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May 19, 2020

Lloyd Shoals Hydroelectric Project (FERC No. 2336-094)
Relicensing Study Reports

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Room 1-A- Dockets Room
Washington, D.C. 20426

Dear Secretary Bose:

On behalf of Georgia Power Company, Southern Company is filing with the Federal Energy Regulatory Commission (Commission) the Wallace Dam relicensing study reports in compliance with the Commission's Integrated Licensing Process regulations at 18 CFR § 5.15(c)(1).

This filing consists of the following parts:

Part 1 of 4 (Public)

1) Cover Letter
2) Geology and Soils Study Report
3) Water Resources Report
4) Fish and Aquatic Resources
5) American Eel Abundance and Upstream Movements Study Report

Part 2 of 4 (Public)

6) Cover Letter
7) Terrestrial, Wetland, and Riparian Resources Study
8) Rare, Threatened, and Endangered Species
9) Recreation and Land Use Study Report

Part 3 of 4 (Public)

10) Cover Letter
11) Cultural Resources Study Report
12) Historic Hydro Engineering Study Report

Part 4 of 4 (Non-Public, Privileged Filings)

13) Cover Letter - Public
14) Terrestrial, Wetland, and Riparian Resources Study – Privileged
15) Cultural Resources Study Report – Privileged

If you require further information, please contact me at 404.506.7219 or cromara@southernco.com.

Sincerely,

Courtenay R. O'Mara

Courtenay R. O'Mara, P.E.
Hydro Licensing & Compliance Supervisor

Enclosure

cc: FERC – Navreet Deo, Allan Creamer
Kleinschmidt – Steve Layman, Ph.D.
Troutman Sanders – Hallie Meushaw

STUDY REPORT

GEOLOGY AND SOILS

LLOYD SHOALS HYDROELECTRIC PROJECT
(FERC NO. 2336)

Prepared with:

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May 2020

STUDY REPORT
GEOLOGY AND SOILS
LLOYD SHOALS HYDROELECTRIC PROJECT
(FERC NO. 2336)

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1.0 INTRODUCTION

This report presents findings of the Geology and Soils Study conducted for Federal Energy Regulatory Commission (FERC) relicensing of Georgia Power Company's (Georgia Power's) Lloyd Shoals Hydroelectric Project (Lloyd Shoals Project, the Project) (FERC No. 2336). This study was conducted according to the approved study plan for the Lloyd Shoals Project. The approved study plan consists of Georgia Power's Revised Study Plan filed on April 19, 2019 (Georgia Power 2019) and the Study Plan Determination issued by FERC's Director of the Office of Energy Projects on May 20, 2019 (FERC 2019). Georgia Power will use the information generated by the study to evaluate the environmental effects of its proposed action in the Preliminary Licensing Proposal, to be filed with FERC by July 1, 2021.

The Lloyd Shoals Project is an existing 18-megawatt project consisting of a dam, powerhouse, and 4,750-acre reservoir (Lake Jackson, or Jackson Lake) on the Ocmulgee River in Butts, Henry, Jasper, and Newton Counties, Georgia (Figure 1). Georgia Power operates the Project in a modified run-of-river mode for generation during peak power demand hours to meet electrical system demand. Georgia Power is not proposing to make any major modifications to the Project under the new license. The Project does not occupy any federal lands. The current license expires December 31, 2023.

Georgia Power proposes to continue operating the Lloyd Shoals Project as currently operated. The Pre-application Document (PAD) describes the project facilities and current operations and presents information characterizing the affected environment (Georgia Power 2018). Scoping Document 2 (FERC 2018) summarizes the environmental issues identified during FERC's public scoping process pursuant to the National Environmental Policy Act (NEPA).

1.1 GOALS AND OBJECTIVES

The goal of this study was to develop information for: (1) characterizing existing shoreline conditions with respect to erosion and sedimentation in Lake Jackson and the Lloyd Shoals tailrace and (2) evaluate the Geology and Soils resource issues identified during FERC's public scoping process pursuant to NEPA that have a nexus with project operations.

The specific objective of the study was to characterize the distribution and sources of erosion and sedimentation within the FERC project boundary based on a shoreline field reconnaissance survey and review and analysis of existing information.

1.2 STUDY AREA

The study area included the FERC project boundary around Lake Jackson and the tailrace area downstream of Lloyd Shoals Dam. The project boundary generally follows the full-pool elevation contour of 530 feet (ft) plant datum (PD)[1] except in some areas where it follows metes-and-bounds property lines, including areas for public recreation and around the powerhouse. Only three percent of the project boundary is marked by metes-and-bounds property lines (Georgia Power 2017). Lake Jackson has 135 miles of shoreline and extends upstream from the dam about 13 river miles into the South and Yellow Rivers each, 11 miles into the Alcovy River, and 8 miles into Tussahaw Creek.

Georgia Power maintains four project recreation access areas within the project boundary, including Lloyd Shoals Park, the Tailrace Fishing Pier, Ocmulgee River Park, and the Jane Lofton Public Access Area (Figure 1). The project boundary extends downstream of Lloyd Shoals Dam approximately 0.5 miles to encompass Ocmulgee River Park.

Project lands provide a buffer for aesthetics, wildlife habitat, water quality protection, and recreation. Through fee-simple ownership, Georgia Power controls approximately 1,138 acres of lands within the Lloyd Shoals project boundary, including approximately 106 miles of shoreline. Included in these numbers are 606 leased lots and 1,351 lots on which Georgia Power owns a strip of land between the shoreline and the privately owned residential property. Georgia Power possesses flood rights beyond the project boundary on 326 additional lots. Georgia Power manages the shoreline of Lake Jackson under its Shoreline Management Guidelines to ensure compliance with the Lloyd Shoals FERC license and other applicable federal and state laws and regulations (Georgia Power 2015).

Literature review and analysis of existing information and data also extended to adjacent lands and watersheds upstream of the project boundary.

[1] Plant datum = mean sea level elevation (NAVD88) + 0.45 feet.

2.0 STUDY METHODS

The study approach followed the approved study plan (Georgia Power 2019; FERC 2019) and consisted of the elements described below.

2.1 SHORELINE RECONNAISSANCE SURVEY

A shoreline reconnaissance survey of the study area was conducted in summer 2019 to inventory and characterize existing sources of erosion and sedimentation within the project boundary and to characterize physical aquatic habitat and available sources of littoral-zone cover for fish. Representative shoreline sites within the project boundary were selected and visually evaluated in the field as described below.

2.1.1 SITE SELECTION

A geographic information system shapefile was prepared defining 500-ft shoreline segments for the study area. The study area was partitioned into five sections (Figure 2) for stratified random selection of 500-ft shoreline segments for the reconnaissance survey as follows:

- South River (SR) – the northwest portion of Lake Jackson that includes the South River embayment upstream of its confluence with the Alcovy River embayment and the junction of Butts, Newton, and Jasper Counties; this section also includes the Yellow River embayment.
- Alcovy River (AR) – the northeast portion of Lake Jackson that includes the Alcovy River embayment upstream of its confluence with the South River embayment and the junction of Butts, Newton, and Jasper Counties;
- Tussahaw Creek (TC) – the Tussahaw Creek embayment of Lake Jackson on the western side of the reservoir;
- Mainstem reservoir (MR) – the mainstem pool of the reservoir from the confluence of the South River and Alcovy River embayments downstream to Lloyd Shoals Dam; and
- Tailrace Area (TR) – the Lloyd Shoals tailrace area extending downstream to and including Ocmulgee River Park.

A total of 106 shoreline segments, or sites, were initially selected for the reconnaissance survey. Twenty-five sites were selected in each of the four reservoir sections (SR, AR, TC, MR) for a total of 100 on Lake Jackson. Six sites were selected in the tailrace area section (TR). The stratified random selection occurred as follows:

- One site was selected at each of the four project recreation facilities (Figure 2). Two facilities were in reservoir section MR (Lloyd Shoals Park and Jane Lofton Public Access Area) and two were in the tailrace section TR (Tailrace Fishing Pier and Ocmulgee River Park).
- The remaining survey sites were randomly selected to total 25 sites in each reservoir section and 6 sites in the tailrace area (TR), three on each side of the river.

A few additional reservoir sites were randomly selected in advance of the field survey for use as alternates in case boating access was precluded in shallow areas of the tributary embayments. Four alternate sites were used, including one extra site in the Tussahaw Creek (TC) section, increasing to 107 the total number of surveyed sites.

The geographic coordinates of the midpoint of each selected shoreline site were determined and tabulated and mapped (Table 1).

2.1.2 FIELD SURVEY

The shoreline survey consisted of visual observation and assessment of each shoreline segment on August 1, 2019 (Lake Jackson) and August 15, 2019 (tailrace area) during dry weather and normal project operating conditions. Two survey teams of three investigators each assessed the reservoir sites by boat, with the exception of two sites in the upper reach of the Tussahaw Creek embayment (TC-13 and TC-14) that were too shallow to readily access. These sites were assessed using 2017-2018 aerial imagery available on Google Earth along with consideration of the observations and ratings from the nearest downstream sites (TC-15 and TC-12), which were all within the same expanse of forested riparian zone. In the tailrace area, sites on the western bank were assessed by boat and those on the eastern bank were assessed from land.

Survey teams completed the visual shoreline assessment using the field data form provided in the study plan. At each site, the survey team inventoried and rated the following shoreline attributes:

- Vegetative buffer zone condition;
- Adjacent land uses;
- Bank stability and vegetative protection;
- Shoreline structural stabilization practices (e.g., seawalls, riprap, seawalls with riprap);
- Potential causes of erosion (project related and non-project related); and
- Sources of littoral-zone fish cover.

The shoreline attributes were jointly rated by all members of the survey team. The inventory of existing shoreline structural stabilization practices included visual estimates of the proportional length of seawalls, riprap, combination of seawalls with riprap at the base, and any other forms of non-vegetated shoreline armoring. Proportional lengths of the various sources of fish cover/habitat available were visually estimated for each site. The completed survey forms in Appendix A define each of the various descriptions and ratings used to characterize the shoreline attributes. In addition, digital photographs were taken of survey sites (Appendix B).

2.2 SEDIMENT DEPOSITION AND SHORELINE TEMPORAL CHANGE ANALYSIS

Sediment transport and patterns of sediment deposition within Lake Jackson were analyzed based on existing watershed information and data for the upper Ocmulgee River basin and a reservoir shoreline temporal change analysis using available aerial photography. No bathymetry data were available for Lake Jackson. Objectives of the analysis were to characterize sources of sediment loading in the major tributary rivers upstream of the Project; assess temporal and spatial changes and trends in reservoir sedimentation patterns; describe the reservoir operations in use over the current license term; and assess how current reservoir management affects sediment deposition in Lake Jackson.

Review of existing information and data pertinent to sediment transport and deposition in the upstream watershed and sediment contaminants included the following sources:

- Metropolitan North Georgia Water Planning District Water Resource Management Plan (CH2M and Black & Veatch 2017) for the 15-county Metro Water District, which profiles the upper Ocmulgee River basin upstream of the Project including land use, impervious areas, impaired waterbodies, sedimentation, management issues, and water management action items.
- Middle Ocmulgee Regional Water Plan (Georgia Environmental Protection Division [GEPD] 2017a), developed as part of Georgia’s state-wide water planning process, which includes Lake Jackson. The plan characterizes current watershed conditions, impaired waterbodies, future water resource needs, and priority water management practices.
- GEPD, including total maximum daily load (TMDL) evaluations for numerous stream segments in the Ocmulgee River basin for sediment (GEPD 2007, 2017b), which assess known and suspected sources of sediment in upstream watersheds.
- Watershed assessments and watershed improvement plans for upper Ocmulgee River basin streams prepared by local governments, including the City of Atlanta’s South River Watershed Improvement Plan Update (BC/DHA 2019).

- Fish consumption guidelines for Georgia waters (Georgia Department of Natural Resources [GDNR] 2018).
- TMDLs for polychlorinated biphenyls (PCBs) (U.S. Environmental Protection Agency [EPA] 1998) and total mercury (EPA 2002) in fish tissue in Lake Jackson.

Spatial and temporal changes in shoreline conditions occurring since 1993, when the current license was issued, were qualitatively characterized using existing aerial photography of the study area. The aerial photography was examined to identify any trends in erosion and sedimentation patterns potentially related to various shoreline uses, sediment loading from upstream watersheds, or water level drawdowns for project operations and maintenance, and to describe any general changes evident in wetlands, riparian, and terrestrial habitats occurring within and adjacent to the project boundary.

Present shoreline conditions, as represented by aerial photography of the study area taken in October/November 2019, were compared to shoreline conditions occurring in the study area at 6- to 11-year intervals since issuance of the current license. The aerial photography review identified several sets of historical imagery dating to 1993, which varied in quality, scale, format, and season taken. Four sets of aerial imagery covering the entire study area were selected and obtained for use in the temporal change analysis, including:

- 1993 aerial photography taken by the U.S. Geological Survey (USGS); date not specified in the metadata.
- 1999 aerial photography taken by USGS; date not specified in the metadata.
- 2010 aerial photography taken July 11, 2010 by the U.S. Department of Agriculture (USDA) National Agricultural Imagery Program (NAIP).
- 2019 aerial photography taken October 23 and November 11, 2019 by USDA NAIP.

Six representative areas of the project shoreline were selected for aerial photography comparisons to characterize shorelines of the major tributary arms, shallow coves with known sediment accumulation, and the main body of the reservoir. The six areas included (Figure 1):

- South River embayment – in the vicinity of the Georgia Highway (Hwy) 36 bridge and downstream reach, Butts and Newton Counties.
- Yellow River embayment – in the vicinity of the Hwy 36 bridge and downstream reach, Newton County.

- Alcovy River embayment – upper reach in the vicinity of the Georgia FFA-FCCLA Center and Bear Creek Marina, Newton and Jasper Counties.
- Tussahaw Creek embayment – upper reach in the vicinity of the Hwy 36 bridge and Reasor's Landing marina, Butts County.
- Mainstem reservoir, middle – area between the confluence of the South River and Alcovy River embayments and the Tussahaw Creek embayment, Butts and Jasper Counties.
- Mainstem reservoir, dam – area near Lloyd Shoals Dam including Lloyd Shoals Park and Lakeview Marina, Butts and Jasper Counties.

Areas of significant sediment accumulation, aggradation, and/or new vegetation development visible in the aerial photography were characterized with respect to sedimentation trends.

2.3 Analysis of Existing Information and Data

The effects of continued project operation on shoreline erosion and sedimentation within the project boundary were evaluated using: (1) findings of the shoreline reconnaissance survey; (2) aerial photography review of spatial and temporal change in erosion and sedimentation occurring in representative shoreline areas and coves; and (3) operational data characterizing Lloyd Shoals daily maximum and minimum reservoir fluctuations during normal, dry, and wet inflow periods. Project related erosion was defined as erosion caused primarily by daily reservoir fluctuations or downstream flow fluctuations from project operation, or by shoreline activities at project recreation sites. Non-project related sources of erosion included flood flows, wind-driven wave action, stormwater run-off from steep terrain, loss of vegetation due to natural causes, and other factors not attributable to project operation.

A literature review was conducted on shoreline structural modifications associated with shoreline development, including seawalls/bulkheads, rock riprap, and combinations of seawalls with riprap at the base, and their effects on littoral-zone aquatic habitats as reflected in fish species composition, diversity, and abundance. The literature review included studies conducted at southeastern hydropower reservoirs in North and South Carolina (Barwick 2004) and Alabama (Purcell et al. 2013), and other relevant scientific literature dealing with shoreline structural stabilization practices.

In addition, a summary was provided of small dredging permits issued at the Project by Georgia Power under the current license and available information pertaining to each dredging event.

3.0 RESULTS

The Lloyd Shoals Project is in the Southern Outer Piedmont ecoregion. This ecoregion has low hills, major forest types of loblolly-shortleaf pine, underlying rocks of gneiss, schist and granite, fine sandy loam soils, and a deep, red clayey subsoil. The Lake Jackson shoreline is characterized by gently sloping topography in most areas. Since the Project was constructed in 1911 and due to its proximity to Atlanta, much of the shoreline in the southern and central portions of the reservoir has been developed for residential and commercial use. Many developed portions of the shoreline have structural stabilization practices in place, including riprap, seawalls, or seawalls with riprap at the base. Conversely, substantial stretches of undeveloped, forested shoreline occur along the Tussahaw Creek arm of the reservoir, west of Georgia Highway (Hwy) 36, and along the South River and Yellow River arms north of Hwy 36. Natural vegetative shoreline cover is prevalent along many of these shorelines.

The shorelines around Lake Jackson and in the Lloyd Shoals tailrace area exhibit low potential for erosion or other forms of instability due to vegetative cover and/or the use of shoreline structural stabilization practices. Sites with the greatest potential for shoreline erosion include public recreation access sites where shoreline activity may contribute to localized bank instability.

3.1 SHORELINE RECONNAISSANCE SURVEY

One hundred seven sites were assessed visually during the shoreline reconnaissance survey. The locations of these sites are shown in Figure 3 through Figure 7, and their geographic coordinates are listed in Table 1. Appendix A provides copies of the completed survey forms. Color photographs of sites are included in Appendix B. The following sections present the findings of the shoreline reconnaissance survey.

3.1.1 SHORELINE VEGETATIVE BUFFER ZONE CONDITION

Thirty-five shoreline sites, or 33 percent of the sites sampled, were characterized by natural vegetative buffer zone conditions (Table 2). Their buffer zones were heavily vegetated with less than 20 percent of the natural vegetation removed. Forty-four shoreline sites (41 percent) were characterized by landscaped buffer zones; that is, they were cleared of more than 50 percent of the natural vegetation or had the underbrush completely removed. Twenty-eight shoreline sites

(26 percent) had a mix of landscaped and natural vegetative buffer zone conditions; they were cleared up to 50 percent with some trees and understory remaining. Natural vegetative buffer zone conditions were most prevalent in the South River (SR sites), mainly upstream of Hwy 36 in both the South River and Yellow River embayments, the Tussahaw Creek embayment (TR sites), and the tailrace area (TR sites). Many of these sites had forested riparian zones. Sites with landscaped riparian zones were widely spread throughout the reservoir but most prevalent in the Mainstem Reservoir (MR sites) and Tussahaw Creek, reflecting the predominance of shoreline residential land uses in these sections. The landscaped-natural sites, which typically included some residential land uses, were most numerous in the Alcovy River (AR sites) section of the reservoir. The tailrace area included both natural and landscaped-natural shoreline vegetative buffer zone conditions.

3.1.2 Adjacent Land Uses

The most common shoreline land uses found adjacent to the reservoir included residential and forested. Residential accounted for 51 percent of adjacent land use observations, whereas forested accounted for 42 percent of adjacent land use. The only other adjacent land uses recorded included recreational/access and transportation. Recreational/access accounted for an additional 5 percent and transportation an additional 2 percent.

3.1.3 Bank Stability and Vegetative Protection

Figure 8 illustrates each shoreline site surveyed according to its bank stability and vegetative protection ratings and indicates which sites had shoreline stabilization practices in use within the 500-ft survey length. Eighty-eight of the 107 shoreline sites (82 percent) had stable banks and 14 (13 percent) had moderately stable banks, indicating small erosion potential at 95 percent of the sites (right-side quadrants in Figure 8). These sites exhibited low potential for future erosion problems due to a high degree of bank vegetative protection and/or the current use of shoreline structural stabilization practices, including seawalls and riprap. Of the 102 sites with stable or moderately stable banks, 41 (40 percent) had well-vegetated banks (70 to greater than 90 percent coverage) and 61 (60 percent) had banks with less than 70 percent vegetative cover. In the latter group (bottom-right quadrant), all but three of the sites were at least partially stabilized through the use of seawalls, riprap, or combinations thereof. Five sites (5 percent) had moderately unstable banks (left-side quadrants) and four of these were poorly vegetated, although three had some structural stabilization in place.

3.1.4 SHORELINE STRUCTURAL STABILIZATION PRACTICES

Sixty-nine of the 107 sites surveyed (64 percent) had some type of shoreline structural stabilization practice along the 500-ft survey length. Table 3 provides a breakdown by survey site. Shoreline stabilization practices were widespread but most concentrated in the Mainstem Reservoir, Alcovy River, and Tussahaw Creek, where 84 percent, 76 percent, and 73 percent of the sites, respectively, had stabilization present. These practices corresponded with those areas of the reservoir having the most residential lots. Forty-two of the 69 sites with stabilization practices (61 percent) had 75 percent or more of the total proportion of the shoreline length armored with shoreline stabilization.

Sixty-four percent of the sites with shoreline stabilization had seawalls, 49 percent had riprap, and 43 percent had a seawall with riprap at the base. Many sites had more than one type of stabilization in place. Boat ramps and a beach also were inventoried as shoreline stabilization but represented only a small fraction of the existing structures.

Of the 53,500 ft of representative shoreline assessed during the survey, approximately 46 percent (24,520 ft) had stabilization structures in place (Figure 9). The proportional lengths of the major stabilization types were 50 percent seawalls only, 28 percent seawalls with riprap at the base, and 21 percent riprap only; other types represented 1 percent. Forty-nine percent of the length of observed shoreline structural stabilization practices included the use of riprap, and this was likely underestimated due to water clarity and depth constraints for detecting riprap next to some seawalls. The Shoreline Management Guidelines for Lake Jackson (Georgia Power 2015) require the placement of riprap along the base of all new seawalls to reduce undermining and restore shoreline aquatic habitat.

3.1.5 POTENTIAL SOURCES OF EROSION

The most common potential sources of shoreline erosion inventoried during the survey were residential landscaping and wave action from watercraft or wind, identified at 54 and 26 reservoir sites, respectively (Table 4). Both residential landscaping and wave action are non-project related causes of erosion. Residential landscaping as a potential source of erosion was identified most frequently in the Mainstem Reservoir and Tussahaw Creek sections. Wave action from watercraft or wind was identified most frequently in the Alcovy River, followed by the South River and Mainstem Reservoir.

Reservoir fluctuations related to project operations were identified as a potential source of erosion at 12 sites: AR-12, AR-15, AR-16, MR-02, MR-04, MR-06, MR-07, MR-12, MR-13, MR-17, MR-22, and TC-18. However, wave action from watercraft and wind was also a potential source at six of the sites, making it difficult to distinguish between project and non-project related sources of erosion at these sites. Site characteristics weighed in distinguishing between reservoir fluctuations and wave action from watercraft and wind included any patterns of erosion or whether it was distributed uniformly across the site, wind exposure, proximity to the main channel, and location with respect to boating access and traffic.

Of the 12 sites potentially influenced by reservoir fluctuations, the three Alcovy River sites were along shorelines classified as landscaped-natural. Site AR-12 had a stable bank while sites AR-15 and AR-16 had moderately stable banks. All three sites had a portion of the bank fortified by shoreline structural stabilization. The sites were all located in residential areas more subject to boat-induced wave action. The eight Mainstem Reservoir sites were along shorelines with landscaped, landscaped-natural, and natural buffer zones. All the sites had moderately stable or stable banks, except for site MR-06, which had moderately unstable banks. MR-06 was along a main channel bank more exposed to wind and boat-generated wave action. Sites MR-2, MR-13, MR-17, and MR-22 had installed shoreline stabilization features. Site TC-18 was on the main channel of Tussahaw Creek along a point subject to wind and boat wave action.

The six sites classified as having moderately unstable banks (AR-21, AR-23, SR-25, MR-02, MR-06, and TR-01) were the sites most susceptible to active shoreline erosion (Table 2; Figure 8). Moderately unstable banks were defined as having 30 to 70 percent of the shoreline length affected by erosion or slumping. The potential sources of erosion identified at these sites were wave action from watercraft or wind (five sites), residential landscapes (three sites), reservoir fluctuations (two sites), stormwater runoff (one site), lack of buffer vegetation (one site), and spillway releases (one site). None of these sites were next to project recreation facilities. The two sites with project related reservoir fluctuations as a potential cause also were potentially influenced by non-project related wave action from watercraft or wind. The six sites are described further below.

- Site AR-21 was along a landscaped lot with forested lands adjacent and no shoreline structural stabilization practices. Potential sources of active erosion were residential landscape, wave action from watercraft/wind, and stormwater runoff.

- Site AR-23 was along a landscaped-natural lot with residential lands and recreational/boat access adjacent. Ten percent of the shoreline was armored by riprap and another 5 percent by seawall. The potential source of active erosion was wave action from watercraft/wind.
- Site SR-25 was along a landscaped-natural lot with residential land adjacent. The shoreline was 100 percent stabilized by a seawall and a seawall with riprap at the base. Potential sources of active erosion included residential landscape, lack of buffer vegetation, and wave action from watercraft/wind.
- Site MR-02 was along a landscaped-natural lot with residential and forested land adjacent. The site contained a seawall along 50 percent of the shoreline and riprap along 5 percent. Potential sources of active erosion included residential landscape, reservoir fluctuations, and wave action from watercraft/wind.
- Site MR-06 was along a natural lot with forested lands adjacent and no shoreline structural stabilization practices. Potential sources of active erosion included reservoir fluctuations and wave action from watercraft/wind.
- Site TR-01 was along a landscaped-natural lot with a road and project dam facilities adjacent. There were no structural shoreline stabilization practices along this shoreline. Potentials sources of active shoreline erosion included spillway releases during high flow periods.

3.1.6 LITTORAL-ZONE FISH COVER

A variety of natural and man-made habitat features were inventoried as potential sources of littoral zone fish cover within a distance of 50 ft of the shoreline (Table 5). The most commonly observed sources of littoral zone fish cover, in descending frequency of observation, were overhanging vegetation, docks/piers/boatslips, large woody debris, riprap, and bedrock/boulders. Emergent vegetation, standing timber, and submersed vegetation were also present at sites around the reservoir; however, they represented a smaller proportion of available littoral fish habitat.

Overhanging vegetation was present at natural, landscaped-natural, and landscaped sites throughout the reservoir. Shorelines with larger proportions of overhanging vegetation were most common in the upper reaches of the South River and Tussahaw Creek embayments and in the tailrace area, where natural shoreline vegetative buffer zone conditions were most common. Of the 35 shoreline sites identified as having natural vegetative buffer zone conditions, all had overhanging vegetation as a source of littoral zone fish cover. Of the 28 sites identified as having landscaped-natural shoreline conditions, 24 sites (86 percent) had overhanging vegetation as a source of littoral zone fish cover. Of the 43 sites identified as having landscaped shoreline conditions, 29 sites (67 percent) had some overhanging vegetation as a source of littoral zone fish cover.

Docks, piers, and boatslips/boathouses were observed at landscaped-natural and landscaped sites, typically in the Mainstem Reservoir, Alcovy River, Tussahaw Creek, and lower South River, where residential lots are widespread. Of the 28 sites identified as having landscaped-natural shoreline conditions, 25 (89 percent) had docks, piers, or boatslips/boathouses as a source of littoral zone fish cover. Of the 44 sites identified as having landscaped shoreline conditions, 28 (67 percent) had docks, piers, or boatslips/boathouses as a source of littoral zone fish cover. Few of these man-made structures were observed in the less developed areas of the reservoir. Only three of the 35 sites (9 percent) identified as having a natural vegetative buffer zone had a dock, pier, or boatslip/boathouse.

