | Landing Time (s) | Handling Time (s) | Fate |
|---|---|---|---|
| 711 | 174 | 236 | Died within 5 min of release |
| 952 | 246 | 123 | Died within 5 min of release |
| 620 | 151 | 147 | Died within 24 h of release |
| 676 | 179 | 93 | Died within 24 h of release |
| 794 | 209 | - | Dead at boatside, not tagged |

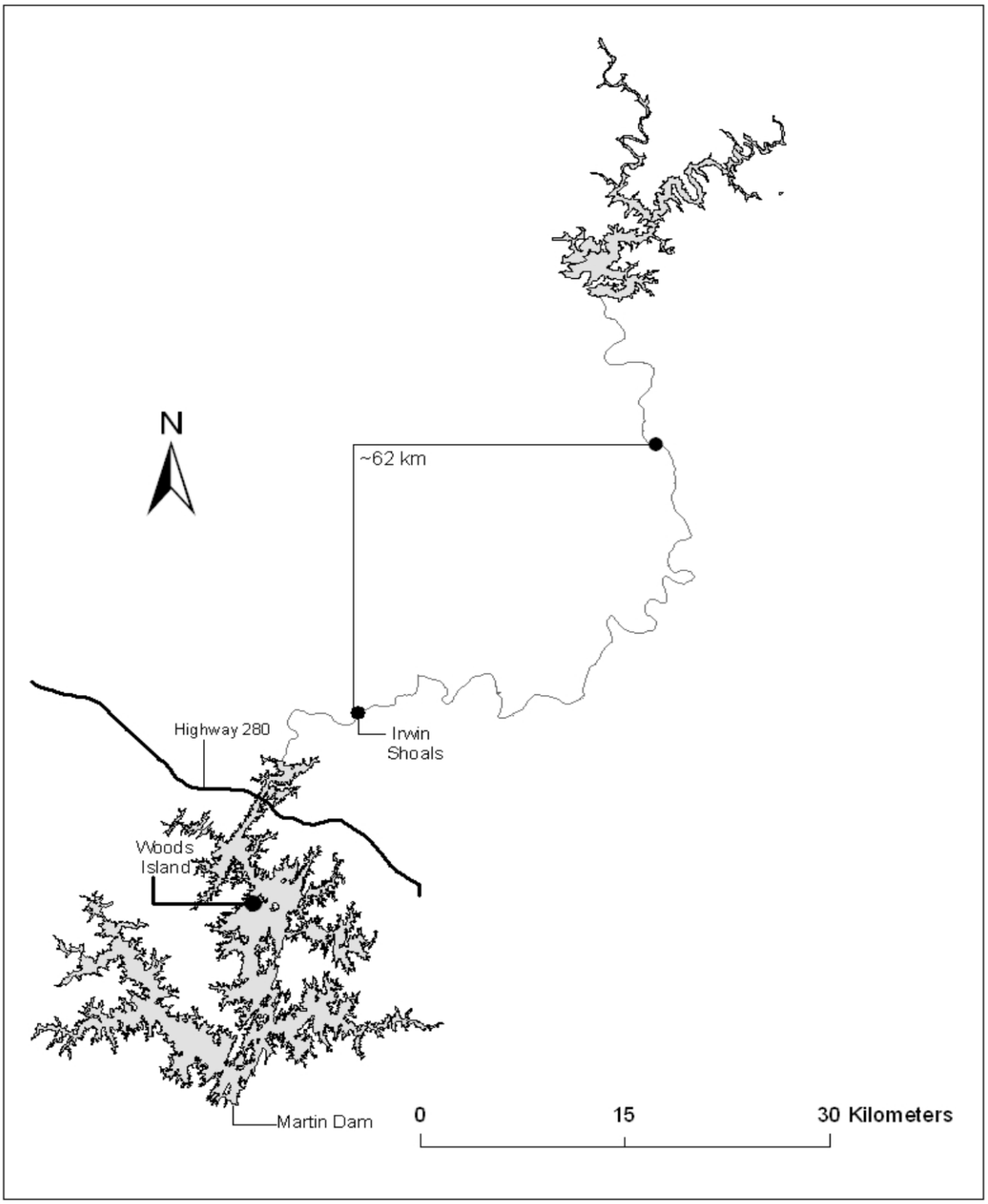


Figure 1. Map of Lake Martin and the Tallapoosa River upstream to Harris Dam and Lake Wedowee. Striped bass were tagged around the Woods Island area in Lake Martin and the Irwin Shoals area of the Tallapoosa River. One fish left the study area and was found June 2, 2009 approximately 62 km upstream in the Tallapoosa River near Wadley Alabama.

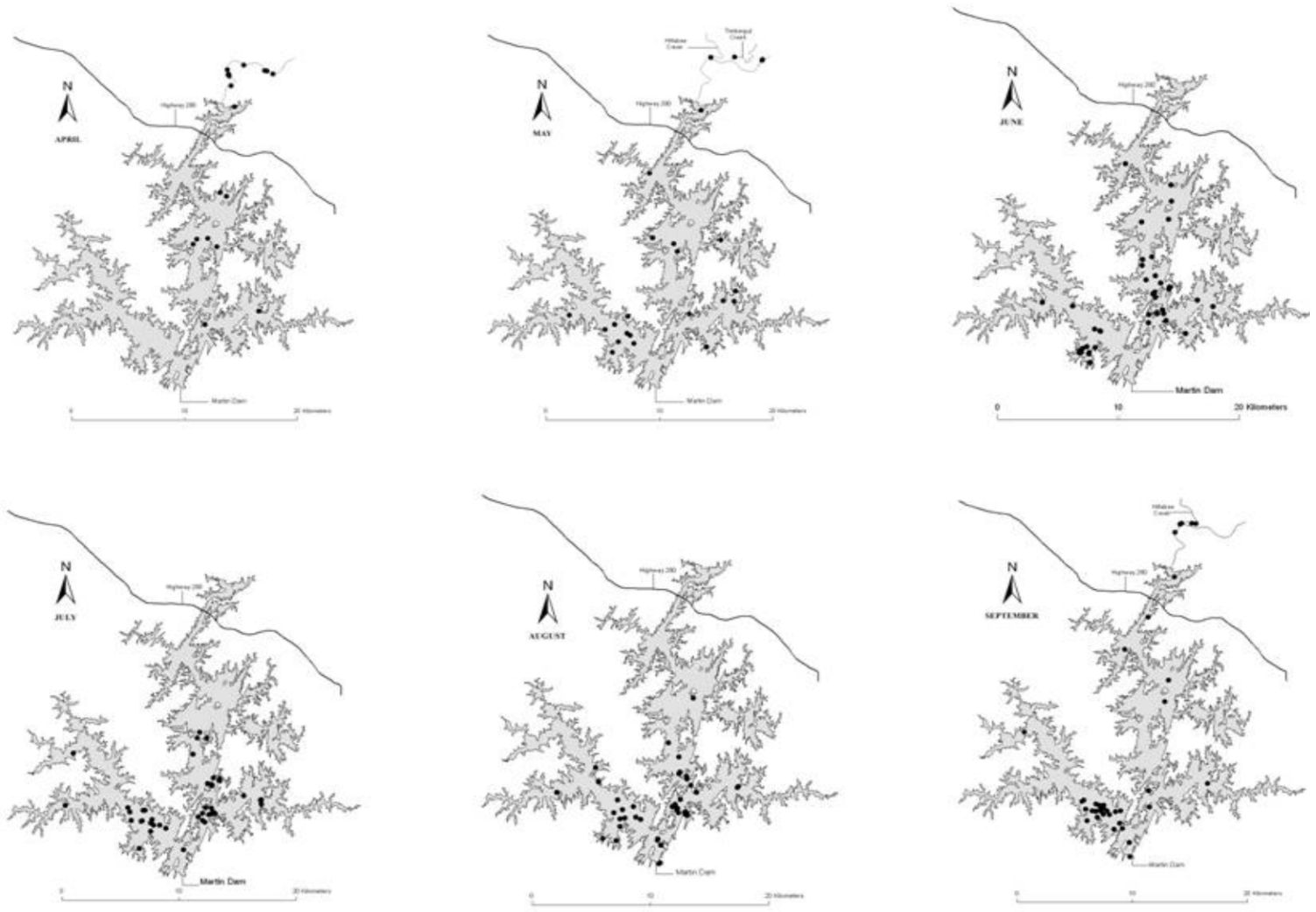


Figure 2. Map of Lake Martin showing weekly locations of tagged striped bass in each month from April-September, 2009.