Large woody debris was widespread as a source of fish cover at sites with natural shoreline vegetation. Of the 35 sites identified as having natural shoreline vegetative buffer zone conditions, 34 (97 percent) had large woody debris as a source of littoral zone fish cover. Woody debris was also common at sites with landscaped-natural (43 percent) and landscaped (39 percent) buffer zone conditions. Bedrock and boulders were predominately observed as a source of fish cover in the Alcovy River, Mainstem Reservoir, and the tailrace area. Emergent vegetation was most commonly observed in the South River, where sediment deposition has been greater than other areas of the reservoir. Submersed vegetation was observed at only two sites, one in the South River and one in the Mainstem Reservoir.

3.1.7 Project Recreation Sites

Of the five shoreline sites surveyed at Georgia Power's four project recreation facilities (MR-11, MR-12, TR-02, TR-03, TR-05), all were rated as stable due either to the presence of a high degree of bank vegetative protection, the use of riprap, or bedrock and boulders (Tables 2 and 5). Site MR-12 at Lloyd Shoals Park had a landscaped vegetative buffer zone condition and riprap along the entire length. Site MR-11 at Jane Lofton Public Access Area was characterized by a natural buffer zone condition and greater than 90 percent bank vegetative protection. Sites TR-02 and TR-03 along the entire waterfront of Ocmulgee River Park also had a natural buffer zone condition and greater than 90 percent bank vegetative protection. Site TR-05 included the Tailrace Fishing Pier. It had a mixed landscaped-natural buffer zone condition and less than 50 percent bank vegetative protection but was stabilized by a preponderance of bedrock and boulders along the shoreline. Although potential sources of erosion inventoried at the project recreation sites included recreational access, adjacent roadways, impervious surfaces, and project generation (tailrace only), no active erosion problem areas were observed.

3.2 Sediment Transport and Deposition Characteristics of the Watershed

The upper Ocmulgee River basin upstream of Lloyd Shoals Dam covers an area of 1,400 square miles (sq mi). About 70 percent of this area (982 sq mi) drains southeastern and eastern metropolitan Atlanta, including portions of Clayton, DeKalb, Fulton, Gwinnett, Henry, and Rockdale Counties (CH2M and Black & Veatch 2017). This area is within the 15-county Metropolitan North Georgia Water Planning District (Metro Water District) centered on metro Atlanta (Figure 10). The watershed is highly developed (Figure 11). Larger cities within the upper Ocmulgee River basin upstream of the Project include Atlanta, Conyers, Lawrenceville, Snellville, Stockbridge, and McDonough. About 100 miles of interstate highway corridors traverse this portion of the upper basin. The South River, Yellow River, Alcovy River, and Tussahaw Creek are the main tributaries draining the Metro Water District. The South River watershed is the largest tributary, covering approximately 553 sq mi (BC/DHA 2019).

Lake Jackson is just outside and downstream of the Metro Water District. The main tributaries converge at Lake Jackson to form the Ocmulgee River. As such, land use and watershed conditions within the Metro Water District substantially affect sediment transport and deposition within Lake Jackson. Watershed imperviousness is high throughout much of the upstream basin and exceeds thresholds considered detrimental to stream stability, water quality, aquatic habitat, and biotic integrity (CH2M and Black & Veatch 2017). Within the Metro Water District, 406 stream miles or 80 percent of the 506 stream miles assessed in the upper Ocmulgee River basin are not supporting their designated uses for one or more parameters. Seventy percent (354 miles) do not meet water quality standards for fecal coliform bacteria as a result of nonpoint source pollution and urban runoff, which carries sediment into streams and increases stream-bank erosion. Twenty-nine percent (146 miles) do not meet water quality standards for biota, which is indicative of high sediment loads in streams degrading aquatic habitat for benthic macroinvertebrates and fish (CH2M and Black & Veatch 2017).

The watershed upstream of the Project also drains about 418 sq mi of the upper end of the Middle Ocmulgee Water Planning Region, which begins downstream of the Metro Water District and includes Butts, Newton, and Jasper Counties around Lake Jackson, and nine counties downstream of the Project (Figure 10) (GEPD 2017a). Land use transitions from suburban near the Metro Water District to rural and residential surrounding Lake Jackson. The lower segments of the South River, Yellow River, and Tussahaw Creek, before they enter Lake Jackson, do not meet water quality standards due to fecal coliform bacteria from nonpoint sources and urban runoff (GEPD 2018). Tussahaw Creek also is impaired for biota due to sedimentation.

3.2.1 Sediment Sources

Sediment sources upstream of Lake Jackson include nonpoint source runoff, soil erosion from construction sites, other regulated stormwater discharges, and streambank erosion due to accelerated streamflow velocities from impervious cover associated with urbanization. GEPD (2007, 2017b) completed Total Maximum Daily Load (TMDL) evaluations for 81 stream segments in the Ocmulgee River basin listed as not meeting water quality standards for biota (fish or macroinvertebrates) due to sedimentation. The segments include 23 stream segments totaling 145 miles in the watershed upstream of Lake Jackson (GEPD 2002a, 2007, 2017b). Sediment-impaired segments of the South River and three direct tributaries (Intrenchment Creek, Snapfinger Creek, and Snapping Shoals Creek) total 50 miles. Most of the other segments are in headwater streams of the South River, Yellow River, and Tussahaw Creek.

GEPD (2007, 2017b) assessed known and suspected sources of sediment in the watershed upstream of Lake Jackson, including point and nonpoint sources. Stormwater runoff from roads and developed urban areas were identified as major sources of erosion and sedimentation. Increased imperviousness from urbanization increases the volume of runoff entering the streams, which in turn causes stream erosion (widening and down-cutting), loss of riparian vegetative cover, and the transport of sediment downstream. Based on small differences in modeled sediment yields between biologically impaired (due to sedimentation) and least-impacted watersheds, GEPD (2007, 2017b) concluded that most of the sediment found in Ocmulgee River basin streams may be legacy sediment resulting from past land use practices. Thus, maintaining sediment loads at or below current levels may allow habitat to recover in many streams over time as sediment is transported downstream.

GEPD (2017b) recommends management practices to help maintain or reduce sediment loads in the Ocmulgee River basin upstream of the Project that include:

- Complying with National Pollutant Discharge Elimination System (NPDES) permit levels and requirements for regulated stormwater and wastewater discharges;
- Implementing water quality management practices recommended in regional water plans, such as low impact development, reducing runoff from impervious surfaces, and watershed improvement/restoration projects; applicable regional plans include the Metro Water District's Water Resource Management Plan (CH2M and Black & Veatch 2017), the City of Atlanta's South River Watershed Improvement Plan (BC/DHA 2019), and the Middle Ocmulgee Regional Water Plan (GEPD 2017a);
- Implementing best manage practices (BMPs) for forestry (Georgia Forestry Commission 2009) and agriculture (Georgia Soil and Water Conservation Commission [GSWCC] 2013);
- Implementing individual Erosion and Sedimentation Control Plans for land-disturbing activities and applying the Manual for Erosion and Sediment Control in Georgia (Green Book) (GSWCC 2016); and
- Implementing the Georgia Stormwater Management Manual (Blue Book) (Atlanta Regional Commission 2016) to facilitate prevention and mitigation of stream bank erosion due to increased stream flow and velocities caused by urban runoff through structural stormwater BMP installation.

3.2.2 Sediment Contaminants

GEPD (2018) lists four segments of the South River upstream of Lake Jackson in the Metro Water District as not supporting their designated Fishing use due to elevated concentrations of legacy polychlorinated biphenyls (PCBs) detected in fish tissue (Fish Consumption Guidelines). These four segments total 51 stream miles. A TMDL was completed for PCBs in the South River (GEPD 2002b). Although the specific sources of PCB in the watershed are unknown, the PCB contamination has been attributed to urban runoff and combined sewer overflows. The use of PCBs was banned in the U.S. in the late 1970s, loadings have been removed or reduced to zero, and levels are decreasing in the water column, sediments, and fish tissues over time. The current fish consumption guidelines (GDNR 2018) for the South River recommend limiting consumption of Bluegill Sunfish and Snail Bullhead to one meal per week based on fish tested from Panola Shoals in Dekalb County and limiting consumption of Largemouth Bass to one meal per week based on fish tested from Snapping Shoals in Henry/Newton County.

GEPD (2018) lists Lake Jackson as not supporting its designated Recreation use due to elevated concentrations of legacy PCBs detected in fish tissue, attributed to urban runoff and nonpoint source pollution. A TMDL was completed for PCBs in Lake Jackson (EPA 1998). Since the ban of PCBs in the late 1970's, their levels are declining and will continue to decline. Based on the TMDL analysis, the detection of PCBs in fish tissue at Lake Jackson was unrelated to Lloyd Shoals project operations. For Lake Jackson, the reduction has been conservatively estimated at 5 percent per year (EPA 1998). There is no longer a fish consumption advisory for Lake Jackson or the South River at Georgia Hwy 36 (within the project boundary) due to PCBs (GDNR 2018), reflecting the declining trend.

A fish consumption advisory remains for Lake Jackson due to mercury for limiting consumption of larger size classes of Largemouth Bass to one meal per week (GDNR 2018). EPA (2002) developed a TMDL for mercury in Lake Jackson. The predominant source of mercury loading to the lake is air deposition, which is unrelated to Lloyd Shoals project operations. Current fish consumption advisories for Largemouth Bass and other sport fishes due to mercury are widespread in Georgia reservoirs (GDNR 2018).

3.2.3 Dredging Activities within the Project Boundary

Georgia Power is authorized through a license amendment issued by FERC on May 11, 2000, to permit dredging of up to 500 cubic yards of sediment per lot under a Small Dredging Permit Program. The focus of the program is to issue permits for minor activities, including the installation and repair of bulkheads and boat docks, in accordance with U.S. Army Corps of Engineers (USACE) programmatic general permits and state and local regulations. Greater amounts of proposed dredging are outside the scope of the program and require approval from USACE, FERC, and additional agencies. Georgia Power's Shoreline Management Guidelines (Georgia Power 2015) and Lake Jackson shoreline management website inform property owners how to obtain a permit for small dredging activities.

Permit applications submitted to Georgia Power must provide a dredging plan for review and approval before work begins. The plan must include an estimate of the volume of material to be removed. The sole purpose for dredging is to remove silt or sedimentation that has accumulated over time. Removal of the original lake or river bottom is prohibited. In addition, any dredging or filling of wetlands or any dredging that would impact threatened and endangered species or historic properties is prohibited. The dredged material is to be disposed of in an upland area so as to avoid any re-entry of the material into the lake. Georgia Power is required to file an annual report with FERC listing the dredging permits issued for quantities between 25 and 500 cubic yards.

Georgia Power issued 29 permits for small dredging activities with the Lloyd Shoals project boundary from 2006 through 2018, as listed in Table 6. The quantity of dredged material by permit ranged from 3.5 to 500 cubic yards and averaged about 142 cubic yards. The areas of Lake Jackson with the greatest amount of small dredging activities were the South River embayment, with 11 permits totaling 1,885 cubic yards, and the Tussahaw Creek embayment, with 10 permits totaling 921 cubic yards. Dredging occurred within the South River from an area just upstream of the Hwy 36 bridge downstream to the confluence with the Alcovy Reservoir (Figure 1). Most of the small dredging activities in Tussahaw Creek were in the upper reach between Barnetts Bridge Road and Hwy 36. Three permits totaling 100 cubic yards were issued for dredging in the Alcovy River embayment upstream of Hwy 212. Five permits were issued for the mainstem reservoir for dredging a total of 784 cubic yards of sediment.

Information for small dredging permits issued prior to 2006 was not as detailed with respect to the areas of Lake Jackson dredged. For the six years 1997, 2000-2003, and 2005, a total of 20 permits were issued for small dredging activities totaling 7,113 cubic yards. The quantity of dredged material by permit ranged from 60 to 500 cubic yards and averaged about 348 cubic yards.

3.3 SHORELINE TEMPORAL CHANGE ANALYSIS

Figure 12 provides an index map of the six areas of Lake Jackson evaluated for temporal change in shoreline conditions. The predominant land uses in the project area are low-density residential along the shorelines, deciduous forest, evergreen forest, open space, and forested wetlands. Clusters of low-intensity urban uses are generally found along the northwestern edge of the Project, along the South and Yellow Rivers in Henry and Newton counties. Lands used for row crops or pasture are also found throughout the project area. Based on the aerial photography comparisons described below, there has been little overall change in the predominant land uses surrounding the Project since 1993.

3.3.1 MAINSTEM RESERVOIR – DAM

Figure 13 and Figure 14 compare the 1993, 1999, 2010, and 2019 aerial imagery of the mainstem reservoir near the dam. The shoreline configuration within this reach has shown little to no change in overall configuration since 1993. The area has experienced some additional land clearing in upland areas outside of the project boundary, namely a tract of land outside of the project boundary in the northeast corner of the map area. There has also been an increase in the number of residential homes and docks constructed in the area. Of the seven shoreline survey sites in this area, five were landscaped, one landscaped-natural, and one natural. Despite the shoreline development in the area, overall shoreline configuration and stability have been maintained. This is in part due to effective structural stabilization practices, as inventoried during the shoreline survey. Only site MR-13 had less than 75 percent of its shoreline fortified with shoreline stabilization; it had 15 percent stabilized. Section MR-09 was the only section in the area noted as having any active erosion.

3.3.2 MAINSTEM RESERVOIR – MIDDLE

Figure 15 and Figure 16 compare the 1993, 1999, 2010, and 2019 aerial imagery of the mainstem reservoir toward the middle of Lake Jackson. Despite significant residential construction in this reach, the shoreline configuration has remained predominantly unchanged since 1993. Most of the home construction along both the eastern and western banks appears to have occurred between 1999 and 2010. Land clearing in upland areas in this reach appears to have been solely for residential construction with no signs of any logging operations. Dock/pier and shoreline stabilization construction has coincided with the residential construction. Of the five shoreline survey sites in this area, four were landscaped and one was landscaped-natural. All of the sites had greater than 50 percent shoreline stabilization; three had greater than 90 percent. One site, MR-02, had moderately unstable banks. Being along the mainstem shoreline, the site was exposed to significant wave action from watercraft and wind. Due to the use of shoreline structural stabilization practices, there was little evidence of shoreline change since 1993.

3.3.3 TUSSAHAW CREEK EMBAYMENT

Figure 17 and Figure 18 compare the 1993, 1999, 2010, and 2019 aerial imagery of the Tussahaw Creek embayment. Shoreline and sedimentation in Tussahaw Creek have been moderately dynamic since 1993. Residential construction along the southern edge and portions of the northern edge have increased. In addition, there appears to have been some logging operations in upland forests on the northern side of the embayment. Any land clearing on the southern portion appears to have been solely for residential construction. Sedimentation and the formation of sandbars and islands have occurred in the upper portion of Tussahaw Creek near the Hwy 36 bridge crossing. The area appears to have been dynamic with deposition and subsequent erosion of deposited sediments during high flow events reconfiguring shoreline and sandbar/island areas in the upstream portion. Sediment input to the embayment changed significantly with the completion of Tussahaw Reservoir in 2007, located about 3.5 miles upstream of the project boundary on Tussahaw Creek. The 1,466-acre drinking water reservoir was constructed by Henry County Water Authority. Although Tussahaw Reservoir does not substantially affect inflows to Lake Jackson during normal and wet years, sediment deposition within the reservoir reduces sediment loads from the upstream watershed that previously entered Lake Jackson. Of the six shoreline survey sites within the reach, three were landscaped, one was landscaped-natural, and two were natural. All of the sites had moderately stable or stable banks. Three had stabilization practices extending along 40 to 100 percent of the shoreline length.

3.3.4 SOUTH RIVER EMBAYMENT

Figure 19 and Figure 20 compare the 1993, 1999, 2010, and 2019 aerial imagery of the South River embayment. This section, which includes the Hwy 36 bridge crossing, represents one of the more dynamic reaches within the project boundary, as the configuration changes from a more riverine to lacustrine system. This transition results in more prevalent changes in natural sediment transport processes in the reach. Similar to other areas of the lake, residential construction has increased since 1993 but not to the same degree as other areas of the lake such as the mainstem reservoir and the Tussahaw Creek embayment. Logging or land clearing activities in upland forests have not been prevalent in this area. Of the two shoreline survey sites within this reach, one was landscaped-natural and the other natural. Neither had any shoreline structural stabilization practices. Both banks were rated as stable with substantial bank vegetative protection. Although “hard-bank” sections of the shoreline in this reach have remained stable, sedimentation along points, islands, and sandbars is prevalent. Ongoing sediment transport and deposition processes are evident visually by the formation of new islands and the reshaping of point-bars in the reservoir. This is a result of the high sediment load received by the South River due to upstream development (Section 3.2.1).

3.3.5 Yellow River Embayment

Figure 21 and Figure 22 compare the 1993, 1999, 2010, and 2019 aerial imagery of the Yellow River embayment. This section, which extends from the Hwy 36 bridge crossing downstream toward the South River confluence, is a dynamic reach showing some signs of sediment deposition and scour as part of natural sediment transport processes. Similar to the South River embayment, sediment deposition appears to be focused along points, islands, and the mouths to backwater areas. The most apparent change in the area within the project boundary is some loss of standing trees in certain undeveloped backwater areas over time. Outside of the project boundary, residential construction was most prevalent between 1993 and 1999. A large tract of upland forest along the western bank appears to have been recently logged in the 2019 imagery. Three shoreline survey sites were located in this reach. Two were classified as natural and one as landscaped-natural. All of the sites had stable banks and none had any shoreline structural stabilization practices.

3.3.6 Alcovy River Embayment

Figure 23 and Figure 24 compare the 1993, 1999, 2010, and 2019 aerial imagery of the Alcovy River embayment. This section is in the upstream reach of the embayment. Similar to the South and Yellow River embayments, this section shows signs of sediment deposition as conditions change from a riverine to a lacustrine system. Sediment deposition is primarily focused in the upper portions of the reach near bends in the river channel. Deposition has resulted in the creation of sandbars and islands that appear to grow and shrink as natural sediment transport processes occur over time. The area has experienced increased residential construction over the time period, although not of the same magnitude as the Tussahaw Creek embayment. Homes along the shoreline were primarily built along the eastern shoreline. Uplands areas of the eastern side have remined primarily undisturbed aside from residential construction. The western side has agricultural fields in the upland boundaries. Only one survey section occurred in this area, AR-27. It was classified as natural with stable banks and had no shoreline stabilization practices.

3.4 Project Operations Relevant to Shoreline Erosion

Project operations have the potential to affect shoreline erosion and sedimentation through daily and seasonal reservoir fluctuations as well as discharge fluctuations to the tailrace area downstream of the dam. Georgia Power operates the Lloyd Shoals Project in a modified run-of-river mode for generation during peak power demand hours to meet electrical system demand. Water for generation at Lloyd Shoals Dam comes from precipitation in the Ocmulgee River basin upstream. There are no large dams reregulating streamflow upstream of the Project; thus, project inflows depend primarily on the timing, duration, and volume of precipitation. Inflows are stored for short periods of time, generally no longer than 24 hours, and then released through the generating turbines during peak power demand periods.

Discussions of normal, high-flow, and drought operations are found in the PAD (Georgia Power 2018) and the Lloyd Shoals Operations Primer in Appendix D of the PAD. The Operations Primer provides 35 figures depicting project operations under the current FERC license.

3.4.1 Reservoir Fluctuations

During normal operations, Georgia Power operates the Lloyd Shoals Project to maintain reservoir elevations between approximately 530 and 527 ft PD, excluding planned drawdowns and drought. The reservoir rises slightly as inflow is temporarily stored during hours when the region is not in its peak power demand period ("off-peak" hours). As power demand increases into the peak power demand period, Lloyd Shoals is operated to release water through the powerhouse turbines and produce energy from the plant generators. This cycle repeats daily and varies seasonally with peak power demand periods.

For the years 1997 through 2016, daily reservoir fluctuations for Lake Jackson were less than 1.5 ft 98 percent of the time and less than 1.0 ft 95 percent of the time. Since the installation of the Obermeyer gate system in 2012, daily reservoir fluctuations were reduced for 2013-2015 (Figure 25).

Prior to the installation of the Obermeyer gates, flashboards on top of the spillway were designed to trip in order to release the water during high inflow periods when the reservoir was above 530 ft PD and inflows exceeded the hydraulic capacity of the powerhouse. The water level would then have to fall 5 ft below the crest of the spillway at elevation 525 ft PD for the flashboards to be safely reset. With the Obermeyer gates, the operators now have more control over the water levels in the reservoir during high inflows. The water releases are controlled to match inflows, resulting in less fluctuation of the reservoir during high inflows.

Prior to 2012, to prevent spilling water during the high inflows normally experienced in the winter and spring months, Georgia Power conducted annual seasonal drawdowns of Lake Jackson of about 8 ft from full pool. During November and December, the reservoir was gradually drawn down and was held at a low elevation of 522 ft in January and February. During March and April, the reservoir was allowed to refill and was operated at a higher level from May through October. Because the Obermeyer gates provide greater control over the reservoir elevation, it is no longer necessary to hold the lake down during November through April. This practice ended once the Obermeyers began operation in 2012.

During drought there may be a sustained drawdown of the lake as Georgia Power supplements river flows downstream; however, during this time there are typically no daily elevation fluctuations because there are no daily peaks during low-flow periods. During maintenance drawdowns, daily fluctuations do still occur, just at a lower elevation level. For both types of drawdowns, the lake elevation is lowered in a very slow manner, which does not contribute to additional sedimentation, so only daily fluctuations are considered a source of potential project-related impacts.

In summary, Lake Jackson is normally operated between 530 and 527 ft PD and daily reservoir fluctuations are less than 1.5 ft 98 percent of the time. These daily fluctuations were considered in inventorying potential sources of erosion (project related and non-project related) during the shoreline reconnaissance survey (Section 3.1.5).

3.4.2 PROJECT DISCHARGE

Lloyd Shoals Dam discharges directly into the Ocmulgee River. Generation flows typically vary between the minimum flow requirement of 400 cubic feet per second (cfs) and the maximum powerhouse hydraulic capacity of 3,720 cfs. Average annual inflow for Lake Jackson is about 1,747 cfs. When the plant is not operating to generate peaking energy, the Project releases a continuous minimum flow of 400 cfs, or inflow, whichever is less, through the turbines into the Ocmulgee River downstream for the protection and enhancement of fish and wildlife resources, as required by Article 402 of the current license.

During low-flow periods or extended drought, inflows at Lloyd Shoals Dam often fall below the 400-cfs minimum flow requirement. On these occasions, Georgia Power supplements flows in the river downstream with a 250-cfs minimum release to ensure adequate stream flows for aquatic life and other downstream uses, such as the Butts County and Macon Water Authority water supply intakes. In practice, no flows less than 250 cfs have been released from the Project in recent years even when inflow has been less than 250 cfs. When the Project discharges 250 cfs it is at a steady rate and does not result in daily fluctuations in the reservoir or tailrace. For the period 1997-2016, daily average discharge from the Project exceeded 250 cfs on 98 percent of the days, 400 cfs on 84 percent of the days, and 1,000 cfs 50 percent of the days (Georgia Power 2018)

The potential for shoreline erosion in the Lloyd Shoals tailrace area is moderated by the prevalence of bedrock and boulders, armoring provided by riprap closer to the tailrace, and the stream bank and riparian zone protection provided by forested vegetation along both sides of the river.

3.5 Relationship between Shoreline Structural Stabilization Practices and Littoral Zone Fish Habitat

The shoreline reconnaissance survey documented the use of structural practices, mainly prevalent in the Mainstem Reservoir, Alcovy River embayment, and Tussahaw Creek embayment, for stabilizing shoreline modified by residential or other development. The most common types of structural stabilization practices in place were seawalls, seawalls with riprap at the base, and riprap rock (Figure 9). These hardened structures protect the physical integrity of the shoreline while minimizing erosion, sedimentation, and loss of property occurring as a result of wave action from wind and watercraft, residential landscapes, water level fluctuations, or other sources of erosion. The following discussion reviews relevant scientific literature dealing with shoreline structural stabilization practices and their effects on littoral zone aquatic habitats.

3.5.1 Literature Review

Much of the research on the relationship between residential shoreline development in lakes and littoral zone fish habitat has been conducted in Wisconsin. To evaluate the effects of incremental shoreline habitat modification on littoral zone fish assemblages, Jennings et al. (1999) sampled fish in 17 Wisconsin lakes with extensive residential and recreational development. Study sites were randomly selected among three different habitat treatments defined by common shoreline management practices. The treatments included retaining walls (seawalls/bulkheads), rock riprap, and no structure. Sites with riprap shoreline contained greater fish species richness than either of the other habitat types, a finding consistent with riprap providing more complex habitat with interstitial spaces for cover and food production.

Seawall sites were the least variable in their depth and substrate characteristics and were more homogeneous as a group. The investigators concluded that when erosion control is a necessity at the scale of individual sites, riprap provides more beneficial littoral zone fish habitat than seawalls. However, they cautioned that when viewed at the scale of the entire lake, converting the entire shoreline to this one habitat type would reduce the overall habitat diversity available in the lake.

Jennings et al. (2003) measured differences in littoral zone habitat with different amounts of residential development and different patterns of watershed land use at 34 northern Wisconsin lakes. Littoral zone habitat measurements were taken in each lake and the degree to which interstitial spaces of coarse substrates were embedded with fine particles was visually estimated. Analysis of covariance among habitat characteristics and development intensity at different spatial scales (residential properties, entire lakeshore, the watershed) found a greater degree of substrate embeddedness associated with developed shoreline sites and with greater density of residential development around the lake. The highest levels of embeddedness were observed at developed sites in lakes with high residential density. This form of habitat modification reduces fish habitat diversity by eliminating interstitial spaces for use as cover and by a variety of food organisms. The quantity of large woody debris as a source of littoral zone fish habitat also was reduced at developed sites and in lakes with higher density of residential shoreline development.

Trial et al. (2001) evaluated modifications associated with shoreline development with regard to effects on littoral fish habitat in a Texas lake. The more open-water habitats associated with non-vegetated shorelines and walled habitats (seawalls) had the fewest fish species (including the fewest sport fish species), lowest species diversity, and weakest seasonal dynamics. Both vegetated and riprapped shoreline habitats contained the greatest number of fish species and highest species diversity. Thus, the study concluded that riprap might be considered an acceptable alternative for use by landowners for stabilization of developed shorelines instead of seawalls, which had fewer characteristic species.

In the southeastern U.S., Barwick (2004) examined the relationship between complex shoreline physical structure and littoral fish habitat in three hydropower reservoirs in North Carolina and

South Carolina. The study assessed whether fish diversity and abundance in littoral habitat created by residential development in the riparian zone differed from that in habitat associated with undeveloped riparian zones. Fish sampling was conducted in residentially developed habitat stabilized by riprap, coarse woody debris habitat containing wind-felled trees and large branches, and relatively undisturbed littoral habitats containing no riprap, piers, coarse woody debris, and little or no additional structure. Fish species richness and abundance of the dominant sport fishes (sunfish and bass) were higher in coarse woody debris and riprapped habitats than in undisturbed littoral habitats. These responses appeared to be related to the greater habitat complexity of these habitat types making them more desirable to littoral zone fish.