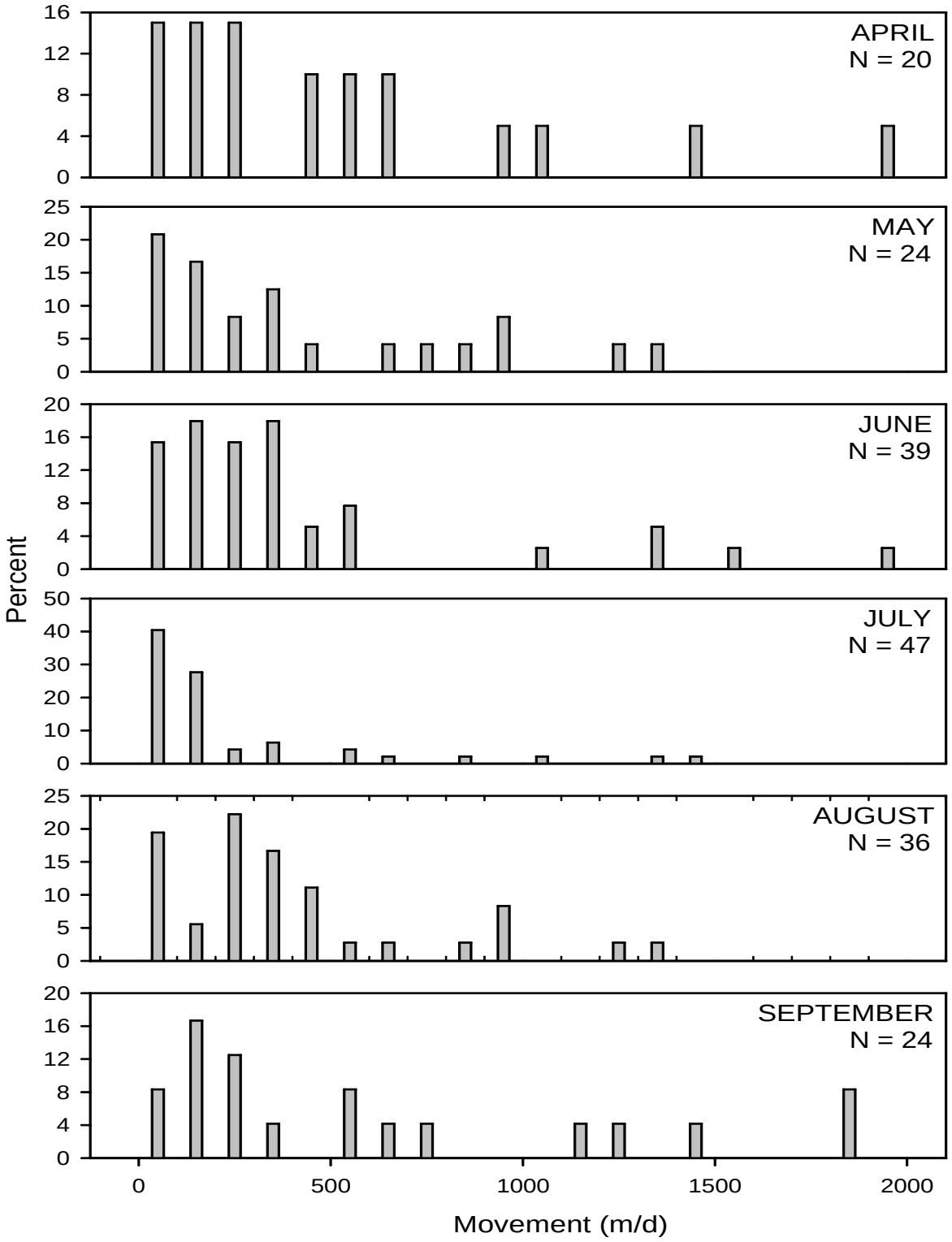


Figure 3. Daily movement distribution of tagged striped bass in Lake Martin, Alabama, over six months in 2009.