Purcell et al. (2013) conducted a study on Lake Martin, a hydropower reservoir on the Tallapoosa River in Alabama, to assess fish abundance and species composition associated with four different shoreline development types. Fish sampling was conducted at replicate sites representing undeveloped shoreline, developed shoreline with seawalls (bulkhead), developed shoreline with riprap, and developed shoreline with both seawalls and riprap at the bottom of the seawalls. Sampling also included larval fish, aquatic macroinvertebrates, zooplankton, and selected water quality parameters. No differences were found among habitat types in water quality and lower trophic levels; however, fish abundance and community structure differed significantly. Fish abundance was lowest at the seawall-only sites relative to any of the sites with riprap or the undeveloped sites. Fish abundance was highest at sites containing riprap, while species richness and diversity tended to be highest at the undeveloped sites versus any of the developed sites. The study concluded that fish abundance can be enhanced by providing some degree of structure with interstitial spaces, such as riprap, as a component of shoreline structural stabilization practices.

3.5.2 Shoreline Management

Relevant scientific literature dealing with the effects of shoreline structural stabilization practices on littoral fish habitat indicates an overall positive relationship between greater habitat complexity of riprapped shoreline habitats and higher species richness, diversity, and abundance of littoral zone fish assemblages, including important sport fishes. When erosion control is necessary at a developed shoreline site, available evidence supports the use of riprap, either alone or in front of seawalls, as providing more beneficial fish habitat than the use of seawalls alone without accompanying structural or non-structural practices.

Potential factors supporting the use of seawalls without riprap may include the integration of other structural or non-structural practices which increase habitat complexity of sources of fish cover, such as docks, piers, boathouses, artificial fish attractors, or revegetation of the shoreline with native riparian vegetation. Based on the findings of the shoreline reconnaissance survey, 49 percent of the length of existing shoreline structural stabilization practices on Lake Jackson incorporate the use of riprap (Figure 9), although this was probably an underestimate because water depth and transparency inhibited the visual observation of riprap along some seawalls. Of the 28 sites surveyed having 50 percent or more of the shoreline length stabilized by a seawall only (Table 3), 26 of these sites (93 percent) had a dock, pier, boathouse, or boatslip as potential littoral zone fish cover, and many also had some overhanging vegetation (Table 5).

Georgia Power proposes to continue to manage the Lake Jackson shoreline in accordance with its Shoreline Management Guidelines (Georgia Power 2015) to ensure compliance with the FERC license and other applicable federal and state laws and regulations. Georgia Power leases 606 residential lots around the project and maintains another 1,231 license agreements through which residents on privately-owned lots may access the shoreline. The Shoreline Management Guidelines include general permitting steps applicable to all Georgia Power lakes as well as specific requirements for Lake Jackson. Landowners must first obtain a valid lease agreement (Georgia Power lots) or access lease agreement (deeded lots) and a Georgia Power permit before beginning any construction, renovation, clearing, tree removal, or grading on Georgia Power land as well as dredging activities (see Section 3.2.3). The guidelines specify that all new construction (dwellings and additions) should be above the project boundary. They also provide specifications for constructing outbuildings, gazebos/picnic shelters/decks, seawalls, ramps (only maintenance and renovation), wharves, boatslips, boathouses, docks, and combinations of these features. The guidelines also include a residential shoreline use section with information about protecting and enhancing the scenic, recreational, and environmental values of the reservoir, as well as maintaining compatibility with overall reservoir project recreational use.

The permit issued for the construction of new seawalls on Lake Jackson requires proper erosion and sedimentation controls, and placing riprap along the base of all seawalls in amounts recommended by the guidelines to reinforce the structures and restore shoreline aquatic habitat. Other requirements of the permit minimize shoreline disturbance from tree removal and mechanical clearing to protect a 25-ft vegetative buffer surrounding the lake. In addition, seawalls, shoreline structures, and any other land disturbance permit requests within the project boundary are also permitted in coordination with applicable USACE programmatic general permits and state and local regulations.

4.0 SUMMARY

4.1 SHORELINE RECONNAISSANCE SURVEY

A shoreline reconnaissance survey of Lake Jackson and the Lloyd Shoals tailrace area in August 2019 found the vast majority of sites to have stable or moderately stable banks. These sites exhibited a high degree of bank vegetative protection and/or the current use of shoreline structural stabilization practices, including seawalls, seawalls with riprap at the base, and riprap. The most commonly inventoried potential sources of shoreline erosion were residential landscaping and wave action from watercraft/wind, at 53 percent and 26 percent of the reservoir sites, respectively. Reservoir fluctuations related to project operations were also among potential sources of erosion at several sites but nearly all had stable or moderately stable banks. Half of these sites were also affected by wave action from watercraft or wind. Only 5 percent of the surveyed sites had moderately unstable banks and all were influenced by wave action from watercraft or wind. None of these sites were associated with project recreation facilities or the project works.

Sixty-four percent of the surveyed sites had shoreline structural stabilization practices in place. The distribution of these sites corresponded with those areas of the reservoir having the most residential lots, including the Mainstem Reservoir, Alcovy River, and Tussahaw Creek. Forty-six percent of the shoreline length surveyed had structural stabilization in approximate proportions of 50 percent seawall, 28 percent seawalls with riprap at the base, and 21 percent riprap only. Forty-nine percent of the length of observed stabilization practices included the use of riprap.

The most commonly observed sources of littoral zone fish cover, in descending frequency of observation, were overhanging vegetation, docks/piers/boatslips/boathouses, large woody debris, riprap, and bedrock/boulders. Shorelines with larger proportions of overhanging vegetation were most common in the upper reaches of the South River and Tussahaw Creek embayments and in the tailrace area, where natural shoreline vegetative buffer zone conditions were most common. Docks, piers, and boatslips/boathouses were widespread in association with residential lots. Emergent vegetation was most commonly observed in the South River embayment, where sediment deposition has been greater than other areas of the reservoir.

4.2 Sediment Transport and Deposition Characteristics of the Watershed

The 1,400-sq mi watershed upstream of the Lloyd Shoals Project includes 982 sq mi of southeastern and eastern metropolitan Atlanta within the 15-county Metro Water District. The South River, Yellow River, Alcovy River, and Tussahaw Creek are the main tributaries draining the Metro Water District. They converge downstream at Lake Jackson to form the Ocmulgee River. Watershed imperviousness is high throughout much of the Metro Water District and 80 percent of the stream miles assessed do not support their designated uses for one or more parameters. Twenty-nine percent do not meet water quality standards for biota, indicative of high sediment loads degrading habitat for benthic macroinvertebrates and fish. TMDL evaluations for 23 biota-impaired stream segments totaling 145 miles in the watershed upstream of Lake Jackson identified stormwater runoff from roads and developed urban areas as major sources of erosion and sedimentation. Increased imperviousness from urbanization increases the volume of runoff entering streams, which in turn causes stream erosion and downstream transport of sediment.

Fifty-one miles of the South River upstream of Lake Jackson do not support their designated use due to elevated concentrations of legacy PCBs detected in fish tissue, attributed to urban runoff and combined sewer overflows. The use of PCBs was banned in the late 1970s, loadings have been removed or reduced, and levels are decreasing in the water column, sediments, and fish tissue over time. Lake Jackson also is listed as not supporting its designated Recreation use due to legacy PCBs in fish tissue but there is no longer a fish consumption advisory for Lake Jackson or the South River at Hwy 36 (within the project boundary), reflecting a decline of PCBs. A fish consumption advisory remains for Lake Jackson due to mercury but the predominant source, air deposition, is unrelated to project operations. Many other Georgia reservoirs also have fish consumption advisories for mercury.

Under the current license, Georgia Power implements a Small Dredging Permit Program to permit minor dredging activities, which may involve the removal of up to 500 cubic yards of sediment per lot. Of 29 permits issued from 2006 to 2018, 11 permits were issued to property owners in the South River embayment and 10 permits were issued to property owners in the Tussahaw Creek embayment. Smaller numbers of permits were issued for lots in the mainstem reservoir and the upper Alcovy River embayment.

4.3 Shoreline Temporal Change Analysis

Six representative areas of the Lloyd Shoals Project were evaluated for temporal change in shoreline and sedimentation conditions. Based on aerial photography comparisons over the period 1993 to 2019, there has been little overall change in the predominant land uses surrounding the Project. Comparison of aerial imagery revealed that the primary changes to land use along the reservoir shoreline were related to residential construction. Primary changes to land use in upland areas outside of the project boundary were residential construction and logging. Shoreline change within the reservoir was most common in the more natural upper reaches of Tussahaw Creek and the South and Alcovy Rivers. Sediment deposition and scour areas were most apparent in these transition areas from riverine to a lacustrine system. Changes in shoreline conditions in the mainstem reservoir and more populated reaches of the river embayments were less common, likely due to the widespread use of shoreline structural stabilization practices. The higher rates of sedimentation observed from aerial imagery in the South River embayment, including the Yellow River, can be attributed to high rates of sediment transport and deposition from the highly urbanized watershed of metropolitan Atlanta.

4.4 Project Operations Relevant to Shoreline Erosion

Georgia Power normally operates the Lloyd Shoals Project to maintain Lake Jackson elevations between approximately 530 and 527 ft PD, excluding planned drawdowns and drought. Prior to installation of the Obermeyer gate system, daily reservoir fluctuations were less than 1.5 ft about 98 percent of the time and less than 1.0 ft about 95 percent time. Since installation of the Obermeyer gates in 2012, fluctuations have been further reduced during high flow events. In addition, with the greater reservoir elevation control during high flow events provided by the new Obermeyer gates, annual seasonal drawdowns of the reservoir by as much as 8 ft from full pool are no longer needed. Although reservoir fluctuations were identified as a potential source of erosion at about 12 percent of the shoreline survey sites, wave action from watercraft or wind was also a factor at half of these sites and nearly all of the sites had stable or moderately stable banks.

Generation flows from the powerhouse into the Ocmulgee River range up to the maximum powerhouse hydraulic capacity of 3,720 cfs. When not generating peaking energy, the plant releases a continuous minimum flow of 400 cfs, or inflow, whichever is less, for the protection and enhancement of fish and wildlife resources, as required by Article 402 of the license. In practice, during those low-flow periods when project inflows fall below 400 cfs, the Project supplements downstream flows with a 250-cfs minimum release to ensure adequate stream flows for aquatic life and other downstream uses. The potential for shoreline erosion in the Lloyd Shoals tailrace area is moderated by the prevalence of bedrock and boulders, armoring provided by riprap closer to the tailrace, and the stream bank and riparian zone protection provided by forested vegetation along both sides of the river.

4.5 RELATIONSHIP BETWEEN SHORELINE STRUCTURAL STABILIZATION PRACTICES AND LITTORAL ZONE FISH HABITAT

Relevant scientific literature dealing with the effects of shoreline structural practices on littoral fish habitat indicates an overall positive relationship between greater habitat complexity of riprapped shoreline habitats and higher species richness, diversity, and abundance of littoral zone fish assemblages, including important sport fishes. When erosion control is necessary at a developed shoreline site, available evidence supports the use of riprap, either alone or in front of seawalls, as providing more beneficial fish habitat than the use of seawalls alone. About 49 percent of the length of existing shoreline structural stabilization practices in place on Lake Jackson includes the use of riprap.

Georgia Power proposes to continue to manage the Lake Jackson shorelines in accordance with the Shoreline Management Guidelines for Georgia Power Lakes, which include specific requirements for Lake Jackson. The guidelines require that riprap be placed along the base of all new seawalls constructed to help reinforce the structures and restore shoreline habitat. Other requirements minimize shoreline disturbance from tree removal, mechanical clearing, and other activities to protect a 25-ft vegetative buffer surrounding the reservoir.

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TABLE 1 GEOGRAPHIC COORDINATES OF SURVEY SECTION MIDPOINTS

SITE ID	LATITUDE	LONGITUDE
Alcovy River		
AR-01	33.3737	-83.8572
AR-02	33.3786	-83.8497
AR-03	33.3864	-83.8509
AR-04	33.3879	-83.8443
AR-05	33.3892	-83.8423
AR-06	33.3911	-83.8437
AR-07	33.4007	-83.8446
AR-08	33.3979	-83.8421
AR-09	33.4098	-83.8329
AR-10	33.4089	-83.8304
AR-11	33.4164	-83.8298
AR-12	33.4202	-83.8337
AR-14	33.406	-83.8262
AR-15	33.3949	-83.8242
AR-16	33.3979	-83.8221
AR-17	33.4075	-83.819
AR-19	33.4063	-83.8183
AR-20	33.3989	-83.8212
AR-21	33.3913	-83.8254
AR-22	33.3874	-83.8345
AR-23	33.3852	-83.8379
AR-24	33.3832	-83.839
AR-25	33.3747	-83.8412
AR-27	33.437	-83.8171
AR-28	33.4042	-83.8182
Mainstem Reservoir		
MR-01	33.3631	-83.8592
MR-02	33.3581	-83.8589
MR-03	33.3507	-83.8493
MR-04	33.3499	-83.8489
MR-05	33.348	-83.8586
MR-06	33.3408	-83.8575
MR-07	33.3435	-83.8461
MR-08	33.3399	-83.8471
MR-09	33.3326	-83.8425
MR-10	33.3304	-83.839
MR-11	33.3223	-83.844
MR-12	33.3189	-83.8466
MR-13	33.3254	-83.8502

SITE ID	LATITUDE	LONGITUDE
MR-14	33.3245	-83.8483
MR-15	33.3305	-83.8497
MR-16	33.3309	-83.8487
MR-17	33.3312	-83.8572
MR-18	33.3364	-83.8714
MR-19	33.338	-83.8707
MR-20	33.3381	-83.8669
MR-21	33.3423	-83.8668
MR-22	33.3456	-83.8723
MR-23	33.3556	-83.8612
MR-24	33.3551	-83.8626
MR-25	33.3566	-83.8643
South River		
SR-01	33.3765	-83.8733
SR-02	33.3781	-83.8768
SR-03	33.3996	-83.8967
SR-04	33.4041	-83.8977
SR-05	33.4097	-83.9003
SR-06	33.4121	-83.9037
SR-07	33.4434	-83.9235
SR-08	33.4269	-83.9128
SR-09	33.4249	-83.9102
SR-10	33.4187	-83.9109
SR-11	33.3926	-83.8861
SR-12	33.3898	-83.8778
SR-13	33.4005	-83.8763
SR-14	33.4077	-83.8755
SR-15	33.4172	-83.884
SR-16	33.4257	-83.8818
SR-17	33.4507	-83.8803
SR-18	33.4459	-83.8775
SR-20	33.4106	-83.8855
SR-21	33.384	-83.8722
SR-22	33.3788	-83.8721
SR-23	33.3794	-83.87
SR-24	33.381	-83.8684
SR-25	33.3715	-83.8627
SR-29	33.3952	-83.8749
Tussahaw Creek		
TC-01	33.352	-83.8741
TC-02	33.3485	-83.8785
TC-03	33.3506	-83.885

SITE ID	LATITUDE	LONGITUDE
TC-04	33.3514	-83.8862
TC-05	33.3498	-83.892
TC-06	33.3532	-83.8984
TC-07	33.3539	-83.8905
TC-08	33.3608	-83.8946
TC-09	33.3632	-83.8948
TC-10	33.3662	-83.9008
TC-11	33.3652	-83.9049
TC-12	33.3707	-83.9192
TC-13	33.3744	-83.9321
TC-14	33.3727	-83.9269
TC-15	33.3715	-83.9202
TC-16	33.3691	-83.9134
TC-17	33.3721	-83.9072
TC-18	33.3683	-83.9045
TC-19	33.3636	-83.893
TC-20	33.3601	-83.8921
TC-21	33.3603	-83.8911
TC-22	33.3545	-83.8767
TC-23	33.3604	-83.8774
TC-24	33.354	-83.8704
TC-25	33.3497	-83.8671
TC-30	33.3699	-83.9154
Tailrace Area		
TR-01	33.3195	-83.8402
TR-02	33.3173	-83.8415
TR-03	33.3162	-83.8404
TR-04	33.3169	-83.8426
TR-05	33.3194	-83.8429
TR-06	33.3204	-83.8423

TABLE 2 VEGETATIVE BUFFER ZONE CONDITION, BANK STABILITY, BANK VEGETATIVE PROTECTION, AND STRUCTURAL STABILIZATION PRACTICES

SITE ID	SHORELINE VEGETATIVE BUFFER ZONE CONDITION	BANK STABILITY	BANK VEGETATIVE PROTECTION	PROPORTION OF SITE WITH STRUCTURAL STABILIZATION PRACTICES
AR-01	Landscaped-Natural	Moderately Stable	<50%	90%
AR-02	Landscaped-Natural	Moderately Stable	<50%	80%
AR-03	Natural	Stable	>90%	0%
AR-04	Landscaped-Natural	Moderately Stable	50-70%	70%
AR-05	Landscaped	Stable	<50%	95%
AR-06	Landscaped	Stable	<50%	100%
AR-07	Natural	Stable	>90%	0%
AR-08	Landscaped	Stable	<50%	90%
AR-09	Landscaped	Stable	<50%	90%
AR-10	Landscaped	Stable	<50%	85%
AR-11	Landscaped	Stable	<50%	85%
AR-12	Landscaped-Natural	Stable	<50%	20%
AR-14	Landscaped-Natural	Stable	50-70%	63%
AR-15	Landscaped-Natural	Moderately Stable	50-70%	75%
AR-16	Landscaped-Natural	Moderately Stable	50-70%	<50%
AR-17	Natural	Stable	>90%	0%
AR-19	Natural	Stable	>90%	0%
AR-20	Landscaped-Natural	Stable	<50%	95%
AR-21	Landscaped	Moderately Unstable	<50%	0%
AR-22	Landscaped	Stable	<50%	95%
AR-23	Landscaped-Natural	Moderately Unstable	50-70%	15%
AR-24	Landscaped-Natural	Stable	<50%	80%
AR-25	Landscaped-Natural	Stable	50-70%	90%
AR-27	Natural	Stable	>90%	0%
AR-28	Landscaped-Natural	Stable	70-90%	10%
MR-01	Landscaped	Moderately Stable	<50%	60%
MR-02	Landscaped-Natural	Moderately Unstable	50-70%	55%
MR-03	Landscaped-Natural	Stable	50-70%	55%
MR-04	Natural	Stable	>90%	0%
MR-05	Landscaped	Stable	<50%	100%
MR-06	Natural	Moderately Unstable	>90%	0%
MR-07	Natural	Stable	>90%	0%
MR-08	Landscaped	Stable	<50%	100%
MR-09	Natural	Moderately Stable	>90%	80%
MR-10	Landscaped	Moderately Stable	<50%	100%
MR-11	Landscaped	Stable	<50%	100%
MR-12	Natural	Stable	>90%	0%
MR-13	Landscaped	Moderately Stable	70-90%	15%

Site ID	Shoreline Vegetative Buffer Zone Condition	Bank Stability	Bank Vegetative Protection	Proportion of Site with Structural Stabilization Practices
MR-14	Landscaped	Stable	<50%	100%
MR-15	Landscaped-Natural	Stable	50-70%	75%
MR-16	Landscaped	Stable	<50%	95%
MR-17	Landscaped	Moderately Stable	<50%	40%
MR-18	Landscaped-Natural	Stable	50-70%	60%
MR-19	Landscaped	Stable	<50%	101%
MR-20	Landscaped	Stable	<50%	85%
MR-21	Landscaped	Stable	<50%	100%
MR-22	Landscaped	Moderately Stable	50-70%	37%
MR-23	Landscaped	Stable	70-90%	90%
MR-24	Landscaped	Stable	<50%	95%
MR-25	Landscaped	Stable	<50%	90%
SR-01	Landscaped-Natural	Stable	<50%	100%
SR-02	Landscaped	Stable	<50%	90%
SR-03	Landscaped-Natural	Stable	70-90%	0%
SR-04	Natural	Stable	>90%	0%
SR-05	Natural	Stable	>90%	0%
SR-06	Landscaped-Natural	Moderately Stable	50-70%	0%
SR-07	Natural	Stable	>90%	0%
SR-08	Natural	Stable	>90%	0%
SR-09	Natural	Stable	>90%	0%
SR-10	Natural	Stable	>90%	0%
SR-11	Natural	Stable	>90%	0%
SR-12	Landscaped	Stable	<50%	80%
SR-13	Landscaped-Natural	Stable	50-70%	0%
SR-14	Natural	Stable	>90%	0%
SR-15	Natural	Stable	>90%	0%
SR-16	Natural	Stable	>90%	0%
SR-17	Natural	Stable	>90%	0%
SR-18	Natural	Stable	>90%	0%
SR-20	Natural	Stable	>90%	0%
SR-21	Natural	Stable	>90%	0%
SR-22	Landscaped	Stable	<50%	100%
SR-23	Landscaped	Moderately Stable	<50%	98%
SR-24	Landscaped	Stable	<50%	60%
SR-25	Landscaped-Natural	Moderately Unstable	50-70%	100%
SR-29	Landscaped	Stable	<50%	40%
TC-01	Landscaped	Stable	<50%	100%
TC-02	Landscaped-Natural	Stable	50-70%	30%
TC-03	Natural	Stable	>90%	0%

SITE ID	SHORELINE VEGETATIVE BUFFER ZONE CONDITION	BANK STABILITY	BANK VEGETATIVE PROTECTION	PROPORTION OF SITE WITH STRUCTURAL STABILIZATION PRACTICES
TC-04	Landscaped	Stable	<50%	60%
TC-05	Landscaped-Natural	Stable	50-70%	80%
TC-06	Landscaped	Stable	<50%	10%
TC-07	Landscaped	Stable	<50%	80%
TC-08	Landscaped	Stable	<50%	90%
TC-09	Landscaped-Natural	Stable	70-90%	60%
TC-10	Landscaped	Stable	<50%	100%
TC-11	Landscaped	Moderately Stable	<50%	<50%
TC-12	Natural	Stable	>90%	0%
TC-13	Natural	Stable	>90%	0%
TC-14	Natural	Stable	>90%	0%
TC-15	Natural	Stable	>90%	0%
TC-16	Landscaped-Natural	Stable	70-90%	5%
TC-17	Landscaped	Stable	<50%	100%
TC-18	Natural	Stable	>90%	0%
TC-19	Landscaped	Stable	<50%	40%
TC-20	Landscaped	Stable	50-70%	35%
TC-21	Natural	Stable	70-90%	10%
TC-22	Landscaped	Stable	<50%	100%
TC-23	Landscaped	Stable	50-70%	70%
TC-24	Landscaped	Stable	<50%	100%
TC-25	Landscaped	Stable	<50%	90%
TC-30	Natural	Stable	>90%	0%
TR-01	Landscaped-Natural	Moderately Unstable	70-90%	0%
TR-02	Natural	Stable	>90%	10%
TR-03	Natural	Stable	>90%	0%
TR-04	Natural	Stable	50-70%	0%
TR-05	Landscaped-Natural	Stable	<50%	5%
TR-06	Landscaped-Natural	Stable	>90%	0%

TABLE 3 SHORELINE STRUCTURAL STABILIZATION PRACTICES

SITE ID	SHORELINE STRUCTURAL STABILIZATION PRESENT	SEAWALL / BULKHEAD	RIPRAP	SEAWALL/BULKHEAD AND RIPRAP COMBINED	OTHER	OTHER %	TOTAL STABILIZATION
AR-01	Yes	90%					90%
AR-02	Yes		80%				80%
AR-03	No						
AR-04	Yes	70%					70%
AR-05	Yes	90%		5%			95%
AR-06	Yes	80%		20%			100%
AR-07	No						
AR-08	Yes		25%	65%			90%
AR-09	Yes	70%			Beach	20%	90%
AR-10	Yes	85%					85%
AR-11	Yes	85%					85%
AR-12	Yes	10%	10%				20%
AR-14	Yes	60%	3%				63%
AR-15	Yes		30%	40%	Boat Ramp	5%	75%
AR-16	Yes	50%					50%
AR-17	No						
AR-19	No						
AR-20	Yes	85%	10%				95%
AR-21	No						
AR-22	Yes	95%					95%
AR-23	Yes	5%	10%				15%
AR-24	Yes	55%	15%	10%			80%
AR-25	Yes			90%			90%

SITE ID	SHORELINE STRUCTURAL STABILIZATION PRESENT	SEAWALL / BULKHEAD	RIPRAP	SEAWALL/BULKHEAD AND RIPRAP COMBINED	OTHER	OTHER %	TOTAL STABILIZATION
AR-27	No						
AR-28	Yes		10%				10%
MR-01	Yes		60%				60%
MR-02	Yes	50%	5%				55%
MR-03	Yes	50%			Boat Ramp	5%	55%
MR-04	No						
MR-05	Yes	50%		50%			100%
MR-06	No						
MR-07	No						
MR-08	Yes	95%			Boat Ramp	5%	100%
MR-09	Yes		5%	75%			80%
MR-10	Yes		100%				100%
MR-11	Yes		100%				100%
MR-12	No						
MR-13	Yes		15%				15%
MR-14	Yes	30%	10%	55%	Boat Ramp	5%	100%
MR-15	Yes	30%	20%	20%	Boat Ramp	5%	75%
MR-16	Yes			95%			95%
MR-17	Yes	40%					40%
MR-18	Yes			60%			60%
MR-19	Yes	30%	1%	70%			101%
MR-20	Yes	80%			Boat Ramp	5%	85%
MR-21	Yes	95%			Boat Ramp	5%	100%
+MR-22	Yes	30%	5%		Boat Ramp	2%	37%

Site ID	Shoreline Structural Stabilization Present	Seawall / Bulkhead	Riprap	Seawall/Bulkhead and Riprap Combined	Other	Other %	Total Stabilization
MR-23	Yes	90%					90%
MR-24	Yes		10%	85%			95%
MR-25	Yes		40%	50%			90%
SR-01	Yes	40%	60%				100%
SR-02	Yes	90%					90%
SR-03	No						
SR-04	No						
SR-05	No						
SR-06	No						
SR-07	No						
SR-08	No						
SR-09	No						
SR-10	No						
SR-11	No						
SR-12	Yes		80%				80%
SR-13	No						
SR-14	No						
SR-15	No						
SR-16	No						
SR-17	No						
SR-18	No						
SR-20	No						
SR-21	Yes	95%		5%			100%
SR-22	Yes	90%		8%			98%
SR-23	Yes	30%		30%			60%

Site ID	Shoreline Structural Stabilization Present	Seawall / Bulkhead	Riprap	Seawall/Bulkhead and Riprap Combined	Other	Other %	Total Stabilization
SR-24	Yes	85%		15%			100%
SR-25	Yes		40%				40%
SR-29	No						
TC-01	Yes		25%	5%			30%
TC-02	No						
TC-03	Yes	20%		40%			60%
TC-04	Yes	20%	15%	45%			80%
TC-05	Yes	10%					10%
TC-06	Yes	80%					80%
TC-07	Yes			85%	Boat Ramp	5%	90%
TC-08	Yes	10%	50%				60%
TC-09	Yes	50%	5%	45%			100%
TC-10	Yes			50%			50%
TC-11	No						
TC-12	No						
TC-13	No						
TC-14	Yes	85%	15%				100%
TC-15	Yes	5%					5%
TC-16	Yes			100%			100%
TC-17	No						
TC-18	Yes	10%	20%	10%			40%
TC-19	Yes		20%	15%			35%
TC-20	Yes		10%				10%
TC-21	Yes		95%		Boat Ramp	5%	100%
TC-22	Yes	70%					70%