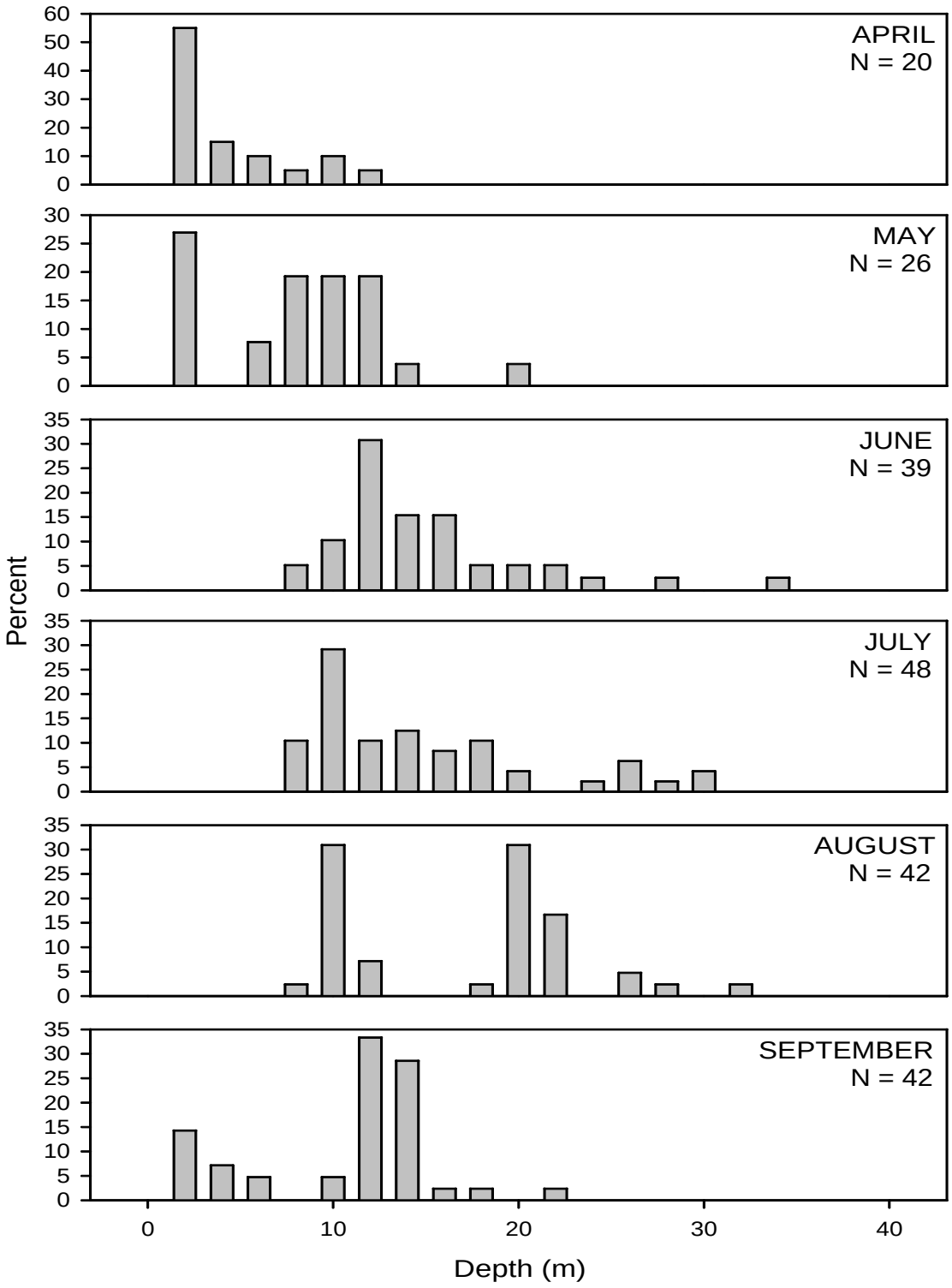


Figure 4. Depth distribution of tagged striped bass in Lake Martin, Alabama, over six months in 2009.

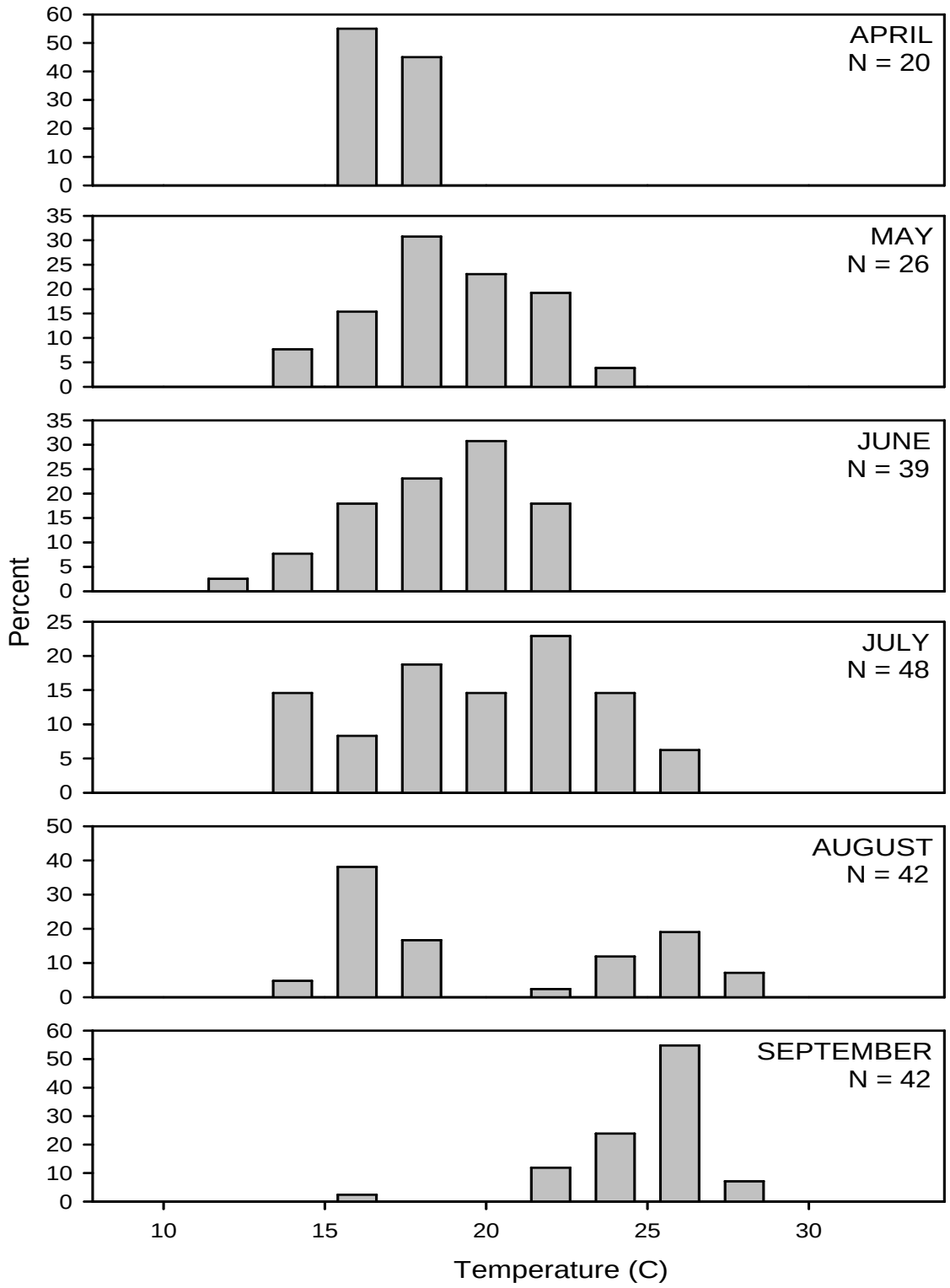


Figure 5. Temperature distribution of tagged striped bass in Lake Martin, Alabama, over six months in 2009.

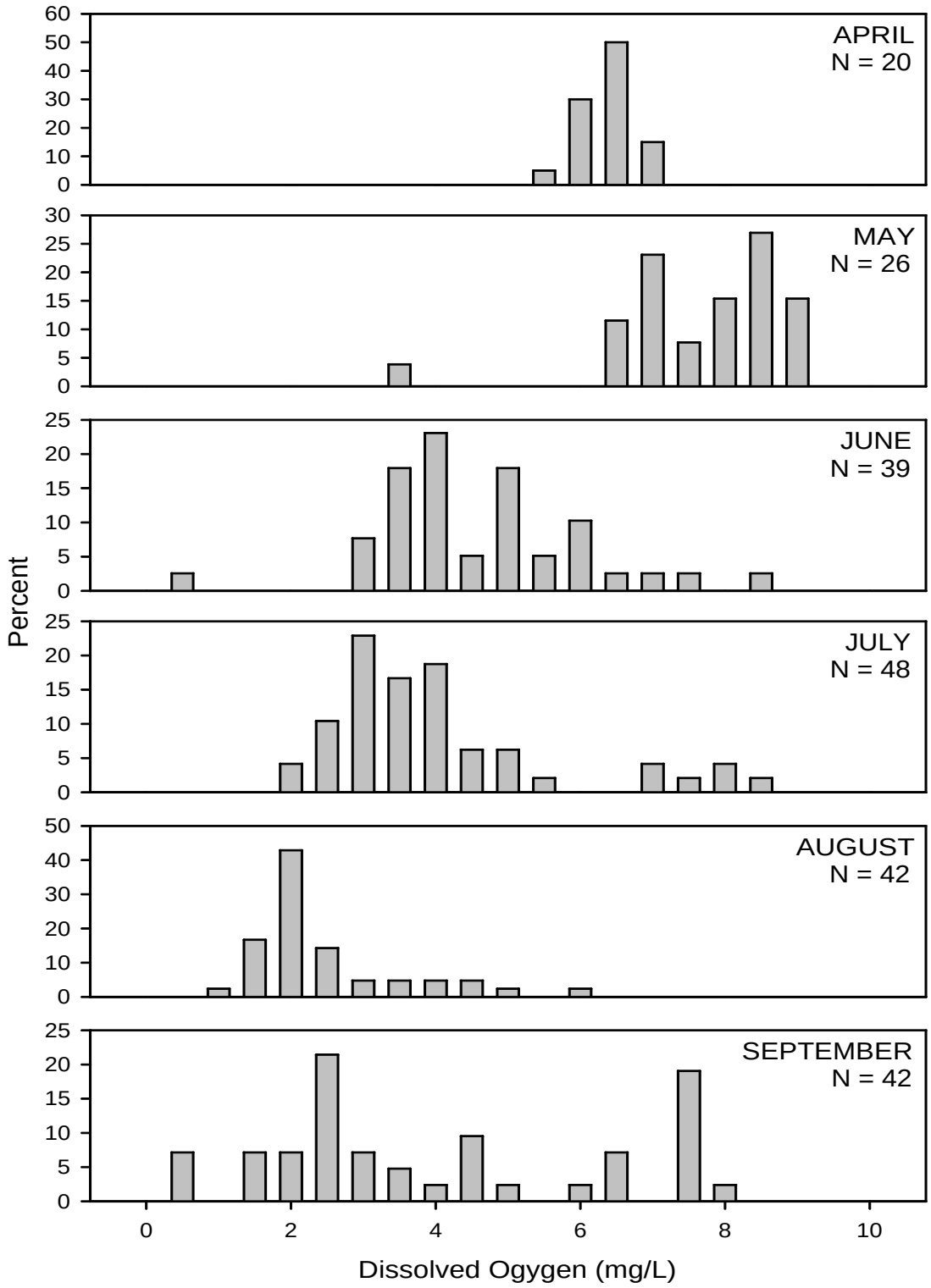


Figure 6. Dissolved oxygen distribution of tagged striped bass in Lake Martin, Alabama, over six months in 2009.

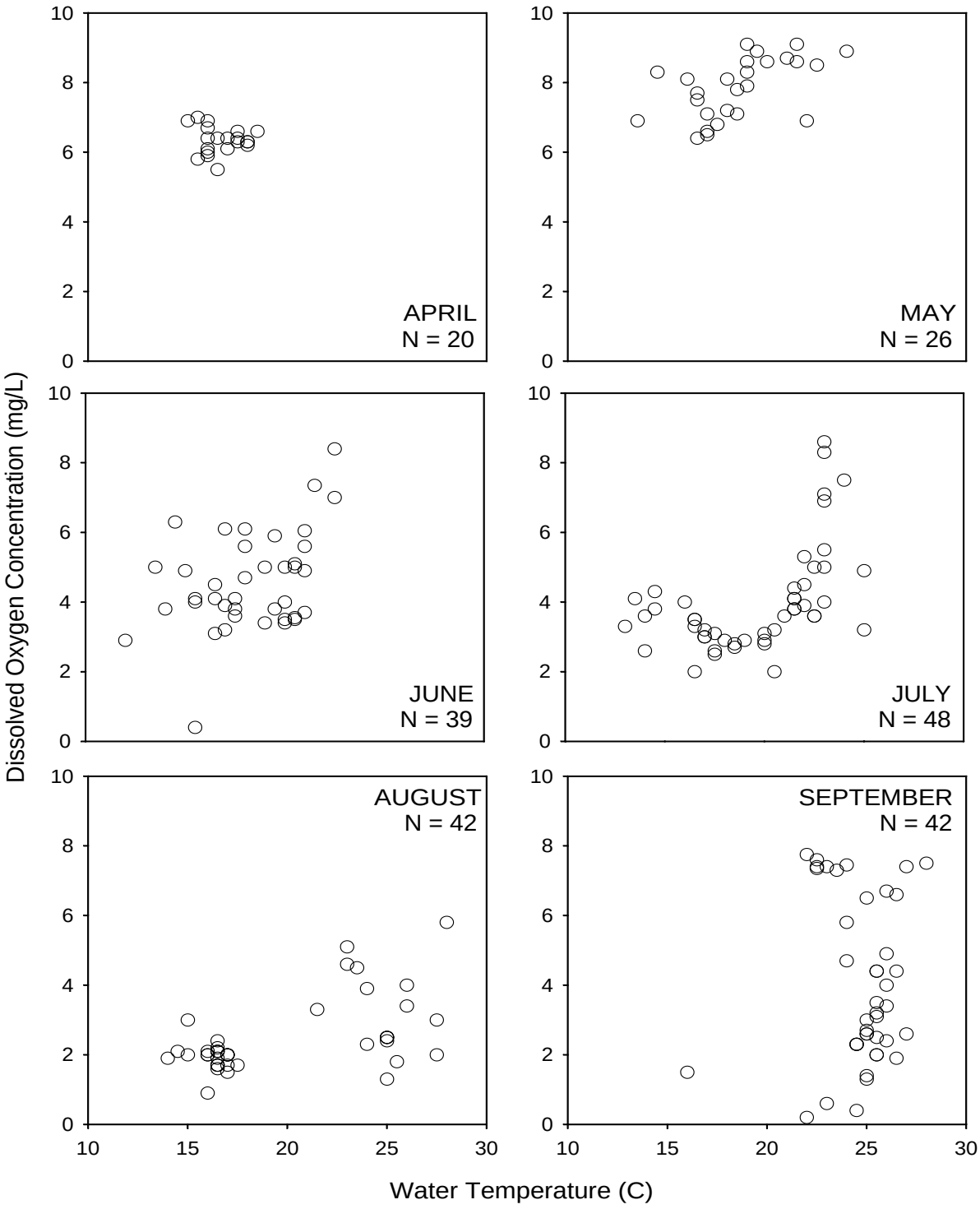


Figure 7. Water temperatures and dissolved oxygen concentrations at locations of tagged striped bass in Lake Martin, Alabama, over six months in 2009.