SITE ID	SHORELINE STRUCTURAL STABILIZATION PRESENT	SEAWALL / BULKHEAD	RIPRAP	SEAWALL/BULKHEAD AND RIPRAP COMBINED	OTHER	OTHER %	TOTAL STABILIZATION
TC-23	Yes	50%		50%			100%
TC-24	Yes			90%			90%
TC-25	No						
TC-30	No						
TR-01	No						
TR-02	Yes		10%				10%
TR-03	No						
TR-04	No						
TR-05	Yes	5%					5%
TR-06	No						

TABLE 4 POTENTIAL SOURCES OF SHORELINE EROSION

SITE ID	LAND DISTURBING ACTIVITY	IMPERVIOUS SURFACES	STORMWATER RUNOFF	RESIDENTIAL LANDSCAPES	ROADS AND BRIDGES	RECREATION / ACCESS	RESERVOIR FLUCTUATION	LACK OF BUFFER VEGETATION	LIVESTOCK ACTIVITY	WAVE ACTION FROM WATERCRAFT	TRIBUTARY FLOW	OTHER
AR-01				X						X		
AR-02										X		
AR-03												
AR-04										X	X	
AR-05												
AR-06												
AR-07												
AR-08												
AR-09												
AR-10												
AR-11				X						X		
AR-12				X			X			X		
AR-14				X						X		
AR-15				X			X			X		
AR-16				X			X			X		
AR-17												
AR-19												
AR-20										X		
AR-21			X	X						X		
AR-22												
AR-23										X		
AR-24				X						X		
AR-25												
AR-27												
AR-28				X								
MR-01				X		X						
MR-02				X			X			X		
MR-03				X								
MR-04				X			X			X		
MR-05				X								
MR-06							X			X		
MR-07							X					
MR-08				X								
MR-09				X						X		
MR-10				X						X		
MR-11		X			X	X				X		

Site ID	Land Disturbing Activity	Impervious Surfaces	Stormwater Runoff	Residential Landscapes	Roads and Bridges	Recreation / Access	Reservoir Fluctuation	Lack of Buffer Vegetation	Livestock Activity	Wave Action from Watercraft	Tributary Flow	Other
MR-12					X	X	X					
MR-13		X		X	X		X					
MR-14				X								
MR-15				X								
MR-16				X				X				
MR-17				X			X					
MR-18				X								
MR-19												
MR-20				X								
MR-21				X								
MR-22	X			X			X					
MR-23				X								
MR-24				X								
MR-25				X								
SR-01								X		X		
SR-02	X		X	X						X		
SR-03				X								
SR-04												
SR-05												
SR-06								X				
SR-07												**Wildlife Trails**
SR-08												
SR-09												
SR-10												
SR-11										X		
SR-12				X						X		
SR-13				X						X		
SR-14										X		
SR-15										X		
SR-16												
SR-17												
SR-18												
SR-20												
SR-21												
SR-22												
SR-23												
SR-24												
SR-25				X				X		X		

SITE ID	LAND DISTURBING ACTIVITY	IMPERVIOUS SURFACES	STORMWATER RUNOFF	RESIDENTIAL LANDSCAPES	ROADS AND BRIDGES	RECREATION / ACCESS	RESERVOIR FLUCTUATION	LACK OF BUFFER VEGETATION	LIVESTOCK ACTIVITY	WAVE ACTION FROM WATERCRAFT	TRIBUTARY FLOW	OTHER
SR-29												
TC-01				**X**								
TC-02				**X**								
TC-03					**X**							
TC-04				**X**								
TC-05				**X**				**X**				
TC-06				**X**								
TC-07				**X**								
TC-08				**X**								
TC-09				**X**								
TC-10				**X**								
TC-11				**X**				**X**				
TC-12												
TC-13												
TC-14												
TC-15												
TC-16				**X**								**Boat Ramp**
TC-17				**X**				**X**				
TC-18							**X**					
TC-19				**X**								
TC-20				**X**								
TC-21				**X**								
TC-22				**X**								
TC-23				**X**								
TC-24				**X**								
TC-25				**X**								
TC-30				**X**								**Adjacent Highway 36**
TR-01												**Spillway Release**
TR-02						**X**						**Generation**
TR-03												**Generation**
TR-04												**Generation**
TR-05						**X**						**Generation**
TR-06												**Generation**
Total	**2**	**2**	**2**	**54**	**4**	**5**	**12**	**7**	**0**	**26**	**1**	**9**

TABLE 5 SOURCES OF LITTORAL ZONE FISH COVER

Site ID	Docks / Piers / Boatslips	Riprap	Bedrock and Boulders	Emergent Vegetation	Submersed Vegetation	Overhanging Vegetation	Large Woody Debris	Standing Timber	Other	Other %
AR-01	5%	10%	10%			10%	2%			
AR-02	5%	80%				5%				
AR-03	0%					90%	10%	5%		
AR-04	5%					15%				
AR-05	5%					2%				
AR-06	5%	20%								
AR-07	5%					30%	5%			
AR-08	10%	85%				5%				
AR-09	15%							5%		
AR-10	10%	5%				5%	2%			
AR-11	5%					3%				
AR-12	10%	10%	15%			3%				
AR-14	15%	3%	3%			10%		5%		
AR-15	10%	70%	<5%			20%	5%			
AR-16	5%							5%		
AR-17				5%		30%	10%			
AR-19				100%		5%				
AR-20	10%	10%								
AR-21	5%		2%			15%	25%	1%		
AR-22	15%					5%				
AR-23	5%	10%				20%				
AR-24	15%	15%	20%			5%				
AR-25	10%	40%	5%			25%				
AR-27				30%		20%	10%	20%		

Site ID	Docks / Piers / Boatslips	Riprap	Bedrock and Boulders	Emergent Vegetation	Submersed Vegetation	Overhanging Vegetation	Large Woody Debris	Standing Timber	Other	Other %
AR-28	10%	10%		10%		1%	5%			
MR-01	5%	60%				1%	5%			
MR-02	5%	5%				5%	10%			
MR-03	5%					5%	5%			
MR-04			5%			30%	20%			
MR-05	5%					1%				
MR-06			5%			5%	60%			
MR-07						15%	5%			
MR-08	5%					0%				
MR-09	5%	80%	5%			10%	10%			
MR-10	5%	100%								
MR-11	5%	100%				<5%			Submerged Fish Attractor	10%
MR-12			1%			10%	10%			
MR-13	1%	15%		<5%		10%	5%			
MR-14	10%	65%				0%				
MR-15	15%	40%	5%			10%	10%			
MR-16	5%	95%				<5%				
MR-17	5%		10%			5%	10%			
MR-18	1%	60%			<5%	5%	<5%			
MR-19	10%	71%								
MR-20	10%									
MR-21	5%									
MR-22	5%	5%				5%	5%			
MR-23	5%		10%							
MR-24	5%	95%	15%			<5%	1%			

Site ID	Docks / Piers / Boatslips	Riprap	Bedrock and Boulders	Emergent Vegetation	Submersed Vegetation	Overhanging Vegetation	Large Woody Debris	Standing Timber	Other	Other %
MR-25	5%	90%				1%	1%			
SR-01	5%	60%	2%			10%	5%			
SR-02	5%		2%			10%	5%			
SR-03	5%			50%	35%	10%	5%			
SR-04				90%		50%	1%			
SR-05				95%		80%	5%			
SR-06	1%					50%	7%			
SR-07						100%	50%			
SR-08						100%	10%			
SR-09						100%	25%			
SR-10						100%	20%			
SR-11						90%	5%			
SR-12	5%	80%		2%		5%				
SR-13	3%			2%		20%				
SR-14						90%	20%			
SR-15						100%	10%			
SR-16						100%	15%			
SR-17						95%	10%			
SR-18						90%	40%			
SR-20						80%	5%			
SR-21						80%	20%			
SR-22	15%			5%			10%			
SR-23	10%	8%				10%				
SR-24	5%	30%				10%				
SR-25	10%	15%				5%				
SR-29	10%	40%				5%	25%			

Site ID	Docks / Piers / Boatslips	Riprap	Bedrock and Boulders	Emergent Vegetation	Submersed Vegetation	Overhanging Vegetation	Large Woody Debris	Standing Timber	Other	Other %
TC-01	15%	15%				10%	2%			
TC-02	10%	30%	<5%			20%	<5%			
TC-03						70%	15%			
TC-04	<5%	40%				15%	<5%			
TC-05	10%	60%				15%				
TC-06	5%			10%						
TC-07	<5%					<5%				
TC-08	25%	85%								
TC-09	15%	50%	5%			10%				
TC-10	10%	50%								
TC-11	10%	50%								
TC-12						90%	20%	1%		
TC-13						70%	30%			
TC-14						60%	20%			
TC-15				50%		20%	10%			
TC-16	5%	5%				70%	5%			
TC-17	5%	100%				1%				
TC-18			5%			40%	10%	1%		
TC-19	5%	30%								
TC-20	5%	35%				5%	1%			
TC-21		10%				5%	20%			
TC-22	1%	95%					1%			
TC-23	5%					20%	1%			
TC-24	10%	50%				5%	5%			
TC-25	5%	90%								
TC-30						40%	5%			

Site ID	Docks / Piers / Boatslips	Riprap	Bedrock and Boulders	Emergent Vegetation	Submersed Vegetation	Overhanging Vegetation	Large Woody Debris	Standing Timber	Other	Other %
TR-01			100%					50%		
TR-02			10%			40%	10%			
TR-03		10%				75%	10%			
TR-04			30%			75%	10%			
TR-05			90%			10%				
TR-06			95%						Fishing Pier	30%
Total	72	50	25	13	2	88	63	9	2	2

Table 6 Small Dredging Activities Approved for Lake Jackson, 2006-2018

County	Permit Number	Quantity (cubic yards)	Area of Reservoir	Start Date	End Date
Newton	46-9-1732-PERM-LLDB-1806-2	--	Alcovy River upstream of Hwy 212	10/23/2006	1/21/2007
Jasper	46-9-1793-PERM-LLDB-1965-2	40	Alcovy River upstream of Hwy 212	2/20/2007	5/21/2007
Jasper	46-9-422-PERM-LLDB-522-5	60	Alcovy River upstream of Hwy 212	3/5/2012	6/3/2012
Butts	46-9-1861-PERM-LLDB-1970-1	500	South River upstream of Hwy 36	4/1/2008	6/30/2008
Butts	46-9-5115-PERM-LLDB-2351-1	500	South River upstream of Hwy 36	4/1/2008	6/30/2008
Butts	46-9-1873-PERM-LLDB-1992-5	200	South River just downstream of Hwy 36	1/3/2011	3/31/2012
Butts	46-9-1516-PERM-LLDB-1564-2	200	South River just downstream of Hwy 36	1/3/2011	3/31/2012
Butts	46-9-1707-PERM-LLDB-1787-2	70	South River just downstream of Hwy 36	5/8/2012	8/6/2012
Newton	46-9-463-PERM-LLDB-244-2	50	South River just downstream of Hwy 36	6/8/2012	9/6/2012
Newton	46-9-2045-PERM-LLDB-872-4	15	South River downstream of Yellow River confluence	8/5/2010	11/3/2010
Butts	46-9-1202-PERM-LLDB-2337-1	300	South River downstream of Yellow River confluence	2/14/2012	5/14/2012
Butts	46-9-1203-PERM-LLDB-2293-2	10	South River downstream of Yellow River confluence	6/12/2012	9/10/2012
Butts	46-9-1992-1-PERM-1	10	South River at confluence with Alcovy River	10/12/2018	1/10/2019
Butts	46-9-690-1-PERM-1	<30	South River at confluence with Alcovy River	11/13/2018	2/11/2019
Butts	46-9-628A-PERM-LLDB-2222-4	20	Tussahaw Creek between Barnetts Bridge Rd and Hwy 36	2/8/2007	5/9/2007
Butts	46-9-735-PERM-LLDB-1551-2	500	Tussahaw Creek between Barnetts Bridge Rd and Hwy 36	4/9/2008	7/8/2008
Butts	46-9-2279-PERM-LLDB-1350-2	3.5	Tussahaw Creek between Barnetts Bridge Rd and Hwy 36	11/6/2009	3/1/2010
Butts	46-9-2279-PERM-LLDB-1350-3	5	Tussahaw Creek between Barnetts Bridge Rd and Hwy 36	2/22/2010	5/23/2010
Butts	46-9-2313-PERM-LLDB-1377-5	18	Tussahaw Creek between Barnetts Bridge Rd and Hwy 36	11/29/2011	2/27/2012
Butts	46-9-1461-PERM-LLDB-1474-1	200	Tussahaw Creek between Barnetts Bridge Rd and Hwy 36	5/4/2012	8/2/2012
Butts	46-9-628A-PERM-LLDB-2222-6	80	Tussahaw Creek between Barnetts Bridge Rd and Hwy 36	6/5/2012	5/22/2012
Butts	46-9-456-PERM-LLDB-322-3	--	Tussahaw Creek between Barnetts Bridge Rd and Hwy 36	5/18/2018	8/16/2018
Butts	46-9-274-PERM-LLDB-364-7	44	Tussahaw Creek downstream of Barnetts Bridge Rd	1/15/2010	4/15/2010
Butts	46-9-544-PERM-LLDB-527-4	50	Tussahaw Creek downstream of Barnetts Bridge Rd	1/3/2011	3/3/2012
Jasper	46-9-3027-PERM-LLDB-1137-2	500	Mainstem reservoir – east side	4/29/2008	7/28/2008
Butts	46-9-321-PERM-LLDB-131-10	70	Mainstem reservoir – lower west side	2/23/2012	5/23/2012

County	Permit Number	Quantity (cubic yards)	Area of Reservoir	Start Date	End Date
Butts	46-9-5264-PERM-LLDB-2423-2	200	Mainstem reservoir – lower west side	6/26/2013	10/1/2013
Jasper	46-9-2334-PERM-LLDB-1428-2	14	Mainstem reservoir – lower east side	1/31/2018	5/2/2018
Jasper	46-9-5252-PERM-LLDB-2280-4	--	Mainstem reservoir – near dam, east side	3/6/2006	6/4/2006

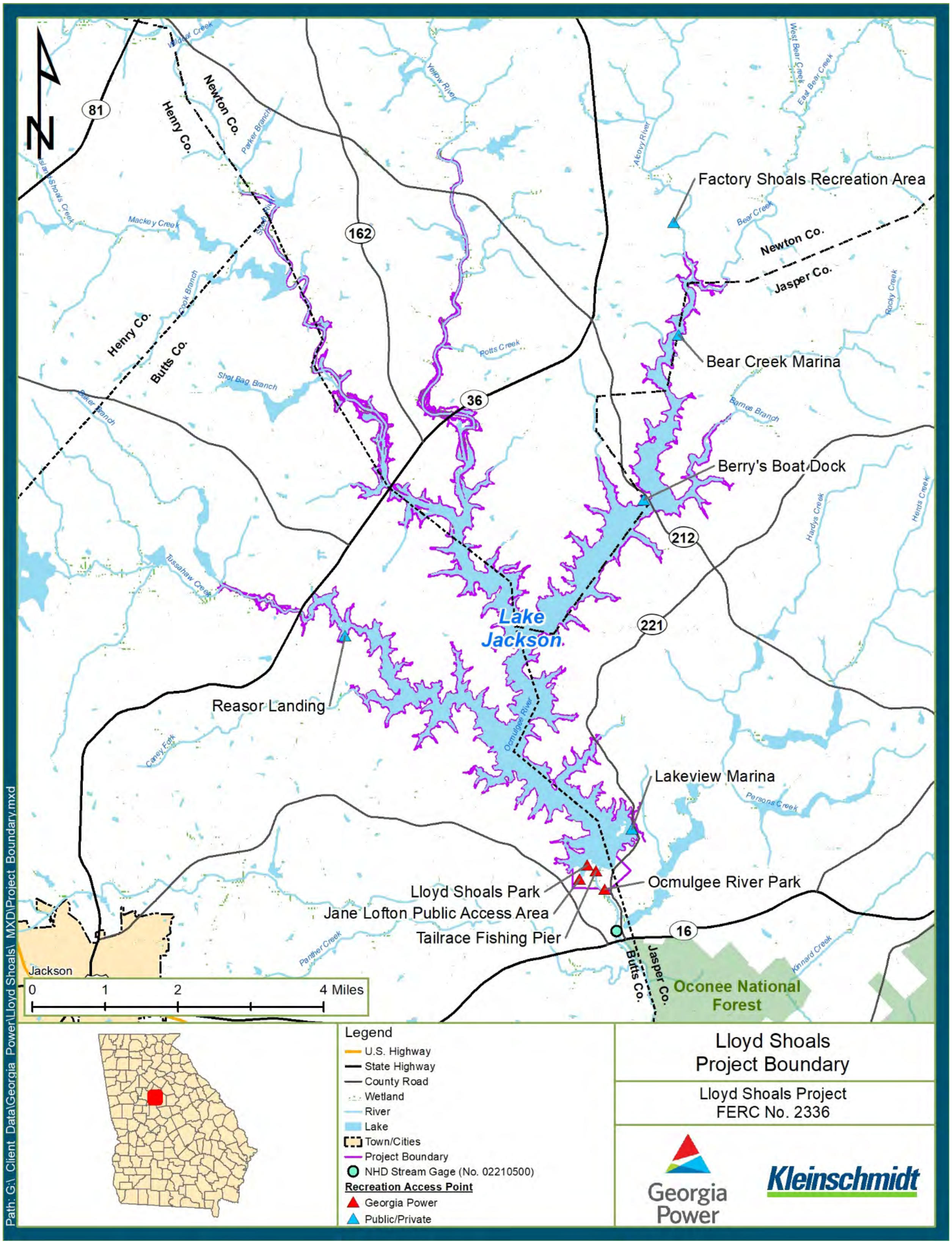

FIGURE 1 PROJECT LOCATION

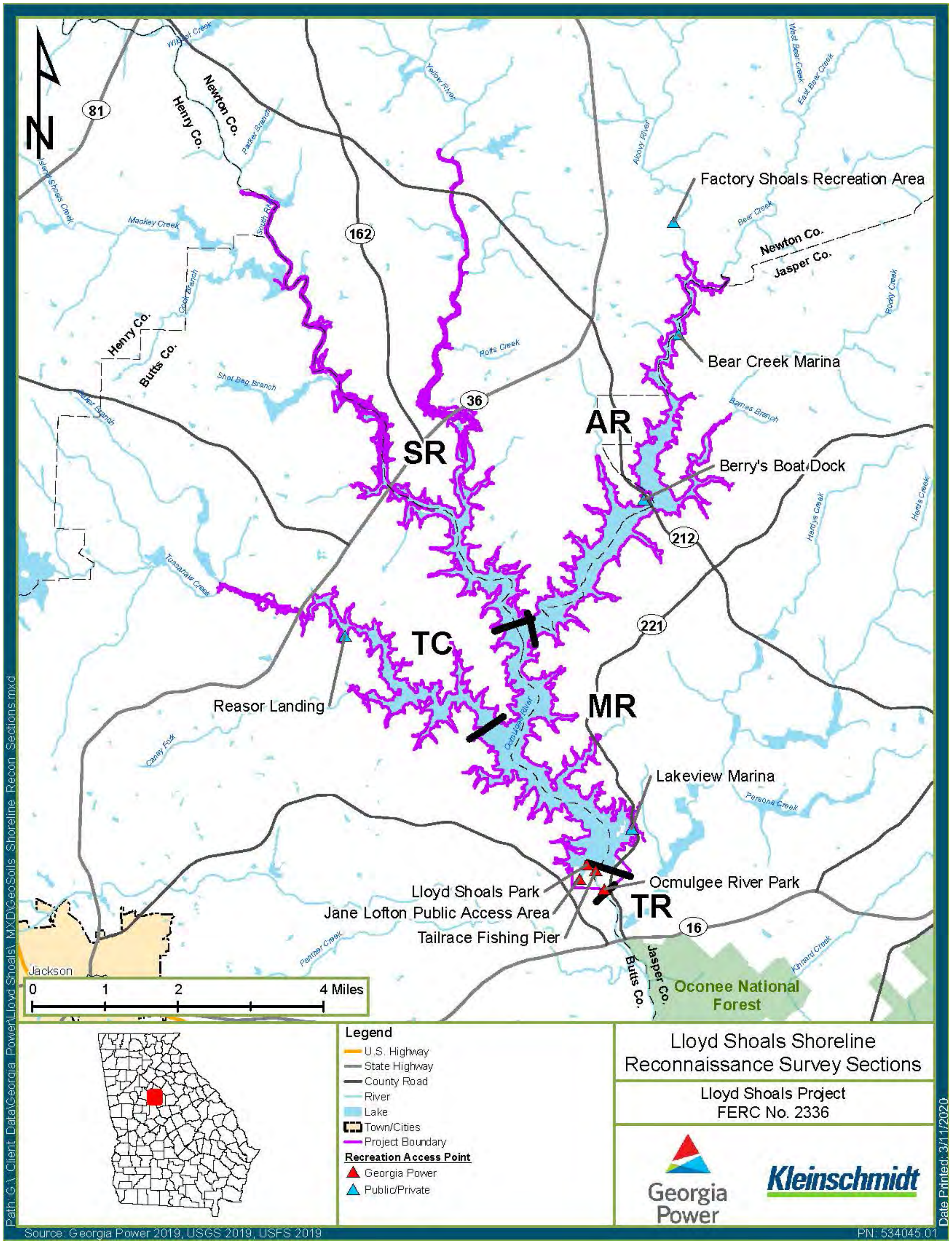

FIGURE 2 SHORELINE RECONNAISSANCE SURVEY SECTIONS

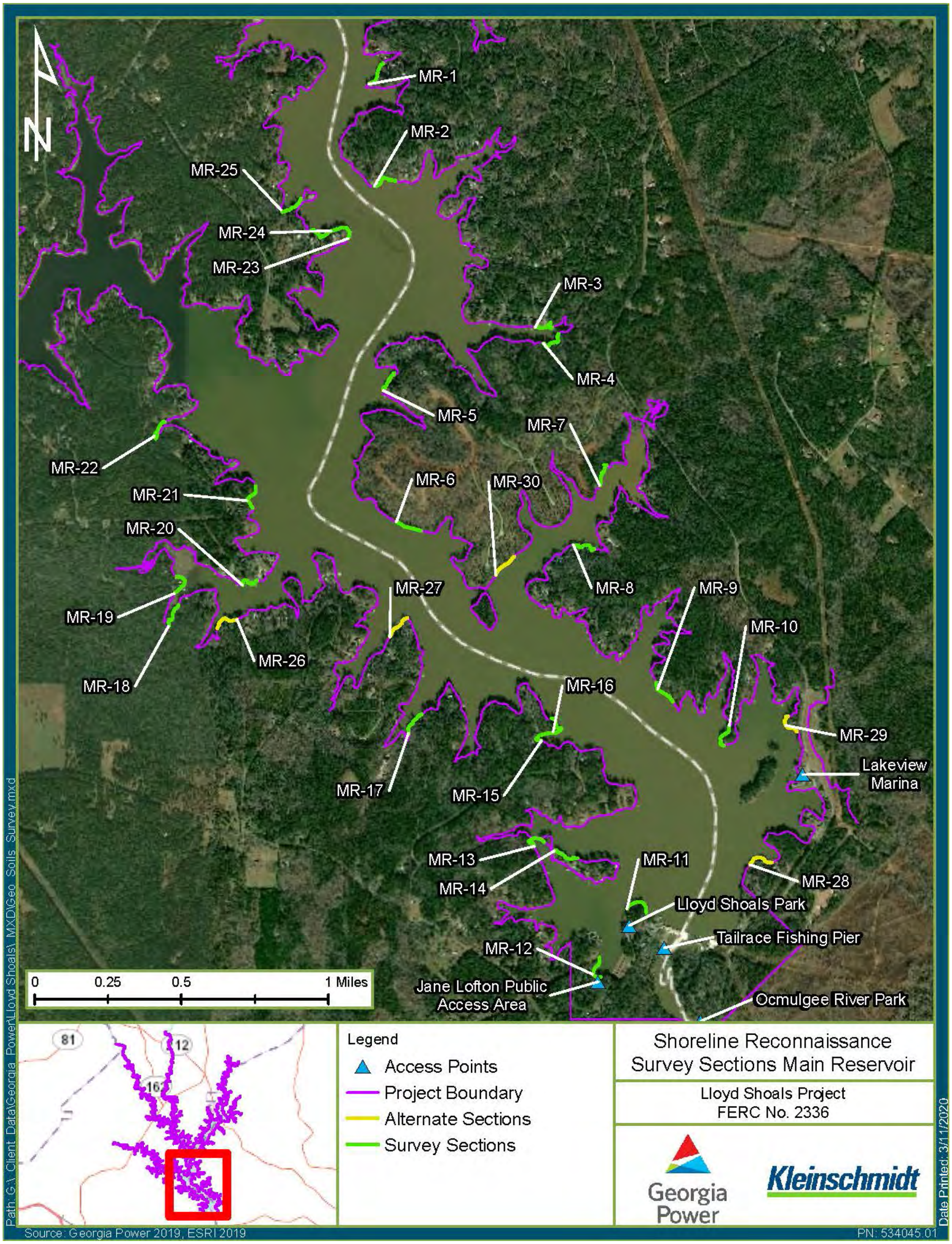

FIGURE 3 MAIN RESERVOIR SHORELINE RECONNAISSANCE SURVEY SECTIONS

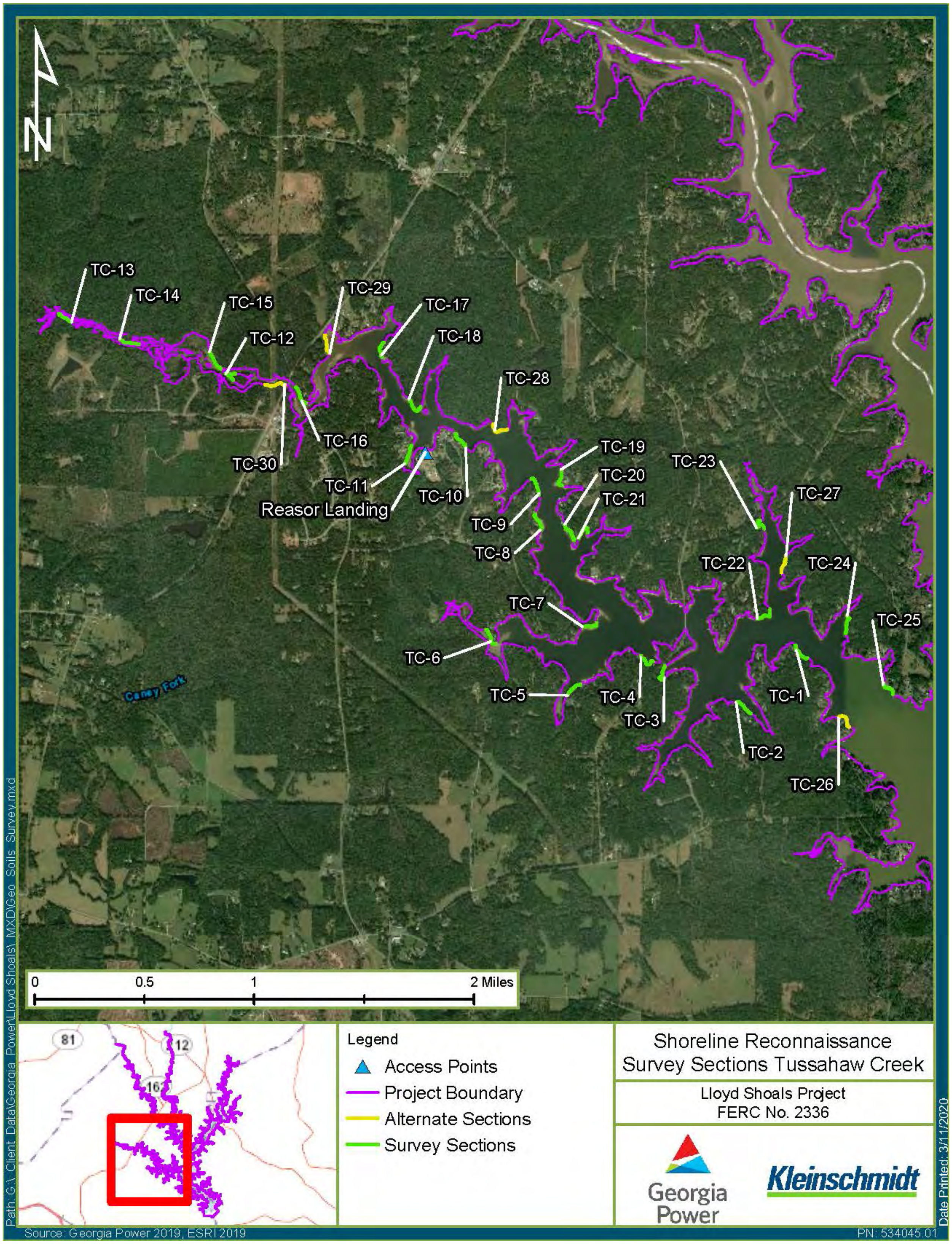

FIGURE 4 TUSSAHAW CREEK SHORELINE RECONNAISSANCE SURVEY SECTIONS

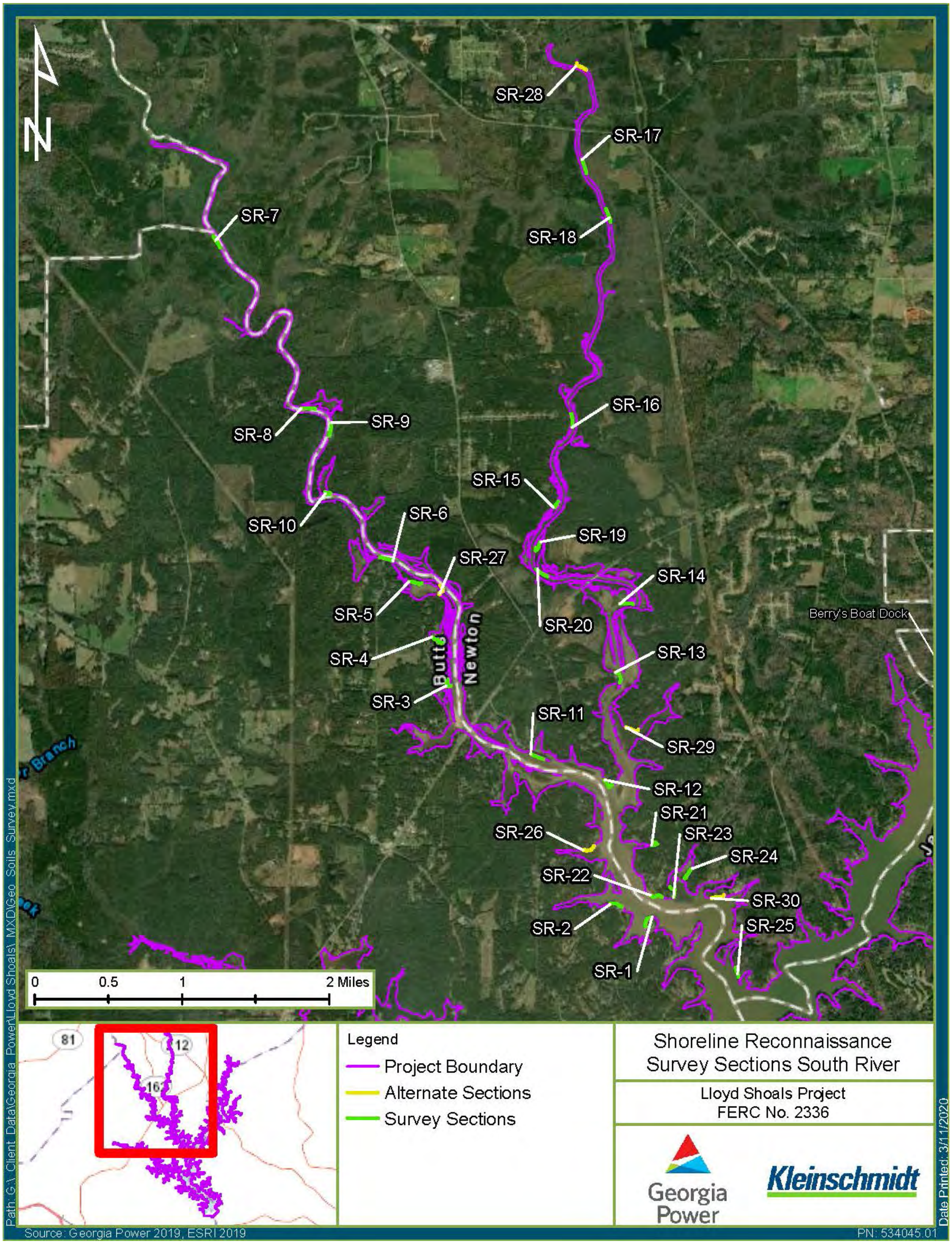

FIGURE 5 SOUTH RIVER SHORELINE RECONNAISSANCE SURVEY SECTIONS

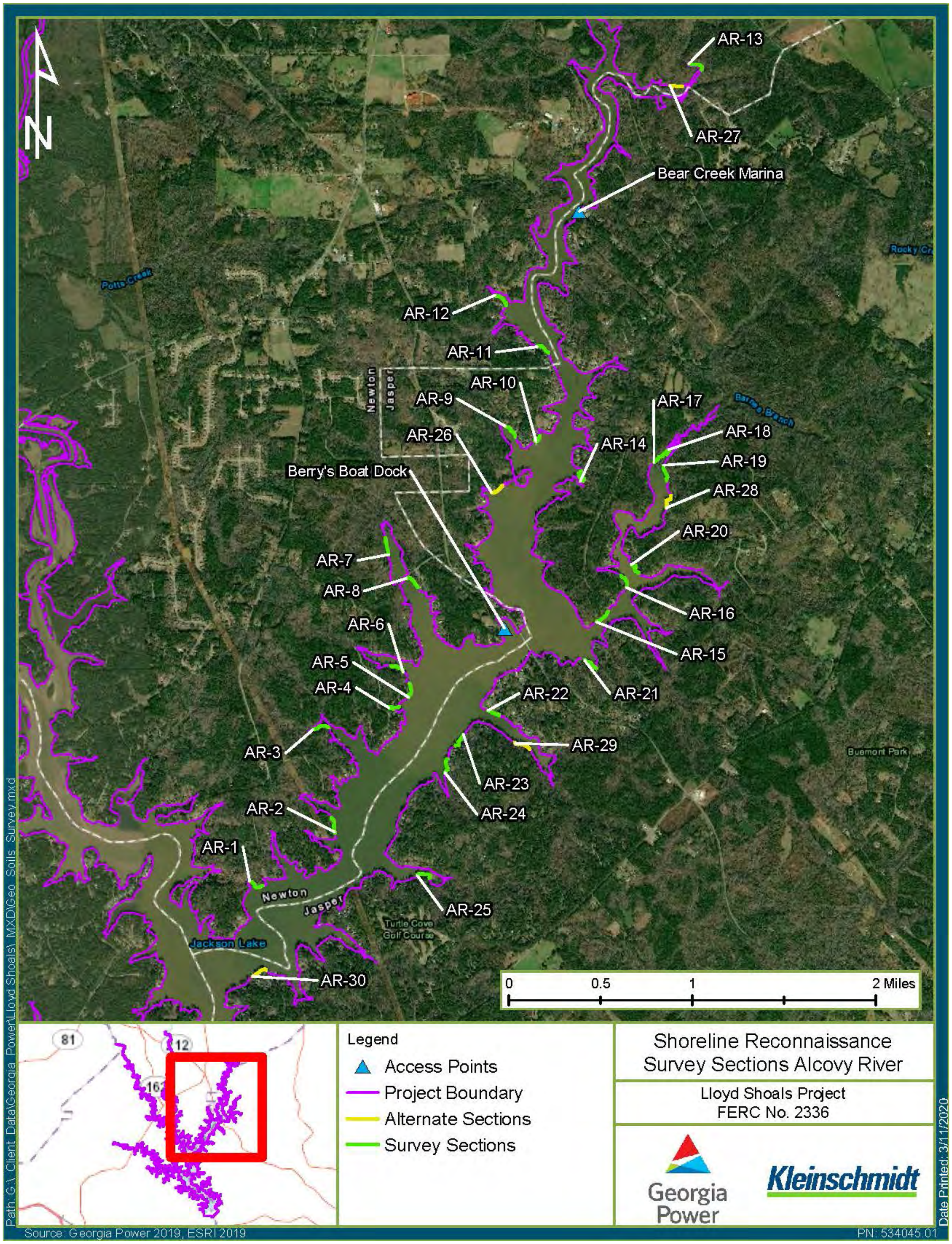

FIGURE 6 ALCOVY RIVER SHORELINE RECONNAISSANCE SURVEY SECTIONS

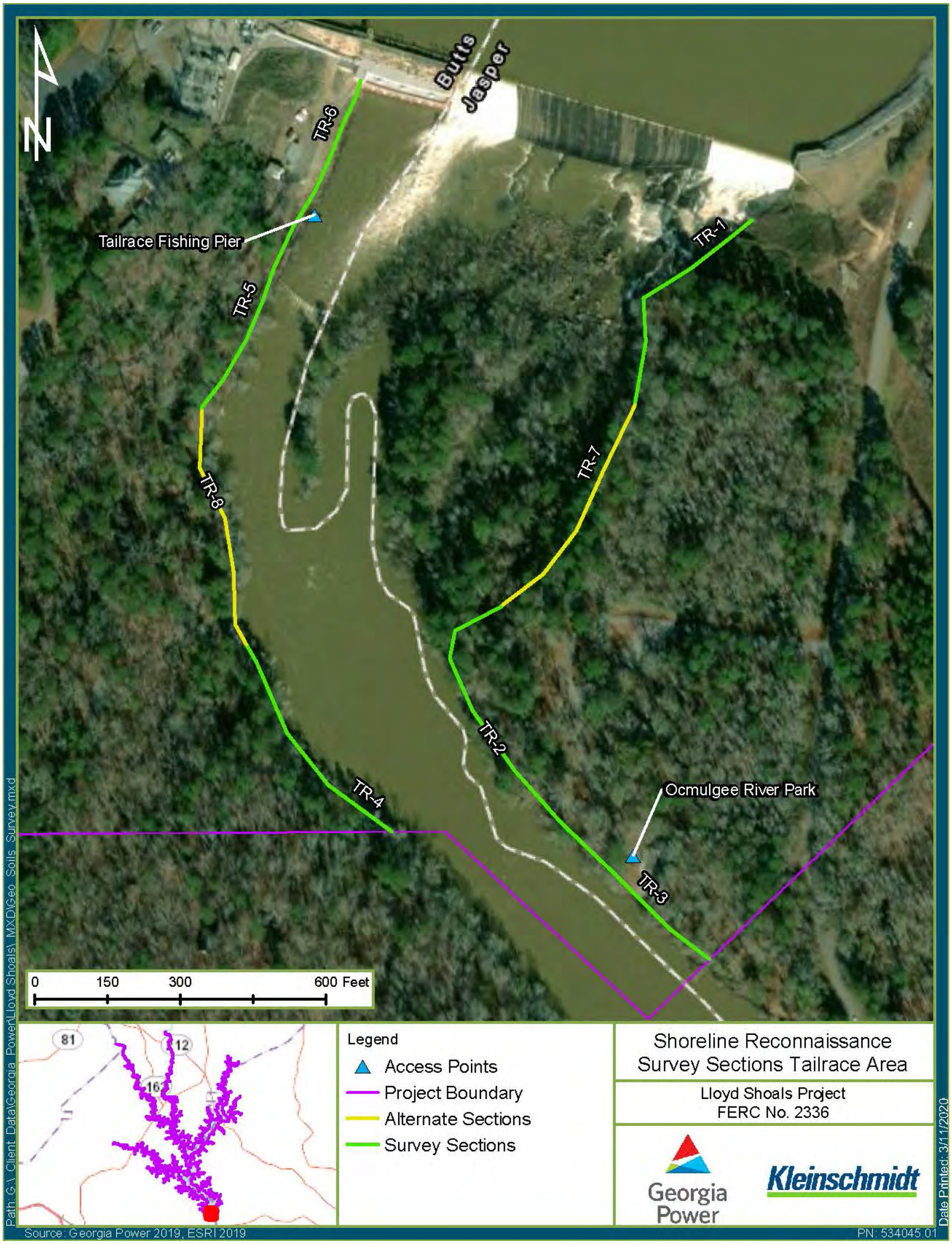

FIGURE 7 TAILRACE AREA SHORELINE RECONNAISSANCE SURVEY SECTIONS

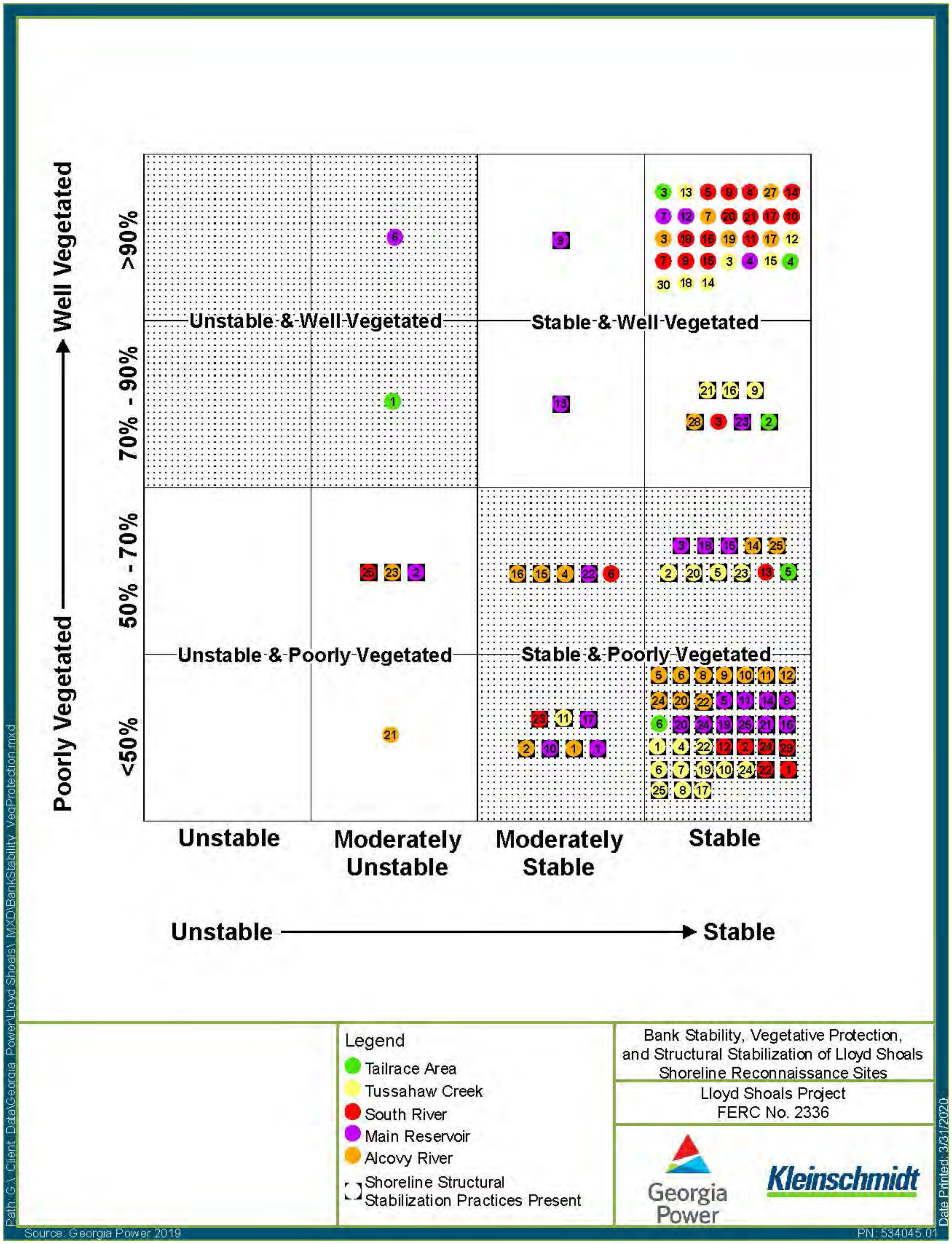

FIGURE 8 **BANK STABILITY, VEGETATIVE PROTECTION, AND STRUCTURAL STABILIZATION OF SHORELINE RECONNAISSANCE SURVEY SECTIONS**