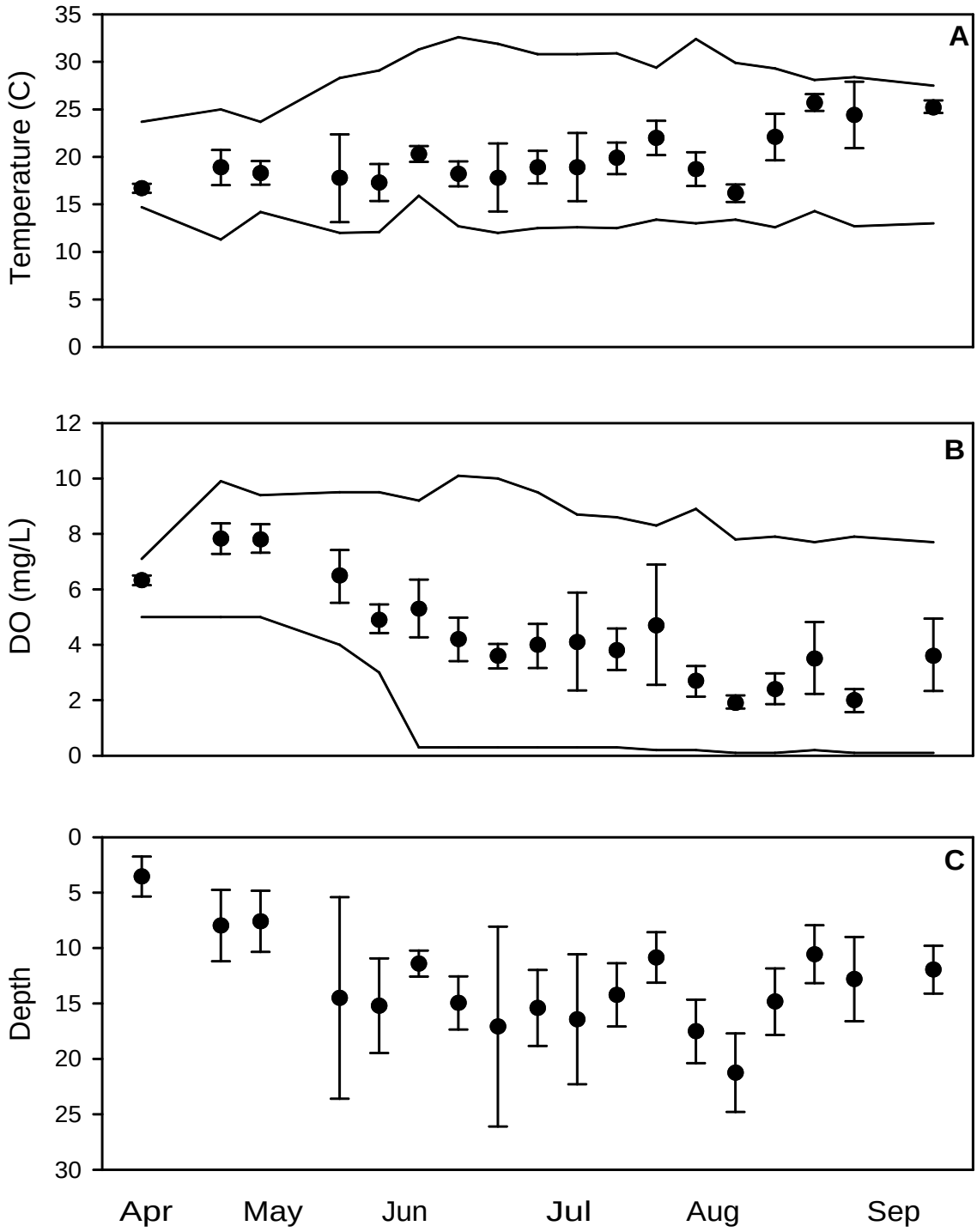


Figure 8. Panels A and B: Weekly maximum and minimum (lines) temperatures and dissolved oxygen observed in Lake Martin, Alabama, over six months in 2009, along with means (with 95% confidence intervals) occupied by tagged striped bass (points and vertical bars). Panel C: Weekly mean depths (with 95% confidence intervals) occupied by tagged striped bass.

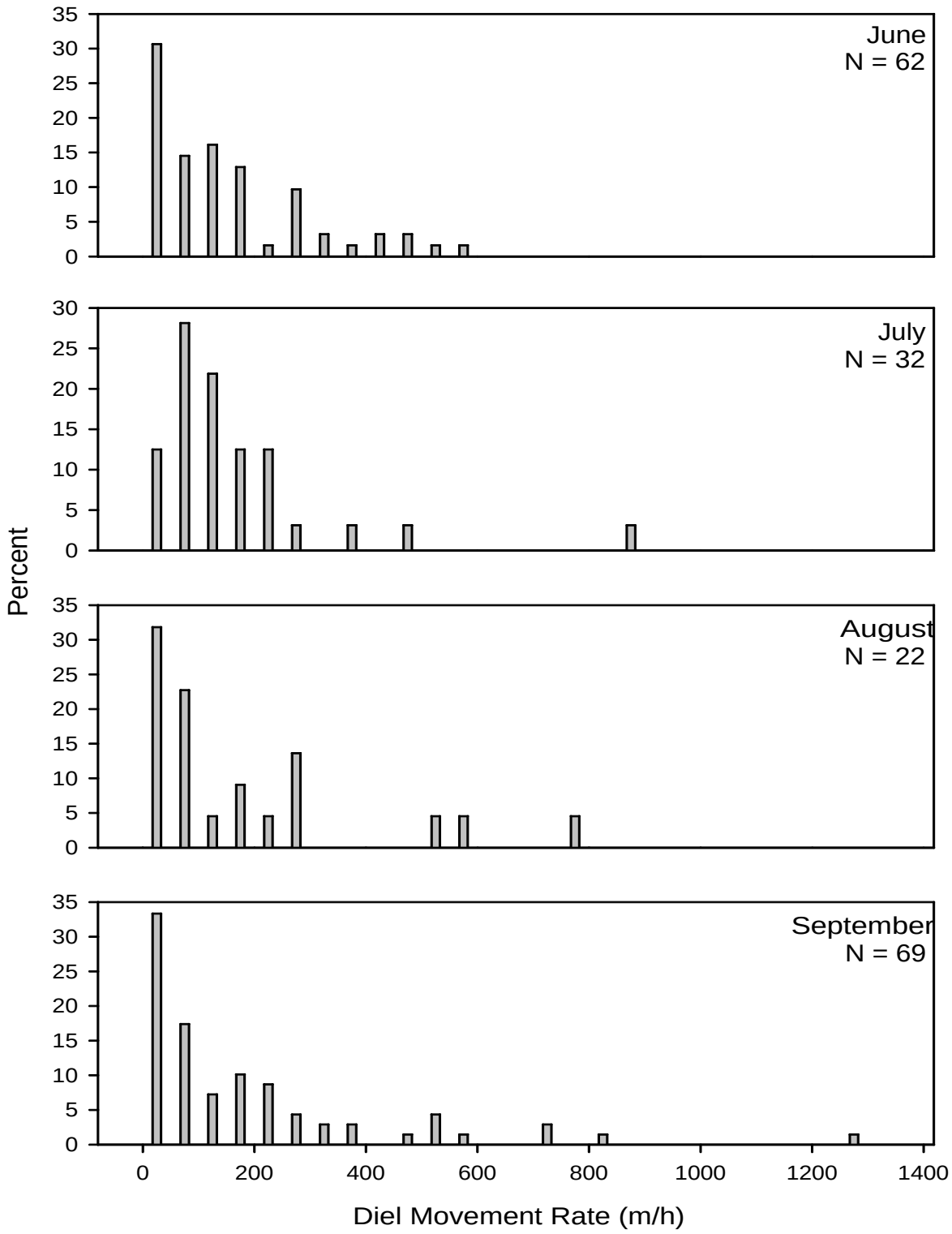


Figure 9. Diel movement of tagged striped bass among four months in Lake Martin, Alabama, during 2009.

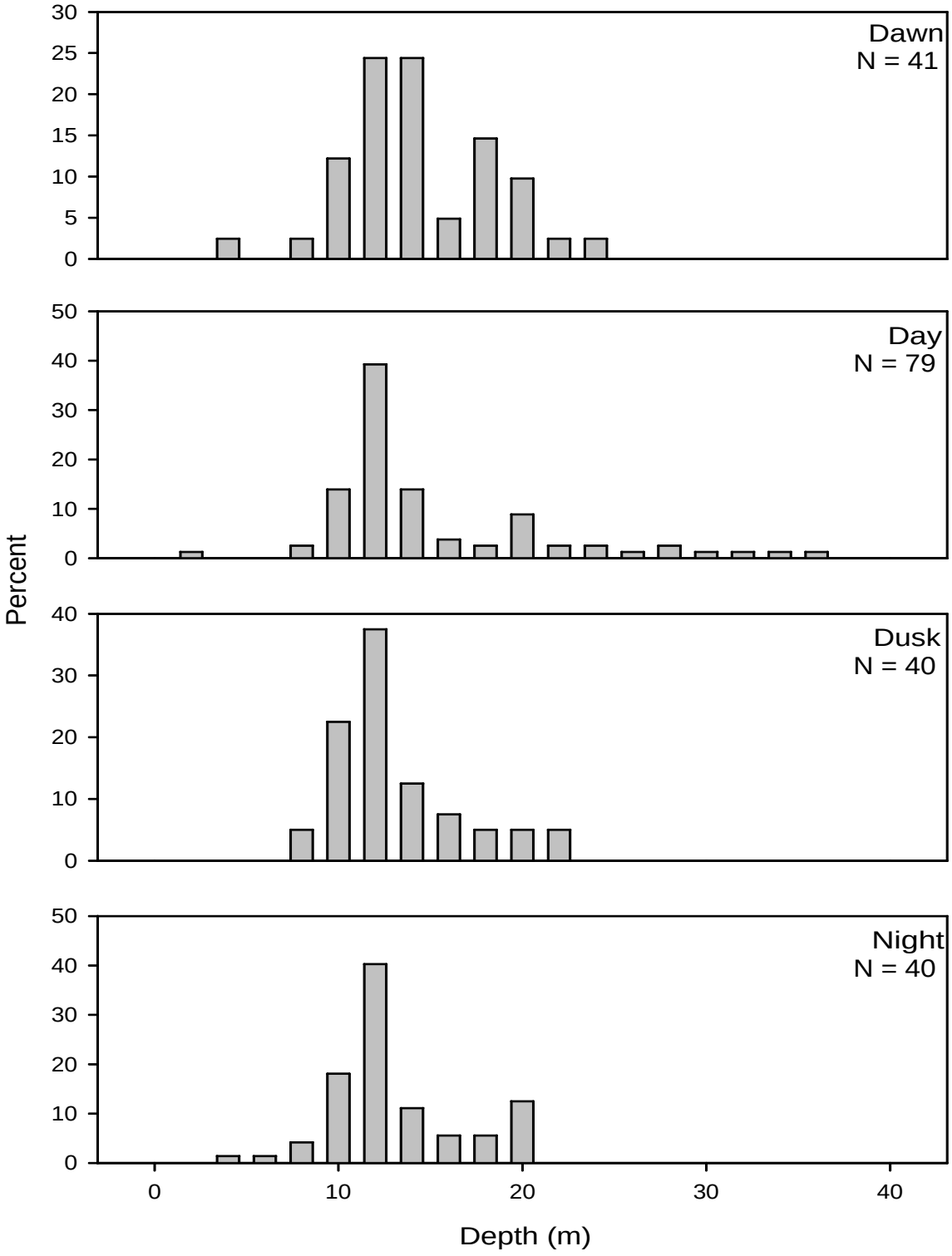


Figure 10. Diel movement distribution among four diel periods of tagged striped bass in Lake Martin, Alabama, during June-September, 2009.

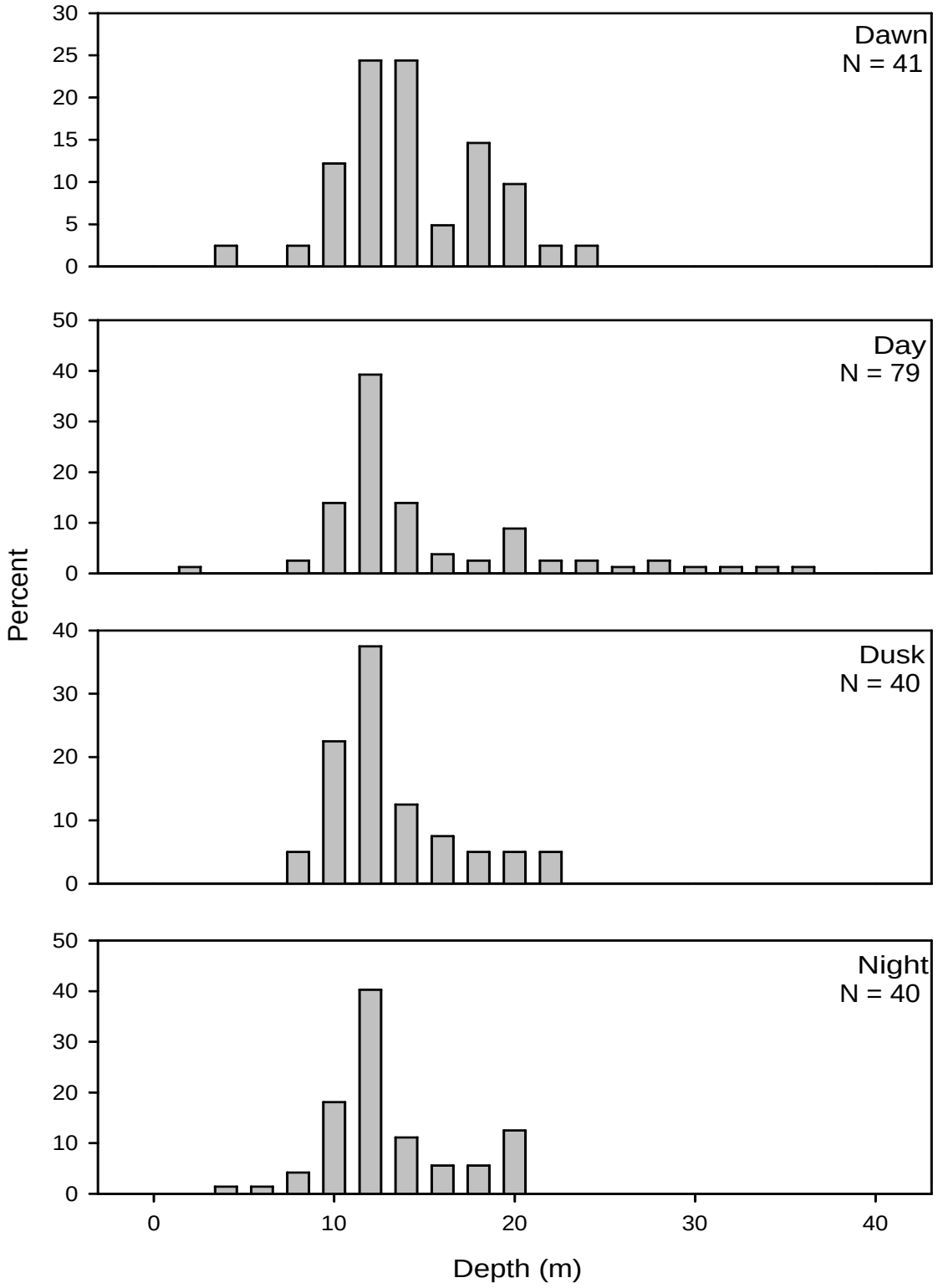


Figure 11. Depth distribution among four diel periods of tagged striped bass in Lake Martin, Alabama, during June-September, 2009.