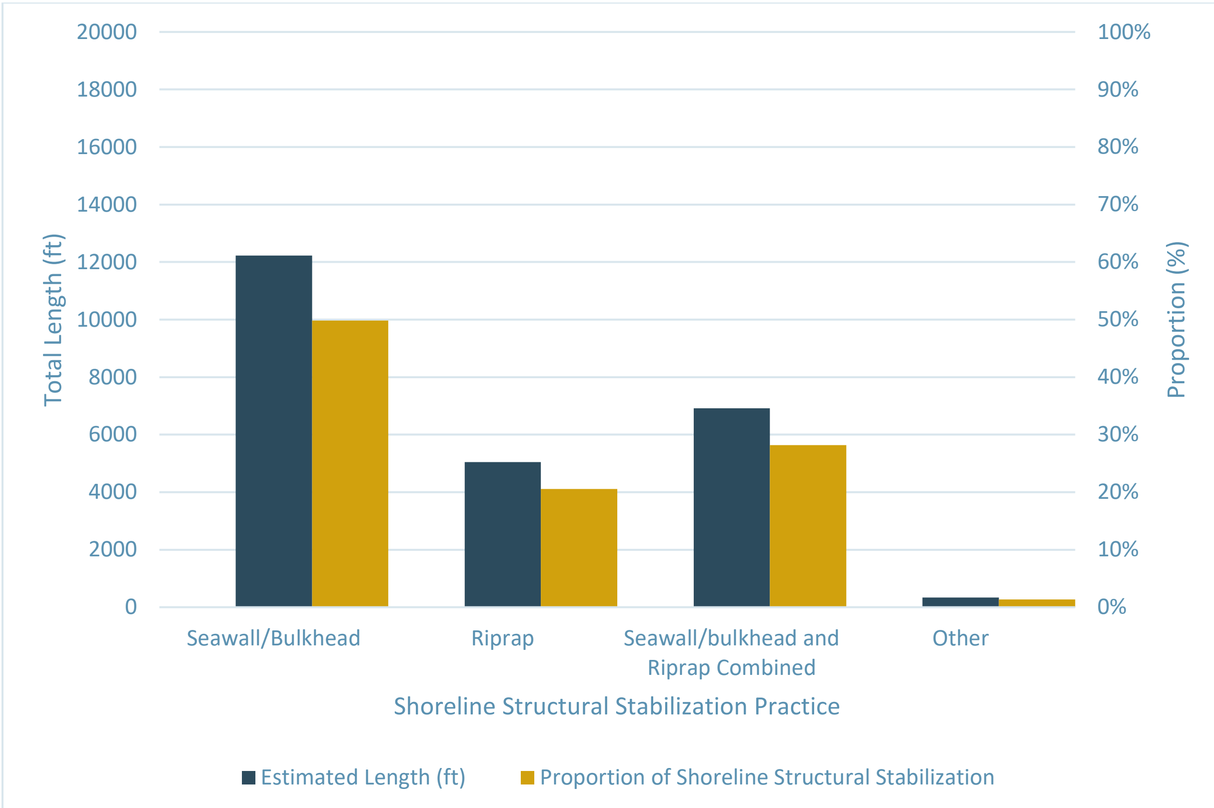

FIGURE 9 **PROPORTIONAL REPRESENTATION OF SHORELINE STRUCTURAL STABILIZATION PRACTICES**

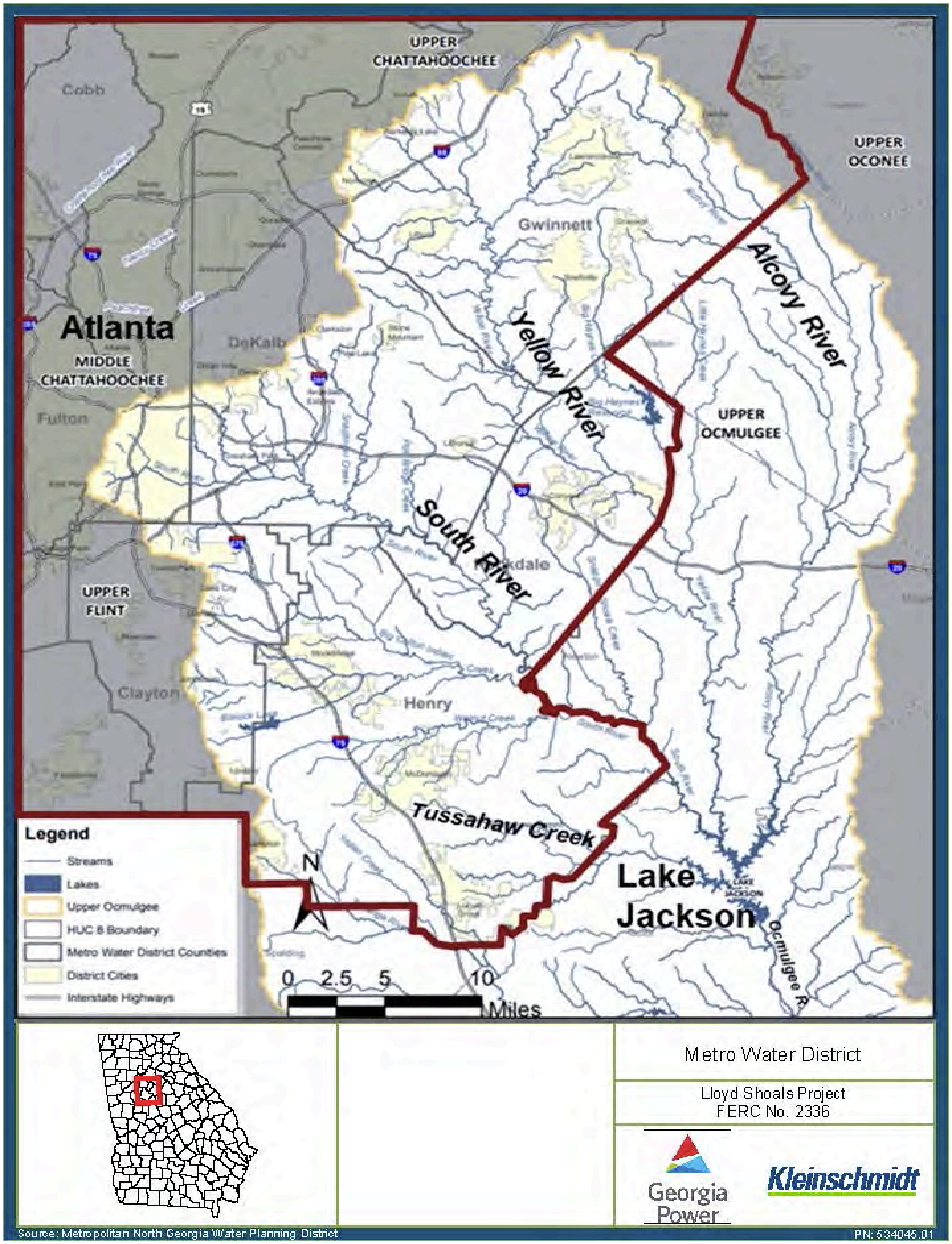

FIGURE 10 METRO WATER DISTRICT

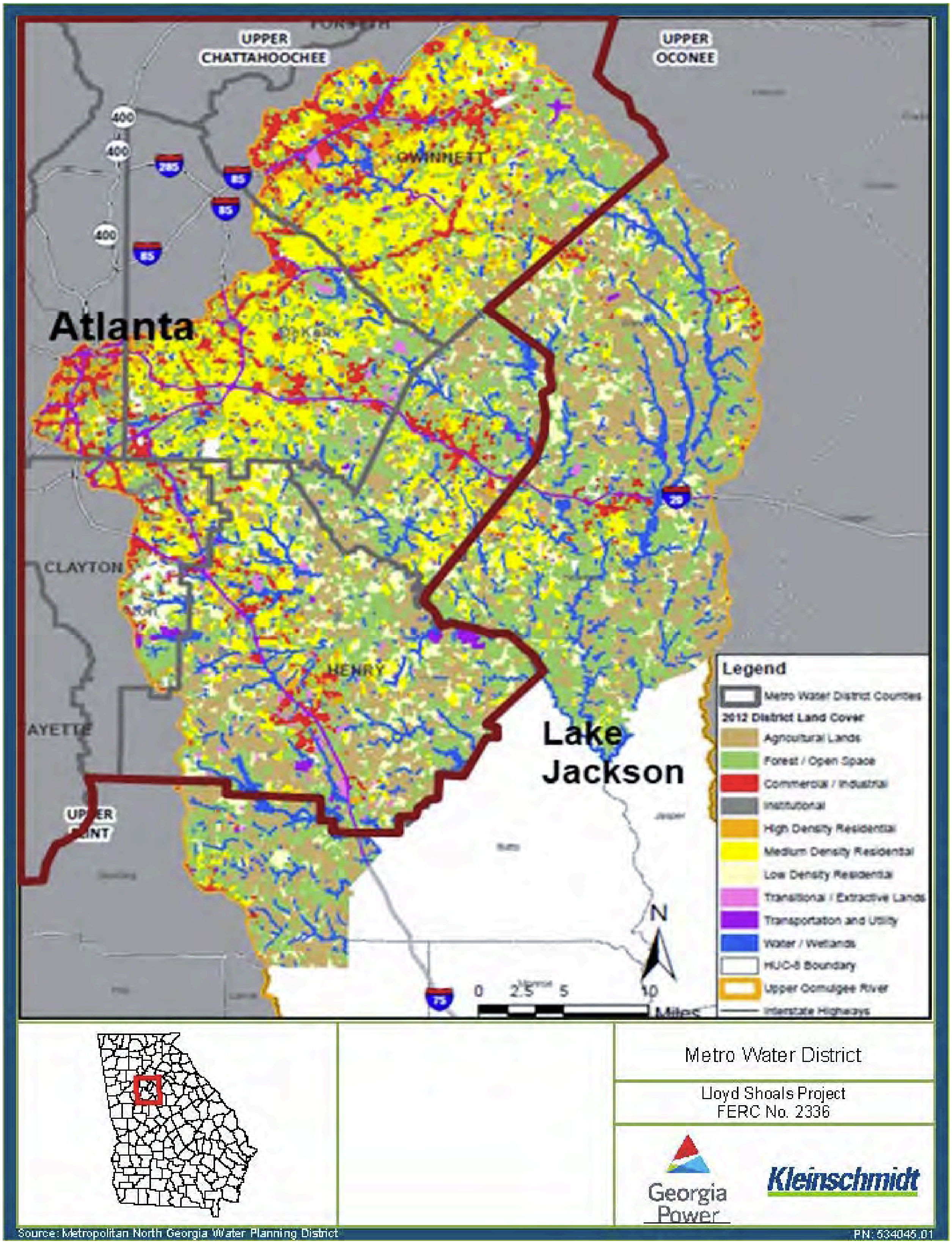

FIGURE 11 METRO WATER DISTRICT LAND COVER

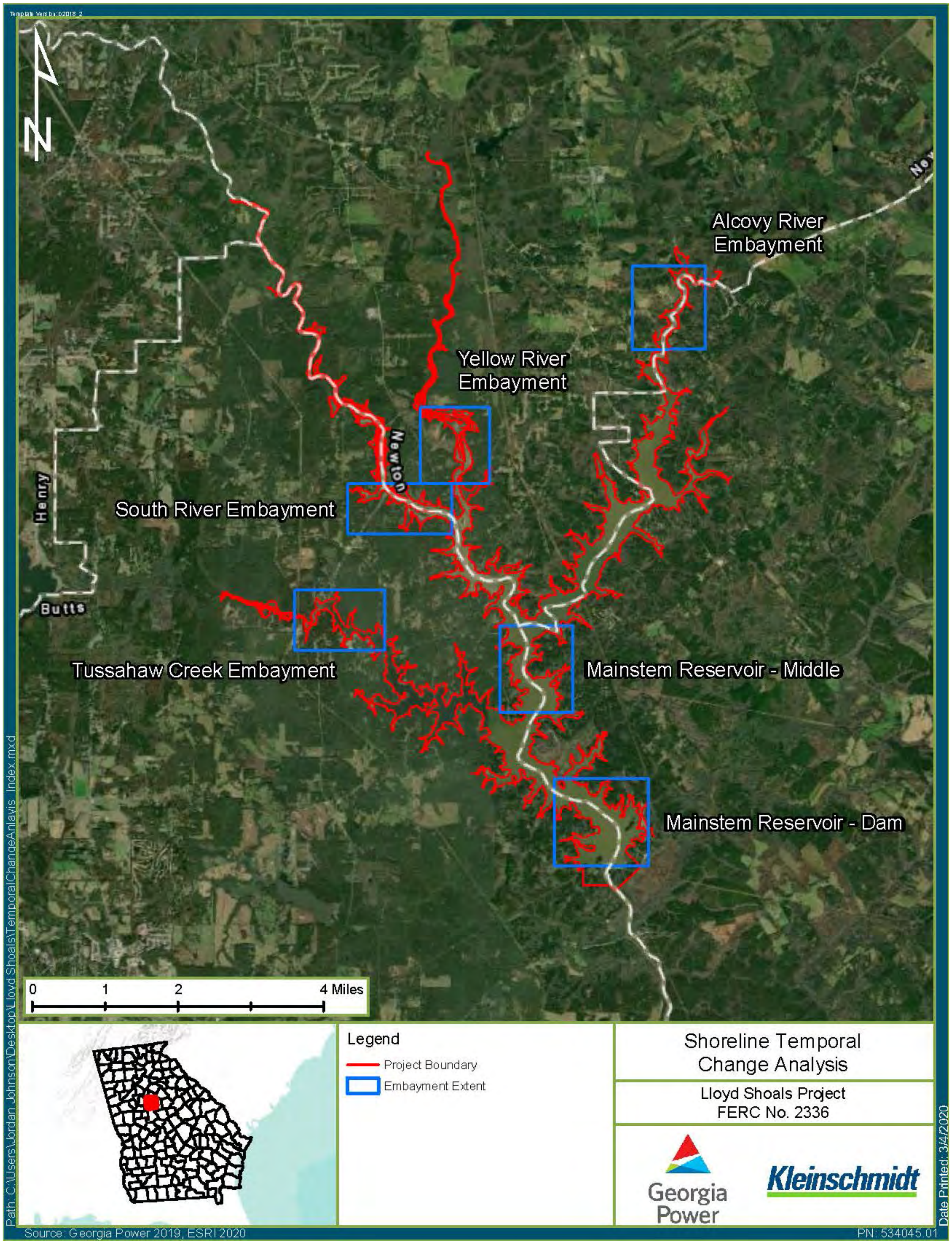

FIGURE 12 SHORELINE TEMPORAL CHANGE ANALYSIS INDEX

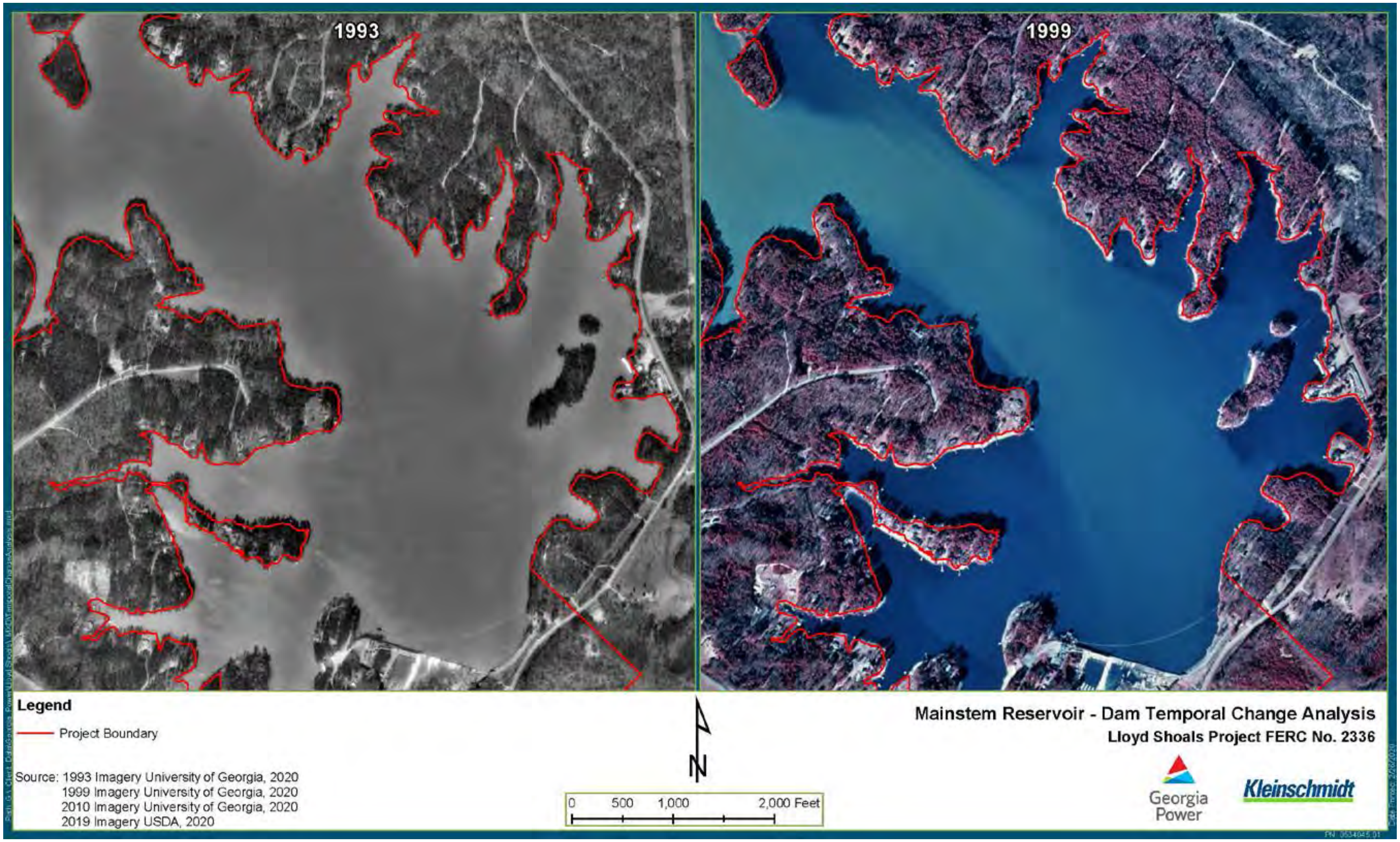

FIGURE 13 SHORELINE TEMPORAL CHANGE ANALYSIS MAINSTEM RESERVOIR - DAM

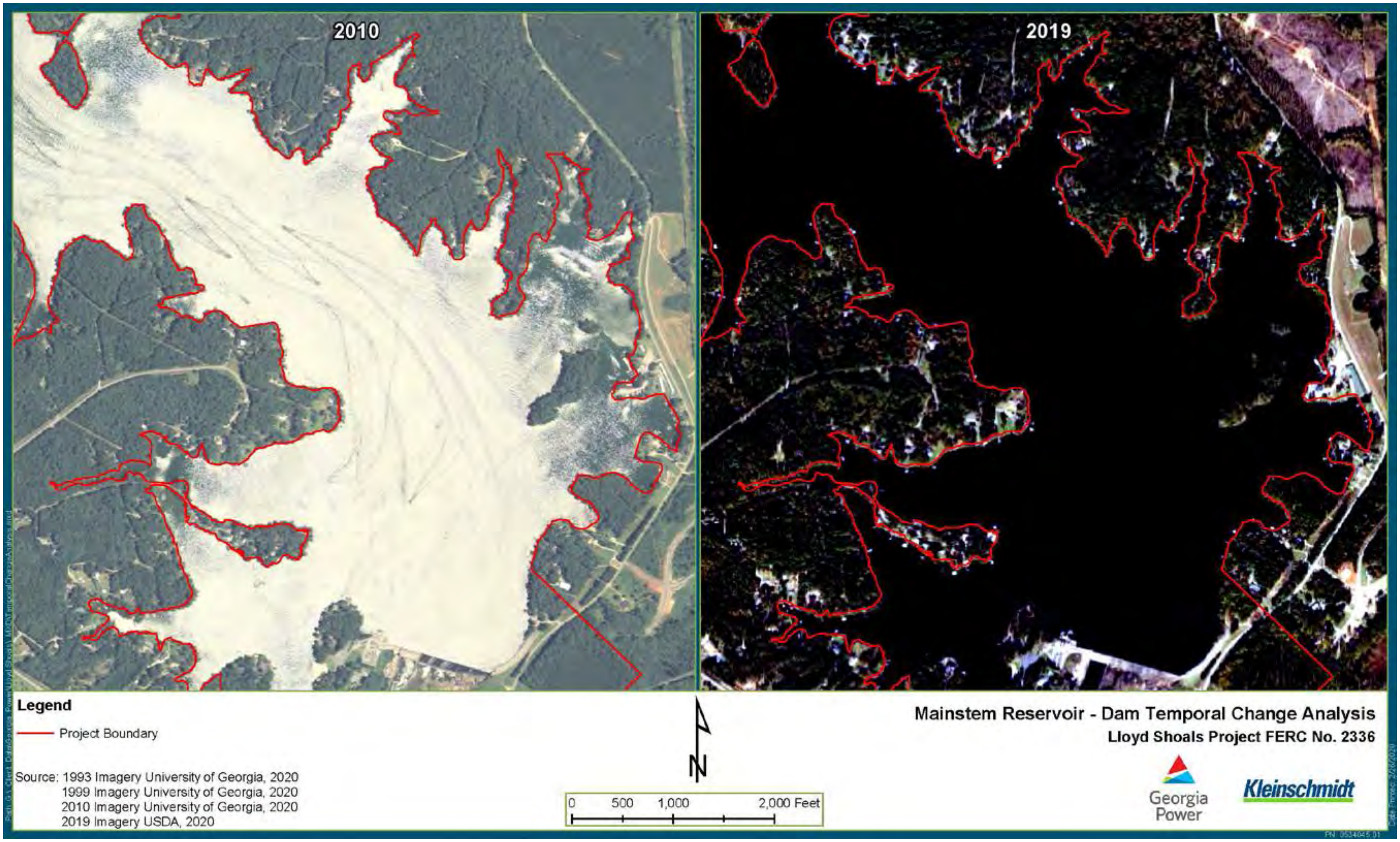

FIGURE 14 SHORELINE TEMPORAL CHANGE ANALYSIS MAINSTEM RESERVOIR – DAM

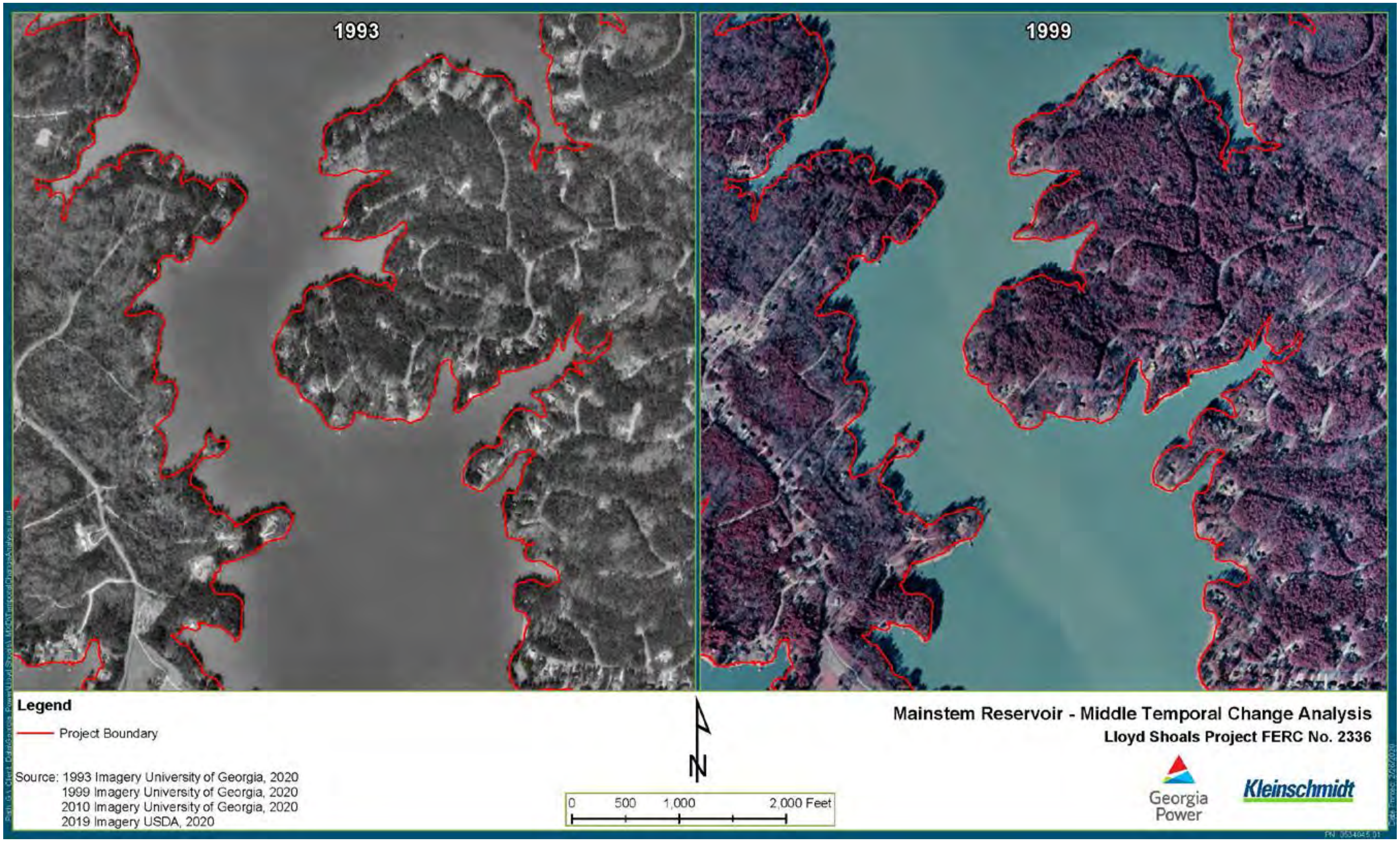

FIGURE 15 SHORELINE TEMPORAL CHANGE ANALYSIS MAINSTEM RESERVOIR – MIDDLE

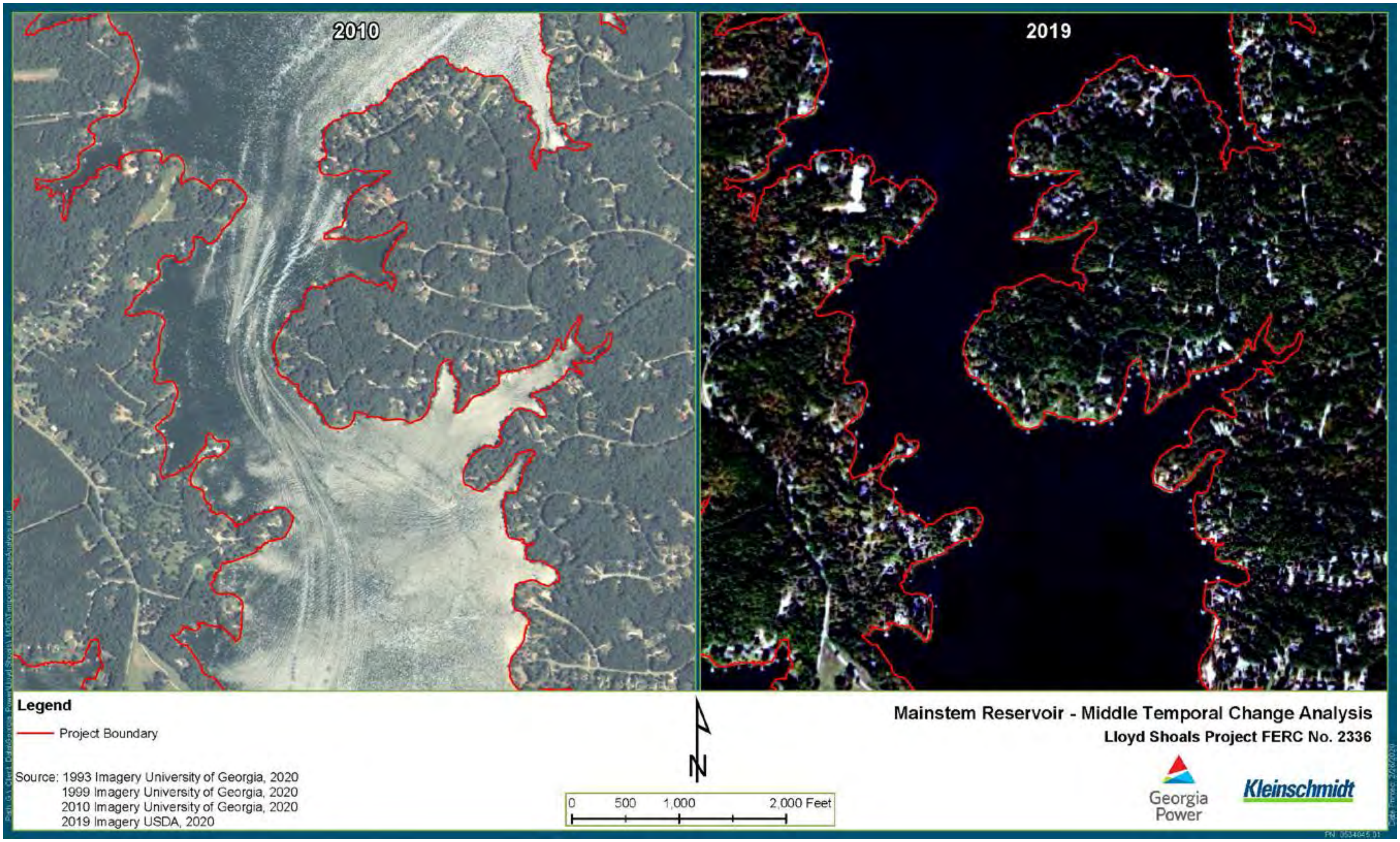

FIGURE 16 SHORELINE TEMPORAL CHANGE ANALYSIS MAINSTEM RESERVOIR – MIDDLE

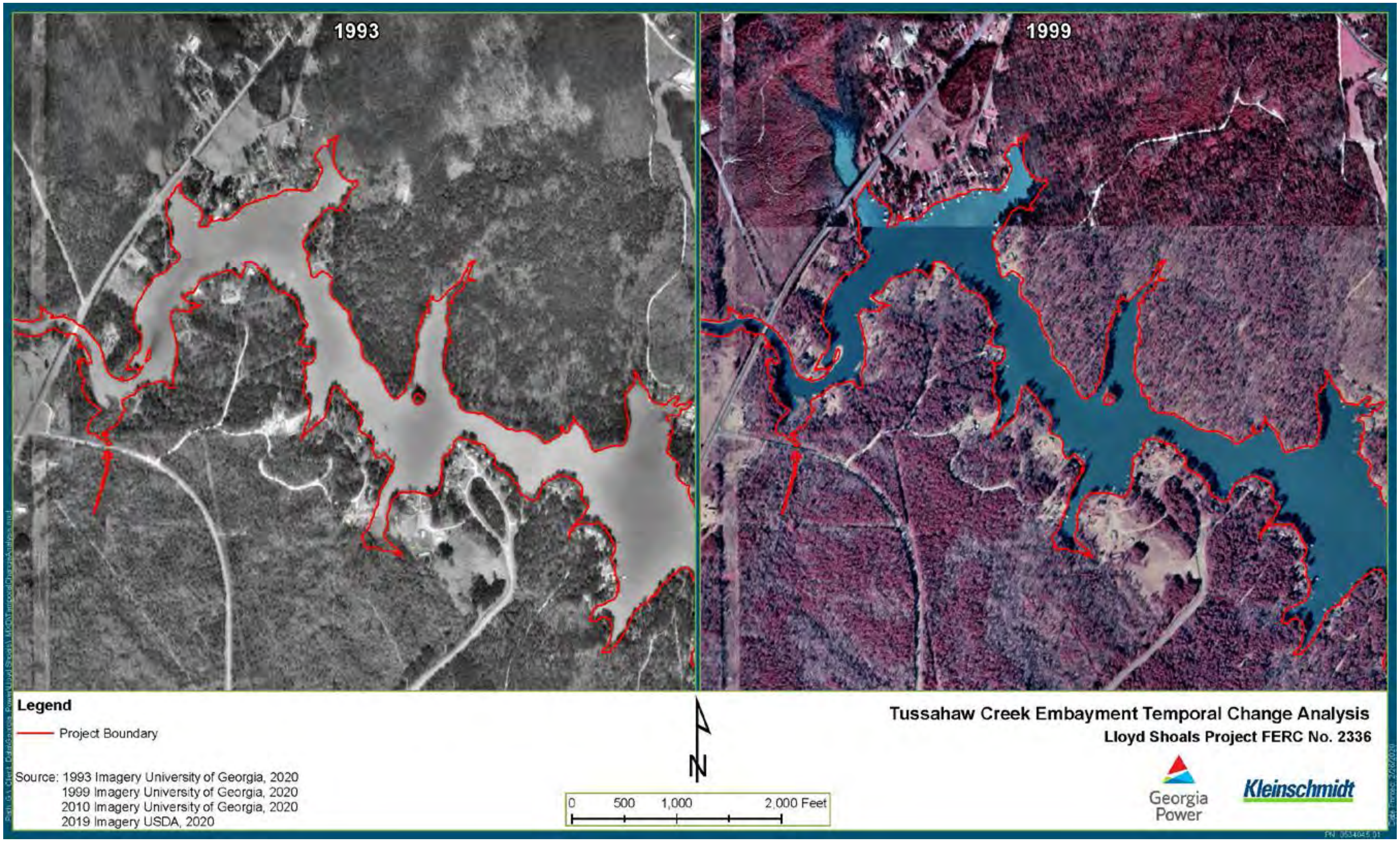

FIGURE 17 SHORELINE TEMPORAL CHANGE ANALYSIS TUSSAHAW CREEK

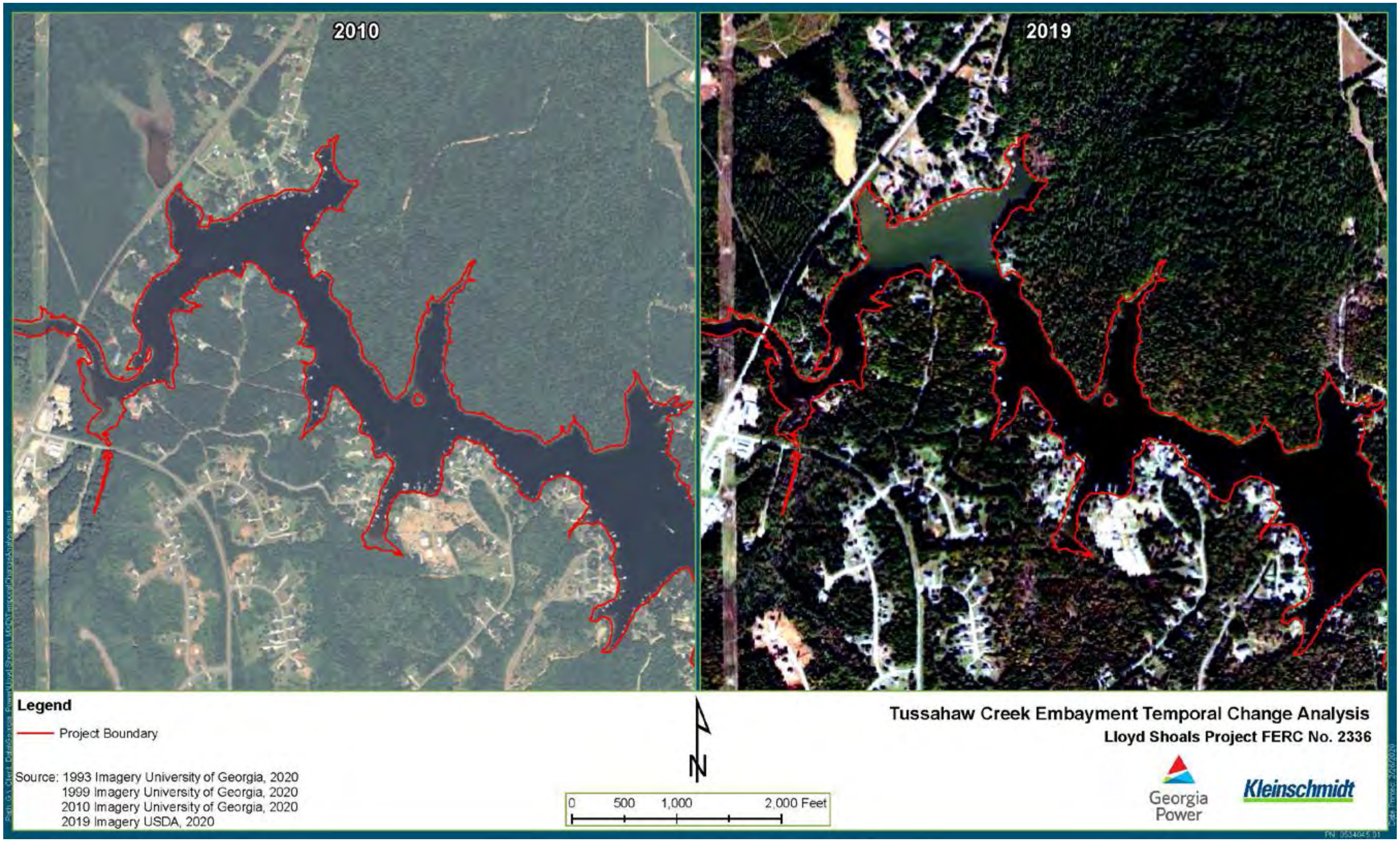

FIGURE 18 SHORELINE TEMPORAL CHANGE ANALYSIS TUSSAHAW CREEK

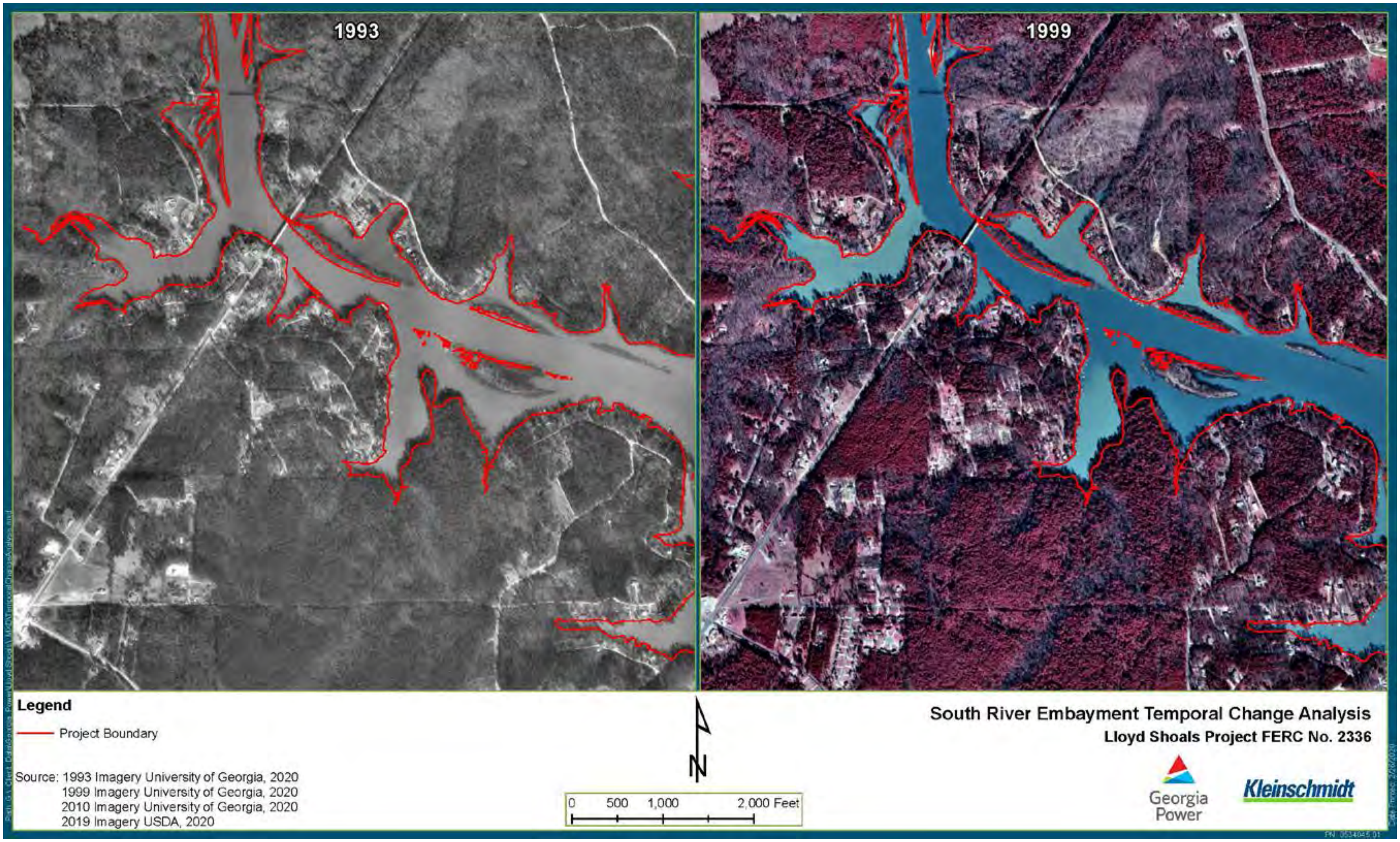

FIGURE 19 SHORELINE TEMPORAL CHANGE ANALYSIS SOUTH RIVER

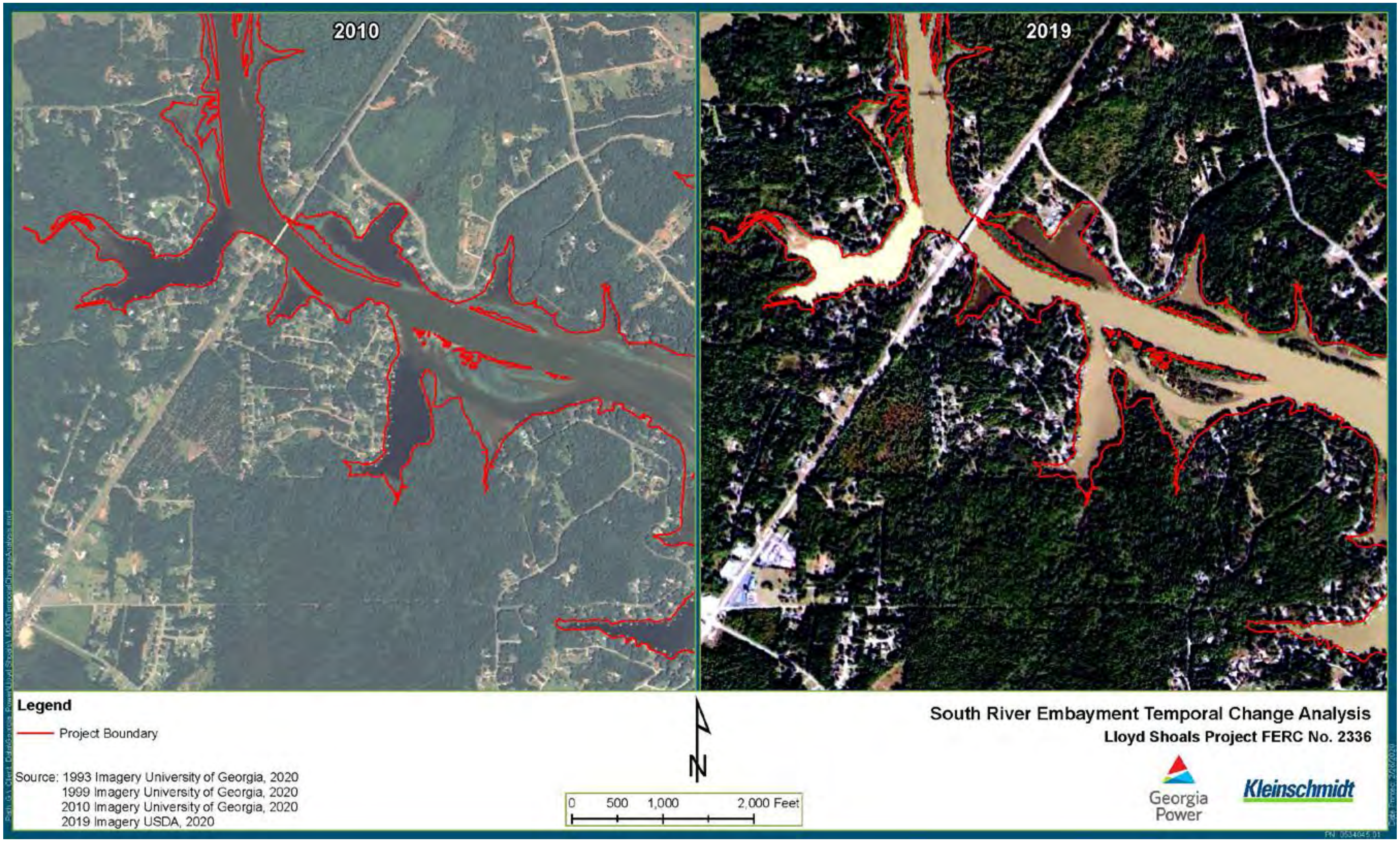

FIGURE 20 SHORELINE TEMPORAL CHANGE ANALYSIS SOUTH RIVER

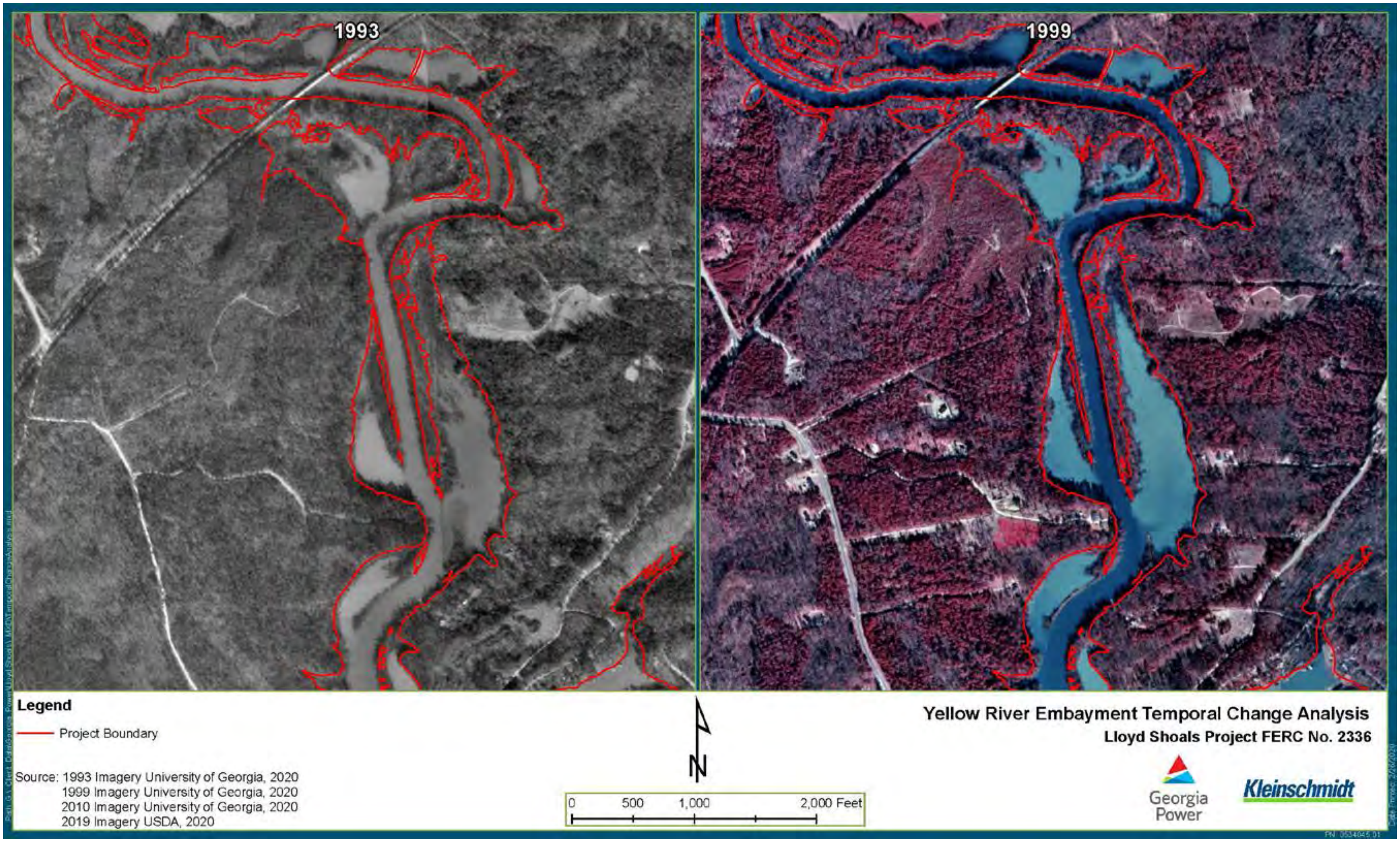

FIGURE 21 SHORELINE TEMPORAL CHANGE ANALYSIS YELLOW RIVER

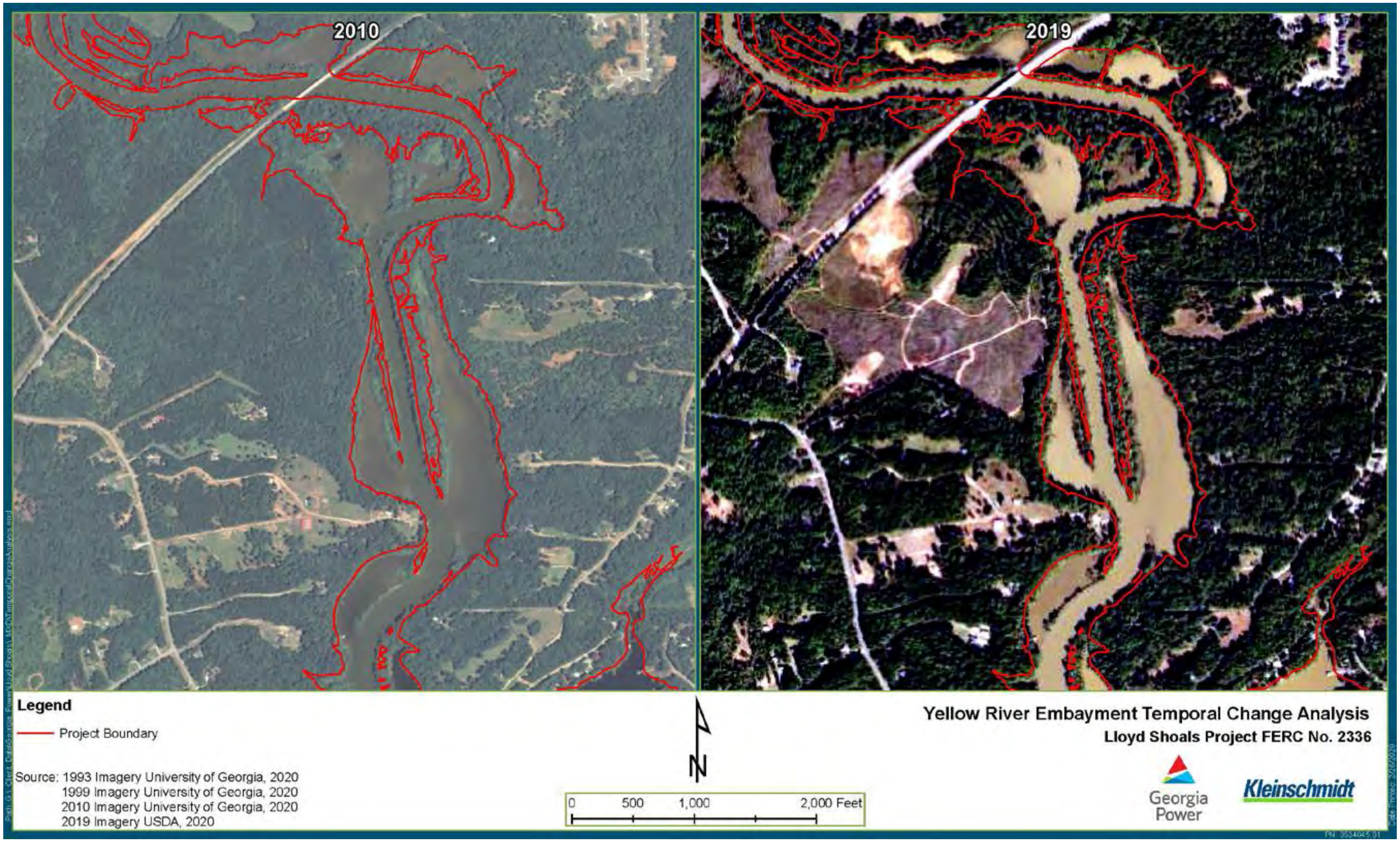