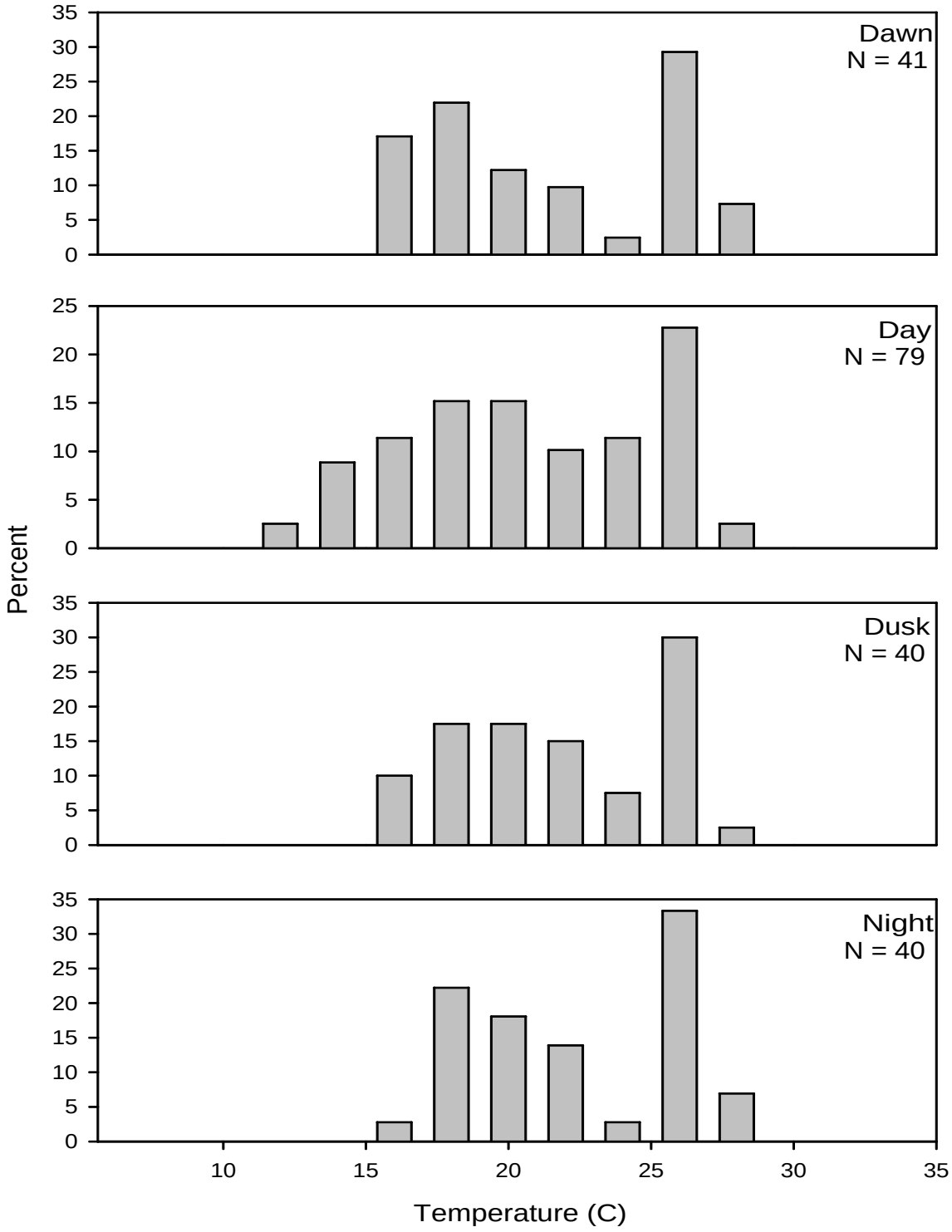


Figure 12. Temperature distribution among four diel periods of tagged striped bass in Lake Martin, Alabama, during June-September, 2009.

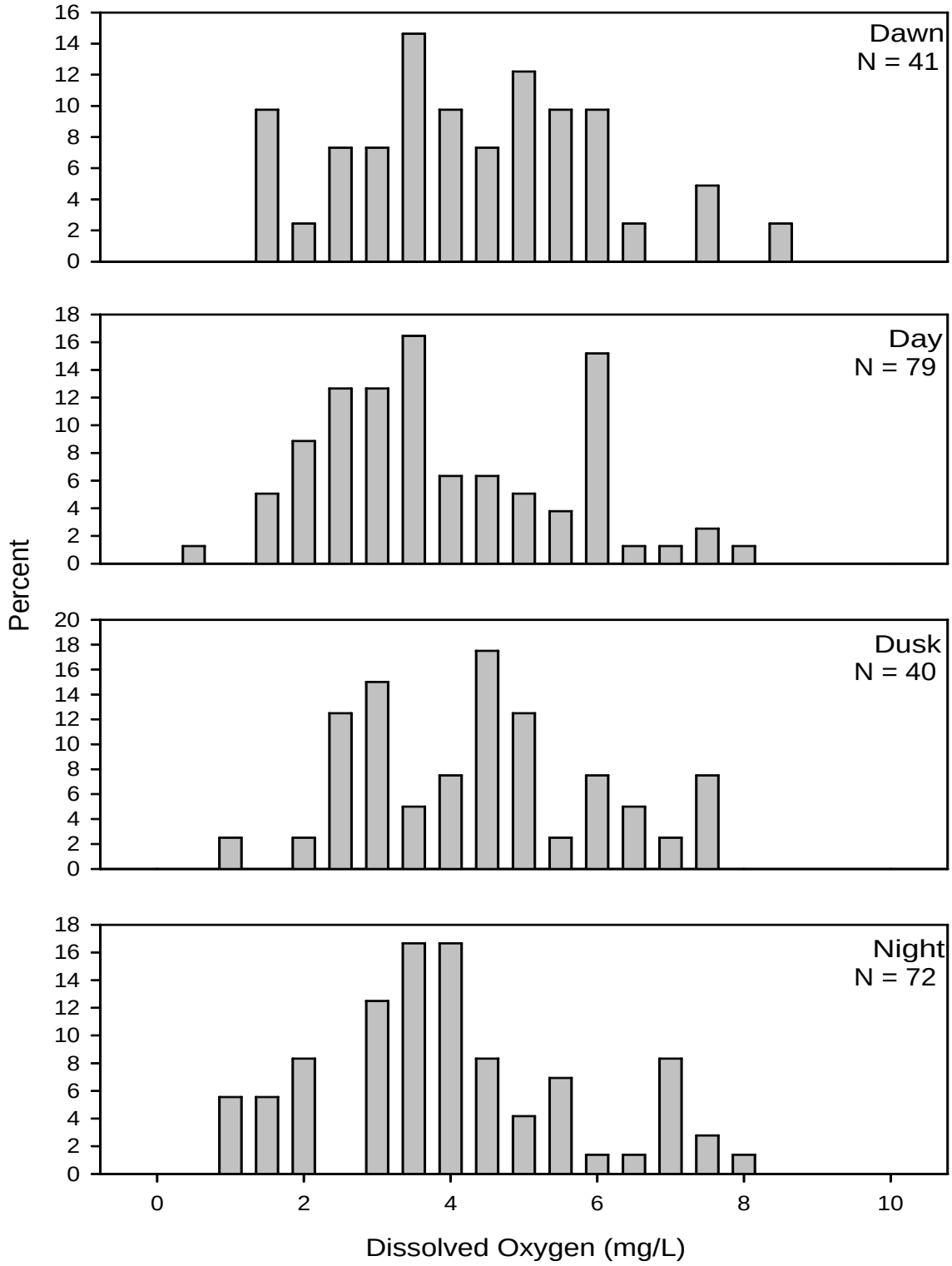


Figure 13. Dissolved oxygen distribution among four diel periods of tagged striped bass in Lake Martin, Alabama, during June-September, 2009.