FIGURE 22 SHORELINE TEMPORAL CHANGE ANALYSIS YELLOW RIVER

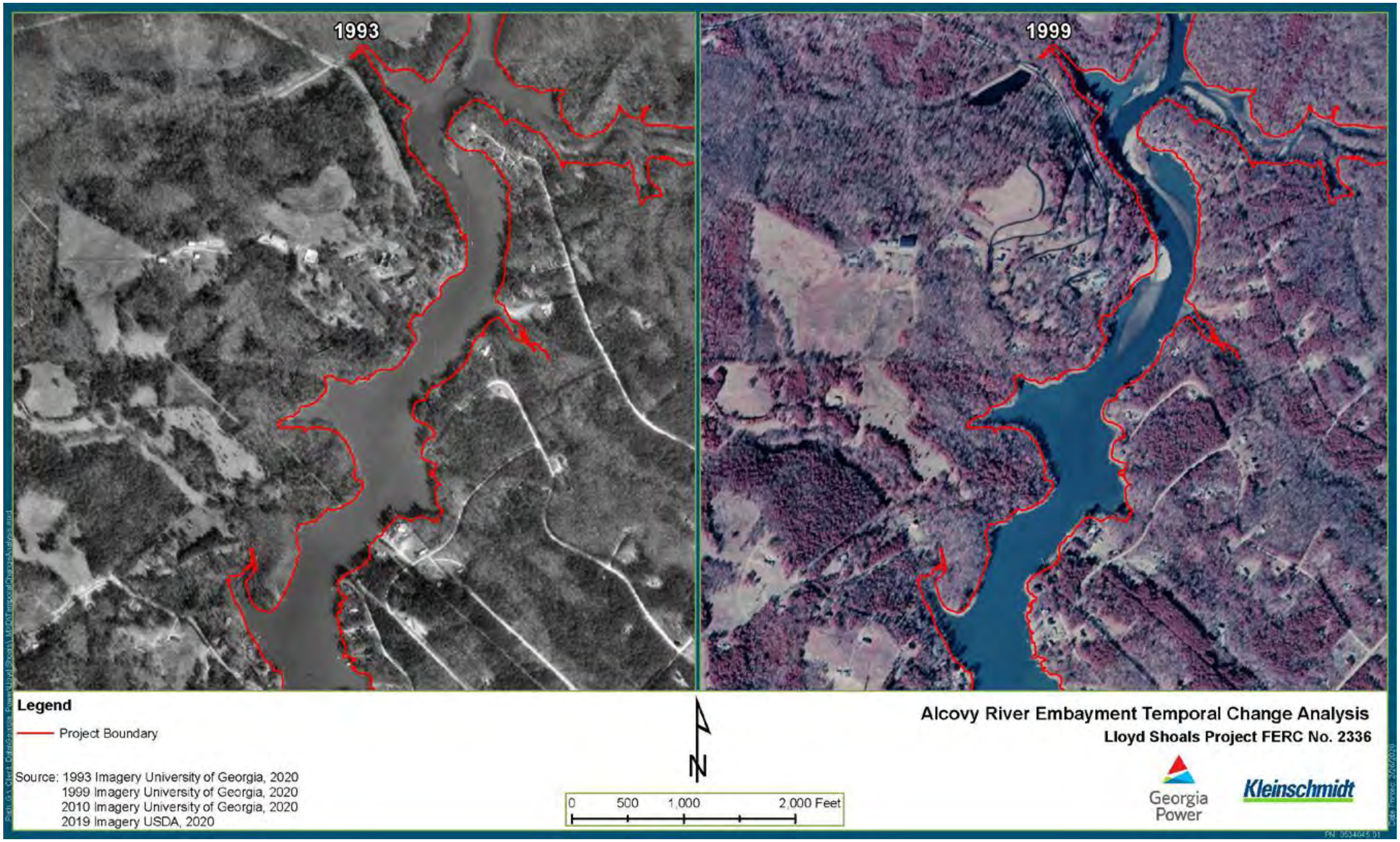

FIGURE 23 SHORELINE TEMPORAL CHANGE ANALYSIS ALCOVY RIVER

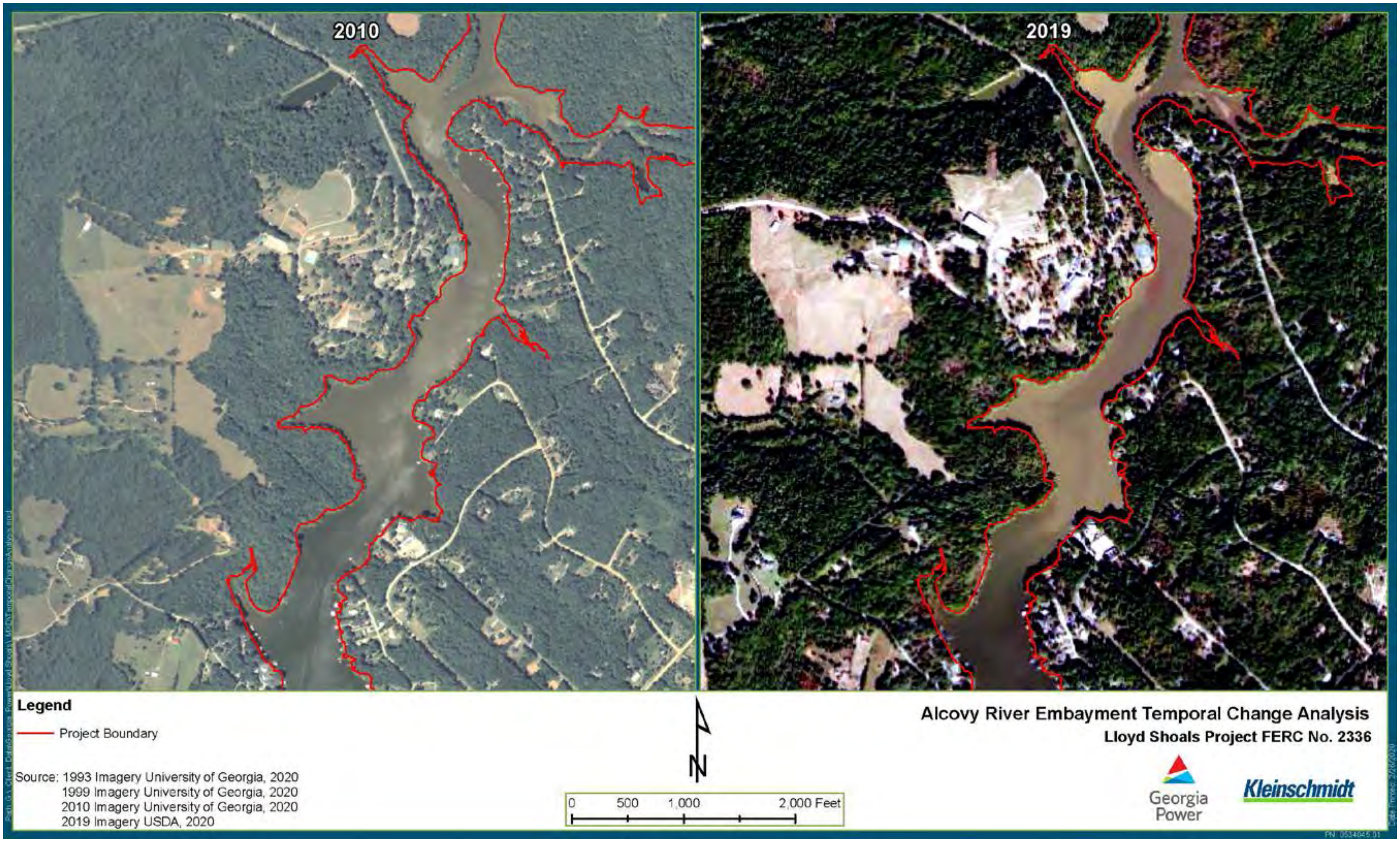

FIGURE 24 SHORELINE TEMPORAL CHANGE ANALYSIS ALCOVY RIVER

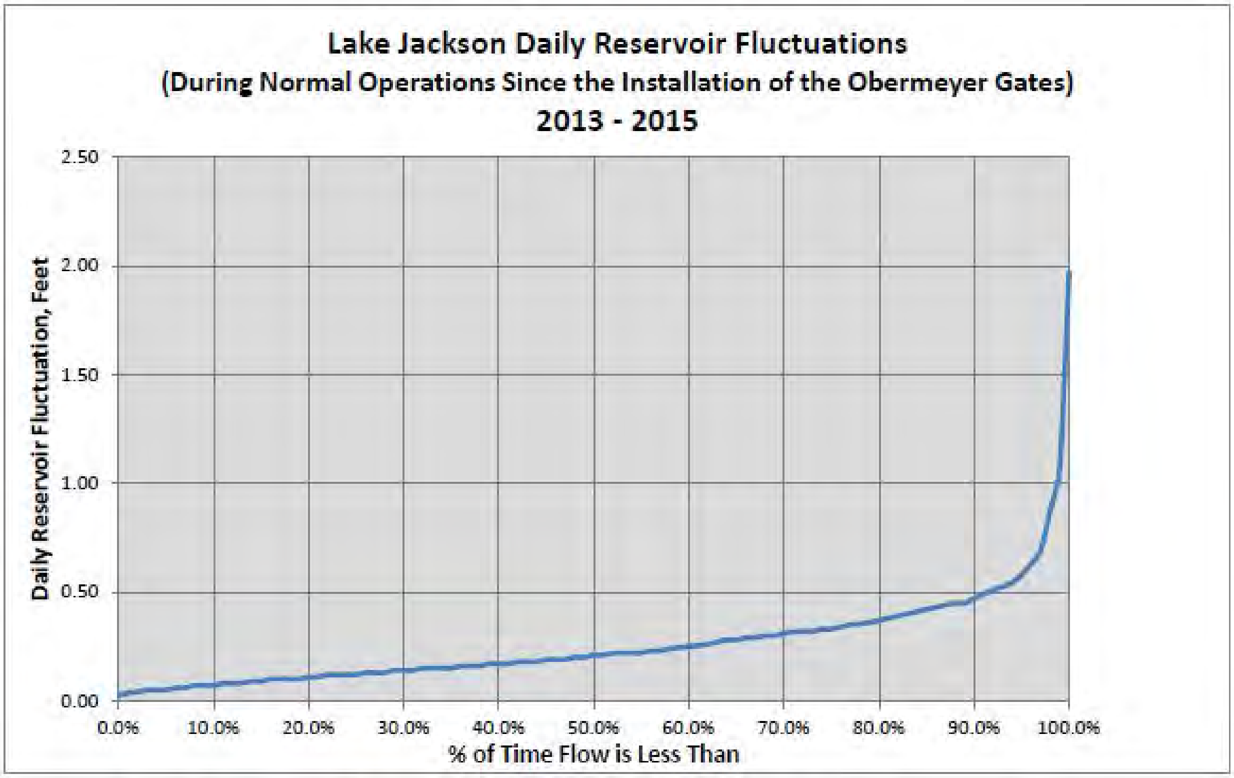

FIGURE 25 LAKE JACKSON DAILY RESERVOIR FLUCTUATION

APPENDIX A

SHORELINE RECONNAISSANCE SURVEY FORMS

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR1	**Date:** 8/1/19	**Time:** 3:09
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet	**Active Erosion Problem Present?:** _X_Yes ___No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	_X_Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

_X_Residential	_X_Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	____Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	_X_Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	_X_<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? _X_Yes ____No **(check all that apply):**

_X_Seawall/bulkhead only (_90_% of site)	____Seawall/bulkhead and riprap combined (_____% of site)
____Riprap or other large stone only (_____% of site)	____Other armoring: ______________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	_X_Residential landscape	____Reservoir fluctuations	_X_Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