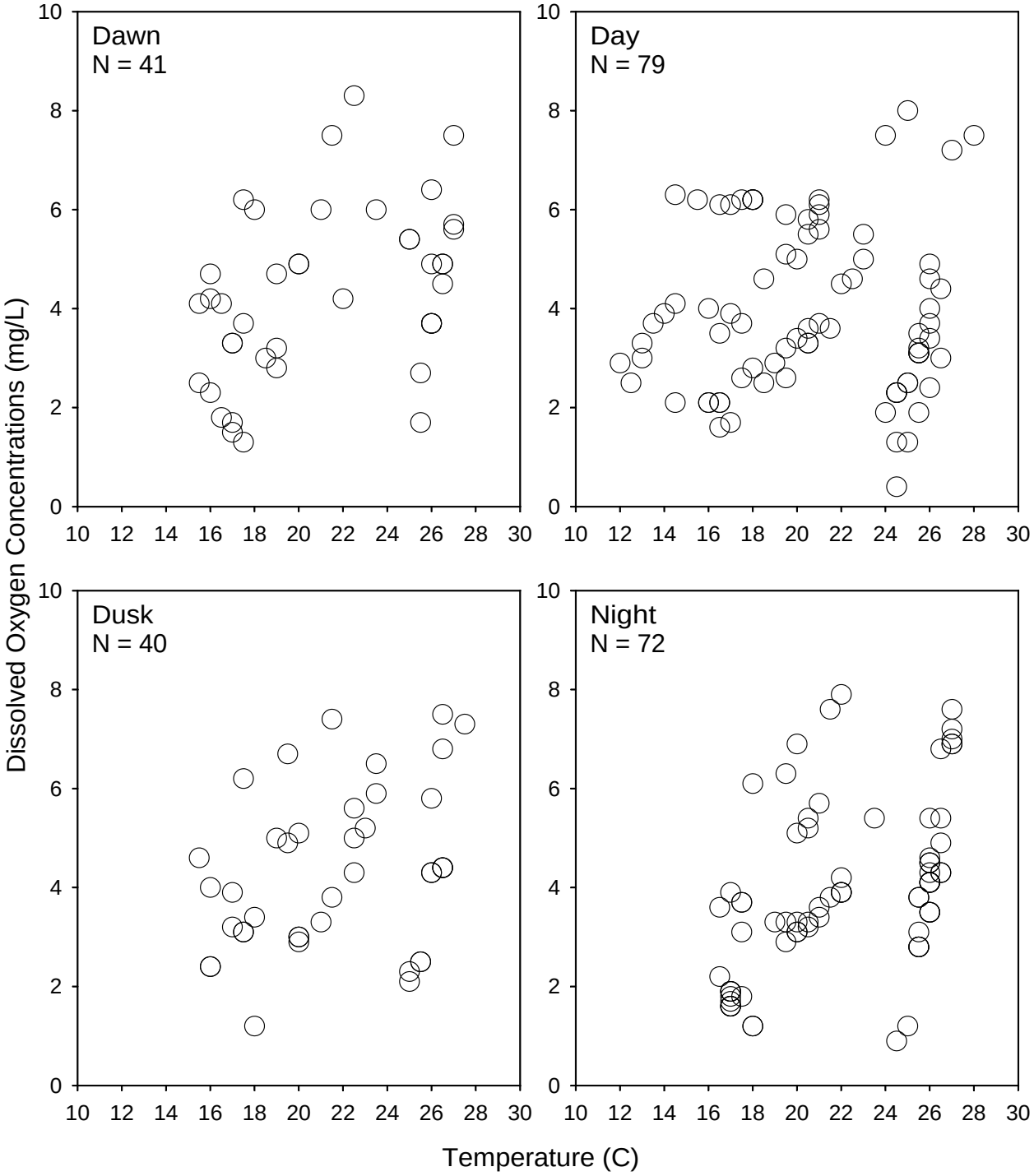


Figure 14. Water temperatures and dissolved oxygen concentrations at locations of tagged striped bass among four diel periods in Lake Martin, June-September, 2009.

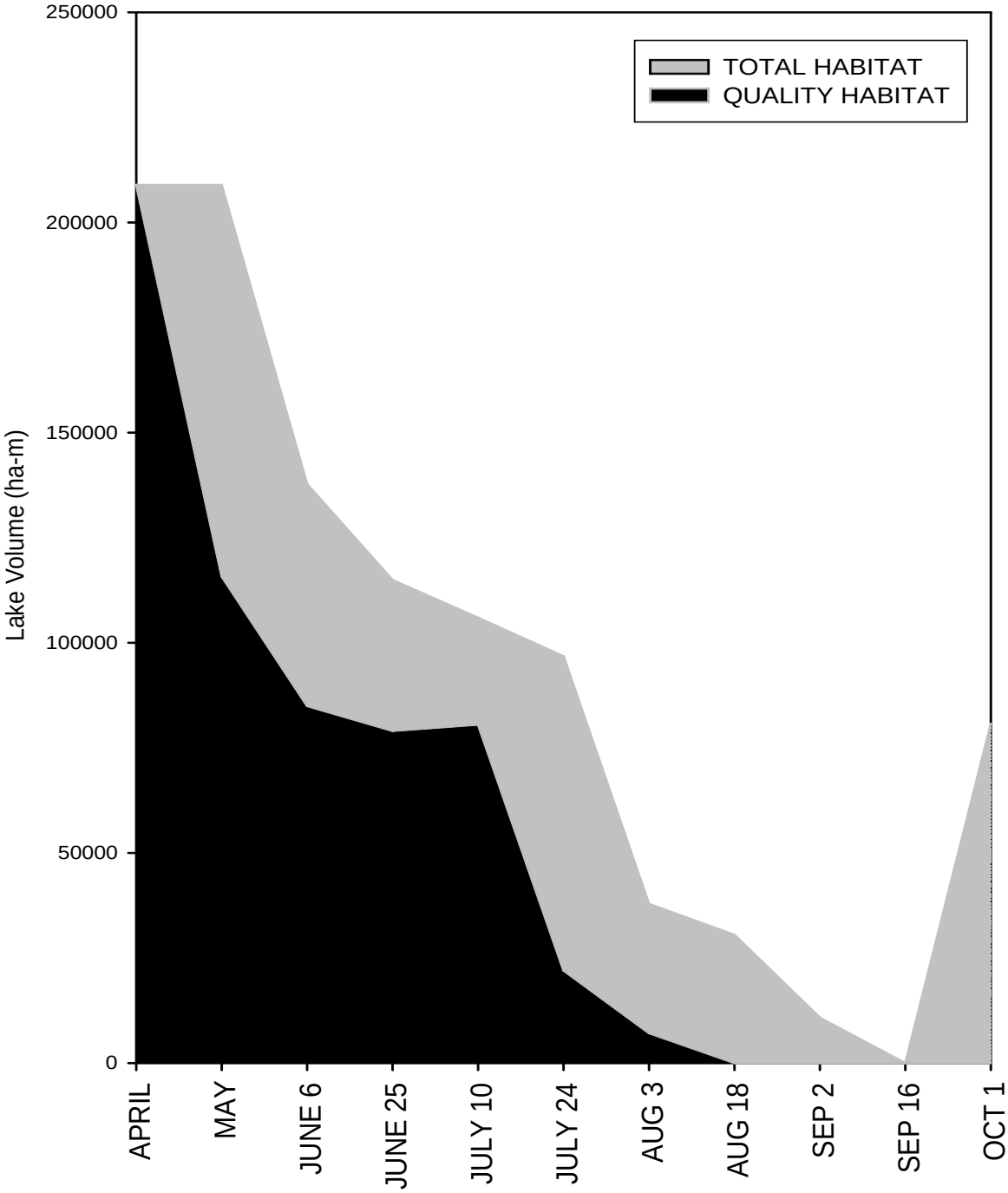


Figure 15. Volumes of striped bass habitat present in Lake Martin, Alabama over a six-month period in 2009. Quality habitat was defined as water with temperatures < 21.3 degrees C and dissolved oxygen concentrations > 2.6 mg/L. Total habitat was defined as water with temperatures $\leq$ 25 degrees C and dissolved oxygen concentrations $\geq$ 1.7 mg/L.