_X_Docks/piers/boatslips (_5_% of shoreline length)	_X_Overhanging vegetation (_10_% of shoreline length)
JP ____Riprap (_____% of shoreline length)	_X_Large woody debris (_2_% of shoreline length)
_X_Bedrock and boulders (_10_% of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 2	**Date:** 8/1/19	**Time:** 3:16
Waterbody: ___Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton	**GPS?:** ___Yes ___No
Site Description:		
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Weather:	**Photos Taken?:** ✓ Yes ___No	
Investigators:		

Length of Assessment Site: X 500 feet ___Other:___feet	**Active Erosion Problem Present?:** X Yes ___No

Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	X Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	___Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

			___Open	___Transportation
X Residential	___Forested	___Golf Course	___Logging	___Other: ___
___Recreation/access	___Agricultural	___Commercial		

Bank Stability:	___Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	X Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	X <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? X Yes ___No **(check all that apply):**

___Seawall/bulkhead only (___% of site)	___Seawall/bulkhead and riprap combined (___% of site)
X Riprap or other large stone only (80% of site)	___Other armoring: ___ (___% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

		___Reservoir fluctuations	X Wave action from watercraft/wind
___Land-disturbing activity	___Residential landscape	___Lack of buffer vegetation	___Tributary inflow
___Impervious surfaces	___Roads and bridges	___Livestock activity	___Other: ___
___Stormwater runoff	___Recreation/access		

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

X Docks/piers/boatslips (5% of shoreline length)	X Overhanging vegetation (5% of shoreline length)
X Riprap (80% of shoreline length)	___Large woody debris (___% of shoreline length)
___Bedrock and boulders (___% of shoreline length)	___Standing timber (___% of shoreline length)
___Emergent vegetation (___% of shoreline length)	___Other: ___ (___% of shoreline length)
___Submersed vegetation (___% of shoreline length)	___Other: ___ (___% of shoreline length)

Other Observations and Aquatic Habitat Notes:

erosion behind riprap

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR3	**Date:** 8/1/19	**Time:** 3:24
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes X No
Shoreline Vegetative Buffer Zone Condition:	X Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

____Residential	X Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: __________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	X >90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes X No **(check all that apply):**

____Seawall/bulkhead only (_____% of site)	____Seawall/bulkhead and riprap combined (_____% of site)
____Riprap or other large stone only (_____% of site)	____Other armoring: __________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: __________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (_____% of shoreline length)	X Overhanging vegetation (90 % of shoreline length)
____Riprap (_____% of shoreline length)	X Large woody debris (10 % of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	X Standing timber (5 % of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other: __________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other: __________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 4	**Date:** 8/1/19	**Time:** 3:31
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet	**Active Erosion Problem Present?:** _X_Yes ____No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	_X_Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

_X_Residential	_X_Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	____Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	_X_Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	_X_50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? _X_Yes ____No **(check all that apply):**

_X_Seawall/bulkhead only (_70_% of site)	____Seawall/bulkhead and riprap combined (_____% of site)
____Riprap or other large stone only (_____% of site)	____Other armoring: ______________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	_X_Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	_X_Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

_X_Docks/piers/boatslips (_5_% of shoreline length)	_X_Overhanging vegetation (_15_% of shoreline length)
____Riprap (_____% of shoreline length)	____Large woody debris (_____% of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 5	**Date:** 8/1/19	**Time:** 3:35
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: ____500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes X No	
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	X Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
X Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	X <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? X Yes ____No **(check all that apply):**			
X Seawall/bulkhead only (90 % of site)		X Seawall/bulkhead and riprap combined (5 % of site)	
____Riprap or other large stone only (______% of site)		____Other armoring: ______________ (______% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
X Docks/piers/boatslips (5 % of shoreline length)	X Overhanging vegetation (2 % of shoreline length)
____Riprap (______% of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 6	**Date:** 8/1/19	**Time:** 3:41
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes X No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	X Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

X Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	X <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? X Yes ____No **(check all that apply):**

X Seawall/bulkhead only (80 % of site)	X Seawall/bulkhead and riprap combined (20 % of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

X Docks/piers/boatslips (5 % of shoreline length)	____Overhanging vegetation (______% of shoreline length)
X Riprap (20 % of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 7		**Date:** 8/1/19	**Time:** 3:51
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton		
Site Description:			**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other			
Weather:		**Reservoir Pool Level:** ___Full ___Medium ✓ ___Low	
Investigators:			**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes X No	
Shoreline Vegetative Buffer Zone Condition:	X Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
X Residential	X Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	X >90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes X No **(check all that apply):**			
____Seawall/bulkhead only (______% of site)		____Seawall/bulkhead and riprap combined (______% of site)	
____Riprap or other large stone only (______% of site)		____Other armoring: ____________ (______% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
X Docks/piers/boatslips (10 85 % of shoreline length)	X Overhanging vegetation (30 % of shoreline length)
____Riprap (______% of shoreline length)	X Large woody debris (5 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 8 8		**Date:** 8/1/19	**Time:** 3:56
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton		
Site Description:			**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other			
Weather:		**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:			**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes _X_No	
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	_X_Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
_X_Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	_X_<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? _X_Yes ____No **(check all that apply):**			
____Seawall/bulkhead only (______% of site)		_X_Seawall/bulkhead and riprap combined (_65_% of site)	
_X_Riprap or other large stone only (_25_% of site)		____Other armoring: ______________ (______% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
_X_Docks/piers/boatslips (_10_% of shoreline length)	_X_Overhanging vegetation (_5_% of shoreline length)
_X_Riprap (_85_% of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 9	**Date:** 8/1/19	**Time:**
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** _✓_Yes ___No

Length of Assessment Site: _✓_500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes _X_No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	_X_Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

_X_Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	_X_<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes ____No **(check all that apply):**

_X_Seawall/bulkhead only (_70_% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	_X_Other armoring: Beach (_20_% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

_X_Docks/piers/boatslips (_15_% of shoreline length)	____Overhanging vegetation (______% of shoreline length)
____Riprap (______% of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	_X_Standing timber (_5_% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

20% beach

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR10	**Date:** 8/1/19	**Time:** 6:15
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes X No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	X Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

X Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	X <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? X Yes ____No **(check all that apply):**

X Seawall/bulkhead only (85 % of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

X Docks/piers/boatslips (10 % of shoreline length)	X Overhanging vegetation (5 % of shoreline length)
X Riprap (5 % of shoreline length)	X Large woody debris (2 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 11	**Date:** 8/1/19	**Time:** 6:09
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet	**Active Erosion Problem Present?:** X Yes ____No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	X <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? X Yes ____No **(check all that apply):**

X Seawall/bulkhead only (85 % of site)	____Seawall/bulkhead and riprap combined (_____% of site)
____Riprap or other large stone only (_____% of site)	____Other armoring: ________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓ Residential landscape	____Reservoir fluctuations	✓ Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

X Docks/piers/boatslips (5 % of shoreline length)	X Overhanging vegetation (3 % of shoreline length)
____Riprap (_____% of shoreline length)	____Large woody debris (_____% of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 12	**Date:** 8/1/19	**Time:** 5:16
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet	**Active Erosion Problem Present?:** X Yes ____No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	X Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

X Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	X <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? X Yes ____No **(check all that apply):**

X Seawall/bulkhead only (10 % of site)	____Seawall/bulkhead and riprap combined (______% of site)
X Riprap or other large stone only (10 % of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	X Residential landscape	X Reservoir fluctuations	X Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

X Docks/piers/boatslips (10 % of shoreline length)	X Overhanging vegetation (3 % of shoreline length)
X Riprap (10 % of shoreline length)	____Large woody debris (______% of shoreline length)
X Bedrock and boulders (15 % of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AK 14	**Date:** 8/1/19	**Time:** 6:26
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet	**Active Erosion Problem Present?** ____Yes _X_No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	_X_Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

_X_Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	_X_50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? _X_Yes ____No **(check all that apply):**

_X_Seawall/bulkhead only (_60_% of site)	____Seawall/bulkhead and riprap combined (______% of site)
_X_Riprap or other large stone only (_3_% of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	_✓_Residential landscape	____Reservoir fluctuations	_✓_Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

_X_Docks/piers/boatslips (_15_% of shoreline length)	_X_Overhanging vegetation (_10_% of shoreline length)
_X_Riprap (_3_% of shoreline length)	____Large woody debris (______% of shoreline length)
_X_Bedrock and boulders (_3_% of shoreline length)	_X_Standing timber (_5_% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR-15 | **Date:** 8/1/19 | **Time:** ~~8~~18:09

Waterbody: ✓ Lake Jackson ___Tailrace | **County:** ___Butts ___Henry ___Jasper ___Newton

Site Description: | **GPS?:** ___Yes ✓ No

Adjacent Land Ownership: ___GPC ✓ Residential ___Commercial ___Other

Weather: Cloudy 88 | **Reservoir Pool Level:** ✓ Full ___Medium ___Low

Investigators: NSH, SL, Dodd | **Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:___feet | **Active Erosion Problem Present?:** ✓ Yes ___No *

Shoreline Vegetative Buffer Zone Condition:
- ___Natural: heavily vegetated, less than 20 percent of natural vegetation removed
- ✓ Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
- ___Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ______

Bank Stability:
- ___Stable; minimal erosion; <5% affected by erosion; low potential for future problems
- ✓ Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
- ___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
- ___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident

Bank Vegetative Protection:
- ___>90% of bank surfaces covered by healthy, living vegetation
- ___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
- ✓ 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
- ___<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ~~No~~ **(check all that apply):**

___Seawall/bulkhead only (______% of site)	✓ Seawall/bulkhead and riprap combined (40 % of site)
✓ Riprap or other large stone only (30 % of site)	✓ Other armoring: boat ramp (5 % of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	✓ Residential landscape	✓ Reservoir fluctuations	✓ Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ______

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (10 % of shoreline length)	✓ Overhanging vegetation (20 % of shoreline length)
✓ Riprap (70 % of shoreline length)	✓ Large woody debris (5 % of shoreline length)
✓ Bedrock and boulders (25 % of shoreline length)	___Standing timber (______% of shoreline length)
___Emergent vegetation (______% of shoreline length)	___Other: ______ (______% of shoreline length)
___Submersed vegetation (______% of shoreline length)	___Other: ______ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes: * 5% severe bank erosion

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR-16	**Date:** 8/1/19	**Time:** 18:19
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Cloudy 88°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: nsh, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet

Active Erosion Problem Present?: ____Yes ✓ No

Shoreline Vegetative Buffer Zone Condition:
- ____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
- ✓ Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
- ____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:
- ____Stable; minimal erosion; <5% affected by erosion; low potential for future problems
- ✓ Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
- ____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
- ____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident

Bank Vegetative Protection:
- ____>90% of bank surfaces covered by healthy, living vegetation
- ____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
- ✓ 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
- ____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes ____No **(check all that apply):**

✓ Seawall/bulkhead only (50 % of site)	____Seawall/bulkhead and riprap combined (_____% of site)
____Riprap or other large stone only (_____% of site)	____Other armoring: ______________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓ Residential landscape	✓ Reservoir fluctuations	✓ Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (5 % of shoreline length)	____Overhanging vegetation (_____% of shoreline length)
____Riprap (_____% of shoreline length)	X Large woody debris (0 % of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	✓ Standing timber (5 % of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR-17	**Date:** 8/1/19	**Time:** 18:28
Waterbody: _✓_Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes _✓_No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Cloudy 88°	**Reservoir Pool Level:** _✓_Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** _✓_Yes ___No

Length of Assessment Site: _✓_500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes _✓_No
Shoreline Vegetative Buffer Zone Condition:	_✓_Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

____Residential	_✓_Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	_✓_Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	_✓_>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes _✓_No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (______% of shoreline length)	_✓_Overhanging vegetation (_30_% of shoreline length)
____Riprap (______% of shoreline length)	_✓_Large woody debris (_10_% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
_✓_Emergent vegetation (_5_% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR-19		**Date:** 8/1/19	**Time:** 18:35
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton		
Site Description:			**GPS?:** ___Yes ✓ No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other			
Weather: Cloudy 88°		**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd			**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:___feet		**Active Erosion Problem Present?:** ___Yes ✓ No		
Shoreline Vegetative Buffer Zone Condition:	✓ Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	___Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
___Residential	✓ Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ______

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	✓ >90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	___<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ___Yes ✓ No **(check all that apply):**			
___Seawall/bulkhead only (_____% of site)		___Seawall/bulkhead and riprap combined (_____% of site)	
___Riprap or other large stone only (_____% of site)		___Other armoring: ______ (_____% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
___Land-disturbing activity	___Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ______

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
___Docks/piers/boatslips (_____% of shoreline length)	✓ Overhanging vegetation (5 % of shoreline length)
___Riprap (_____% of shoreline length)	___Large woody debris (_____% of shoreline length)
___Bedrock and boulders (_____% of shoreline length)	___Standing timber (_____% of shoreline length)
✓ Emergent vegetation (100 % of shoreline length)	___Other: ______ (_____% of shoreline length)
___Submersed vegetation (_____% of shoreline length)	___Other: ______ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR20	**Date:** 8/1/19	**Time:** 6:40
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** X Yes ____No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	✓ Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	X <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? X Yes ____No **(check all that apply):**

X Seawall/bulkhead only (85 % of site)	____Seawall/bulkhead and riprap combined (______% of site)
X Riprap or other large stone only (10 % of site)	____Other armoring: ______________ (______% of site)

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Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	✓ Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (10 % of shoreline length)	____Overhanging vegetation (______% of shoreline length)
✓ Riprap (10 % of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 21	**Date:** 8/1/19	**Time:** 6:48
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: ___500 feet ____Other:____feet	**Active Erosion Problem Present?:** X Yes ____No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	____Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	✓ Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	✓ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes X No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	X Residential landscape	____Reservoir fluctuations	X Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
X Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

X Docks/piers/boatslips (5 % of shoreline length)	X Overhanging vegetation (15 % of shoreline length)
____Riprap (______% of shoreline length)	X Large woody debris (25 % of shoreline length)
X Bedrock and boulders (2 % of shoreline length)	X Standing timber (1 % of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 22	**Date:** 8/1/19	**Time:** 4:05
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes X No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	X Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

X Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	X <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? X Yes ____No **(check all that apply):**

X Seawall/bulkhead only (95 % of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

X Docks/piers/boatslips (15 % of shoreline length)	X Overhanging vegetation (5 % of shoreline length)
____Riprap (______% of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 23	**Date:** 8/1/19	**Time:** 4:10
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet	**Active Erosion Problem Present?:** X Yes ____No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	X Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

X Residential	____Forested	____Golf Course	____Open	____Transportation
X Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	____Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	X Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	X 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? X Yes ____No **(check all that apply):**

X Seawall/bulkhead only (5 % of site)	____Seawall/bulkhead and riprap combined (______% of site)
X Riprap or other large stone only (10 % of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	X Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

X Docks/piers/boatslips (5 % of shoreline length)	X Overhanging vegetation (20 % of shoreline length)
X Riprap (10 % of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 24	**Date:** 8/1/19	**Time:** 4:15
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes X No	
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	X Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
X Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	X <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? X Yes ____No **(check all that apply):** JD			
X Seawall/bulkhead only (85 % of site)		____Seawall/bulkhead and riprap combined (~~85~~ % of site)	
X Riprap or other large stone only (15 % of site)		____Other armoring: ________ (_____% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	X Residential landscape	____Reservoir fluctuations	X Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
X Docks/piers/boatslips (15 % of shoreline length)	X Overhanging vegetation (5 % of shoreline length)
X Riprap (15 % of shoreline length)	____Large woody debris (_____% of shoreline length)
X Bedrock and boulders (20 % of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 25	**Date:** 8/1/19	**Time:** 4:21
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes X No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	X Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

X Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	X 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
SD	~~X~~ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? X Yes ____No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	X Seawall/bulkhead and riprap combined (40 % of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

X Docks/piers/boatslips (10 % of shoreline length)	X Overhanging vegetation (25 % of shoreline length)
X Riprap (40 % of shoreline length)	____Large woody debris (______% of shoreline length)
X Bedrock and boulders (5 % of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other: ________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other: ________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR 27	**Date:** 8/1/19	**Time:** 5:46
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ____No

Shoreline Vegetative Buffer Zone Condition:	_X_Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

____Residential	_X_Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	_X_>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes _X_No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (______% of shoreline length)	_X_Overhanging vegetation (_20_% of shoreline length)
____Riprap (______% of shoreline length)	_X_Large woody debris (_10_% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	_X_Standing timber (_20_% of shoreline length)
_X_Emergent vegetation (_30_% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: AR-28	**Date:** 08/1/19	**Time:** 18:38
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ✓No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Cloudy 88°	**Reservoir Pool Level:** ✓Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓Yes ___No

Length of Assessment Site: ✓500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes ✓No	
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	✓Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
✓Residential	✓Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	✓Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation		
	✓70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? ✓Yes ____No **(check all that apply):**			
____Seawall/bulkhead only (______% of site)		____Seawall/bulkhead and riprap combined (______% of site)	
✓Riprap or other large stone only (10 % of site)		____Other armoring: ______________ (______% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	✓Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
✓Docks/piers/boatslips (10 % of shoreline length)	✓Overhanging vegetation (01 % of shoreline length)
✓Riprap (10 % of shoreline length)	✓Large woody debris (5 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
✓Emergent vegetation (10 % of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-01	**Date:** 8/1/19	**Time:** 15:12
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton	
Site Description: recreation area. subdivision?		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: Partly cloudy, 90°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	___Forested	___Golf Course	___Open	___Transportation
✓ Recreation/access	___Agricultural	___Commercial	___Logging	✓ Other: beach

Bank Stability:	___Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	✓ Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	✓ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ___No **(check all that apply):**

___Seawall/bulkhead only (_____% of site)	___Seawall/bulkhead and riprap combined (_____% of site)
✓ Riprap or other large stone only (60 % of site)	___Other armoring: ____________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	✓ Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	✓ Recreation/access	___Livestock activity	___Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (5 % of shoreline length)	✓ Overhanging vegetation (01 % of shoreline length)
✓ Riprap (60 % of shoreline length)	✓ Large woody debris (5 % of shoreline length)
___Bedrock and boulders (_____% of shoreline length)	___Standing timber (_____% of shoreline length)
___Emergent vegetation (_____% of shoreline length)	___Other:____________ (_____% of shoreline length)
___Submersed vegetation (_____% of shoreline length)	___Other:____________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes: 15% beach shore line

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-02	**Date:** 8/1/19	**Time:** 15:03
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton	
Site Description:		**GPS?:** ___Yes ✓ No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: Partly Cloudy 90°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	✓ Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	___Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ________

Bank Stability:	___Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	✓ Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	✓ 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	___<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ___No **(check all that apply):**

✓ 50 Seawall/bulkhead only (50 % of site)	___Seawall/bulkhead and riprap combined (_____% of site)
✓ 5 Riprap or other large stone only (5 % of site)	___Other armoring: ____________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	✓ Residential landscape	✓ Reservoir fluctuations	✓ Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (5 % of shoreline length)	✓ Overhanging vegetation (5 % of shoreline length)
✓ Riprap (5 % of shoreline length)	✓ Large woody debris (10 % of shoreline length)
___Bedrock and boulders (_____% of shoreline length)	___Standing timber (_____% of shoreline length)
___Emergent vegetation (_____% of shoreline length)	___Other:____________ (_____% of shoreline length)
___Submersed vegetation (_____% of shoreline length)	___Other:____________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)

Georgia Power Company

Site ID No.: MR-03	**Date:** 8/1/19	**Time:** 1453
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Cloudy 90°	**Reservoir Pool Level:** ✓Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓Yes ___No

Length of Assessment Site: ✓500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ✓No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	✓Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓Residential	✓Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	✓Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	✓50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓Yes ____No **(check all that apply):**

✓Seawall/bulkhead only (50 % of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	✓Other armoring: boat ramps (5 % of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓Docks/piers/boatslips (5 % of shoreline length)	✓Overhanging vegetation (5 % of shoreline length)
____Riprap (______% of shoreline length)	✓Large woody debris (5 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-04	**Date:** 8/1/19	**Time:** 14:47
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Cloudy 90°	**Reservoir Pool Level:** ✓Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓Yes ___No

Length of Assessment Site: ✓500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ____No

Shoreline Vegetative Buffer Zone Condition:	✓Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓Residential	✓Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	✓Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	✓>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes ✓No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓Residential landscape	✓Reservoir fluctuations	~~✓~~ NH Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (______% of shoreline length)	✓Overhanging vegetation (30% of shoreline length)
____Riprap (______% of shoreline length)	✓Large woody debris (20% of shoreline length)
✓Bedrock and boulders (5% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-05	**Date:** 8/1/19	**Time:** 14:44
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Cloudy 90°	**Reservoir Pool Level:** √ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd	**Photos Taken?:** √ Yes ___No	

Length of Assessment Site: √ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes √ No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	√ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

√ Residential	√ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	√ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	√ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? √ Yes ____No **(check all that apply):**

√ Seawall/bulkhead only (50% of site)	√ Seawall/bulkhead and riprap combined (50 % of site)
____Riprap or other large stone only (_____% of site)	____Other armoring: ____________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	√ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

√ Docks/piers/boatslips (5 % of shoreline length)	√ Overhanging vegetation (01 % of shoreline length)
____Riprap (_____% of shoreline length)	____Large woody debris (_____% of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-06	**Date:** 8/4/19	**Time:** 14:37
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Cloudy 90°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ✓ No

Shoreline Vegetative Buffer Zone Condition:	✓ Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

____Residential	✓ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	N ~~✓~~ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	✓ Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	✓ >90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes ✓ No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	✓ Reservoir fluctuations	✓ Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (______% of shoreline length)	✓ Overhanging vegetation (5 % of shoreline length)
____Riprap (______% of shoreline length)	✓ Large woody debris (60 % of shoreline length)
✓ Bedrock and boulders (5 % of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes: early development

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-07	**Date:** 8/1/19	**Time:** 14:30
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Sunny 90°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ✓ No

Shoreline Vegetative Buffer Zone Condition:	✓ Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

~~✓~~ Residential X (fish)	✓ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	✓ >90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes ✓ No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	✓ Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (______% of shoreline length)	✓ Overhanging vegetation (15 % of shoreline length)
____Riprap (______% of shoreline length)	✓ Large woody debris (5 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-8		**Date:** 8/1/19	**Time:** 14:29
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton		
Site Description:			**GPS?:** ___Yes ___No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other			
Weather: Sunny 90°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low		
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No	

Length of Assessment Site: ✓ 500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes ___No
Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	___Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ______

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	✓ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ___No **(check all that apply):**

✓ Seawall/bulkhead only (95 % of site)	___Seawall/bulkhead and riprap combined (_____% of site)
___Riprap or other large stone only (_____% of site)	✓ Other armoring: boat ramp (5 % of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	✓ Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ______

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (5 % of shoreline length)	___Overhanging vegetation (_____% of shoreline length)
___Riprap (_____% of shoreline length)	___Large woody debris (_____% of shoreline length)
___Bedrock and boulders (_____% of shoreline length)	___Standing timber (_____% of shoreline length)
___Emergent vegetation (_____% of shoreline length)	___Other: ______ (_____% of shoreline length)
___Submersed vegetation (_____% of shoreline length)	___Other: ______ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MB-09	**Date:** 8/1/19	**Time:** 14:17
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet		**Active Erosion Problem Present?:** ✓ Yes ____No
Shoreline Vegetative Buffer Zone Condition:	✓ Natural: heavily vegetated, less than 20 percent of natural vegetation removed	
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining	
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed	

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	____Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	✓ Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	✓ >90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ____No **(check all that apply):**

____Seawall/bulkhead only (_____% of site)	✓ Seawall/bulkhead and riprap combined (75 % of site)
✓ Riprap or other large stone only (5 % of site)	____Other armoring: ____________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓ Residential landscape	____Reservoir fluctuations	✓ Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (5 % of shoreline length)	✓ Overhanging vegetation (10 % of shoreline length)
✓ Riprap (80 % of shoreline length)	✓ Large woody debris (10 % of shoreline length)
✓ Bedrock and boulders (5 % of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-10	**Date:** 8/1/19	**Time:** 14:08
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Sunny 90°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH/SL/Dodd	**Photos Taken?:** ✓ Yes ___No	

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	____Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	✓ Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	✓ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ____No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
100 Riprap or other large stone only (✓ % of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓ Residential landscape	____Reservoir fluctuations	✓ Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (5 % of shoreline length)	____Overhanging vegetation (______% of shoreline length)
✓ Riprap (100 % of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes: bank erosion all around w/ riprap helping preventing worse erosion

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

ID No.: MR-11	**Date:** 8/1/19 **Time:** 17:26
terbody: ✓ Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton
te Description: lloyd shoals park	**GPS?:** ___Yes ✓ No
djacent Land Ownership: ___GPC ___Residential ___Commercial ___Other	
Weather: Cloudy 88°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low
Investigators: NSH, SL, Dodd	**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes ✓ No

Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

___Residential	___Forested	___Golf Course	___Open	___Transportation
✓ Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ______

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	✓ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ___No **(check all that apply):**

___Seawall/bulkhead only (______% of site)	___Seawall/bulkhead and riprap combined (______% of site)
✓ Riprap or other large stone only (100 % of site)	___Other armoring: ______ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	___Residential landscape	___Reservoir fluctuations	✓ Wave action from watercraft/wind
✓ Impervious surfaces	✓ Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	✓ Recreation/access	___Livestock activity	___Other: ______

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (5 % of shoreline length)	✓ Overhanging vegetation (<5 % of shoreline length)
✓ Riprap (100 % of shoreline length)	___Large woody debris (______% of shoreline length)
___Bedrock and boulders (______% of shoreline length)	___Standing timber (______% of shoreline length)
___Emergent vegetation (______% of shoreline length)	✓ Other: submerged fish attractor (10 % of shoreline length)
___Submersed vegetation (______% of shoreline length)	___Other: ______ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MB-12	**Date:** 08/01/19	**Time:** 17:30
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description: Jane lotten park		**GPS?:** ____Yes ✓ No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Cloudy 88°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, JSL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes ✓ No	
Shoreline Vegetative Buffer Zone Condition:	✓ Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
____Residential	✓ Forested	____Golf Course	____Open	____Transportation
✓ Recreation/access	____Agricultural	____Commercial	____Logging	✓ Other: transmisson line

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	✓ >90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes ✓ No **(check all that apply):**	
____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	✓ Reservoir fluctuations	____Wave action from watercraft/wind
✗ Impervious surfaces	✓ Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	✓ Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
____Docks/piers/boatslips (______% of shoreline length)	✓ Overhanging vegetation (10 % of shoreline length)
____Riprap (______% of shoreline length)	✓ Large woody debris (10 % of shoreline length)
✓ Bedrock and boulders (1 % of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-13	**Date:** 08/01/19	**Time:** 16:16
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ✓ No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: cloudy 90°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ____No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	____Golf Course	____Open	✓ Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	____Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	✓ Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	✓ 70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes ____No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
✓ Riprap or other large stone only (15 % of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓ Residential landscape	✓ Reservoir fluctuations	____Wave action from watercraft/wind
✓ Impervious surfaces	✓ Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (______% of shoreline length)	✓ Overhanging vegetation (~~[illegible]~~ 10 % of shoreline length)
✓ Riprap (15 % of shoreline length)	✓ Large woody debris (5 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
✓ Emergent vegetation (15 % of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-14	**Date:** 08/01/19	**Time:** 16:12
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton	
Site Description:		**GPS?:** ___Yes ✓ No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: Cloudy slight rain 90°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dald		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	___Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ______

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	✓ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ___No **(check all that apply):**

✓ Seawall/bulkhead only (30 % of site)	✓ Seawall/bulkhead and riprap combined (55 % of site)
✓ Riprap or other large stone only (10 % of site)	✓ Other armoring: boat ramp (5 % of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	✓ Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ______

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (10 % of shoreline length)	___Overhanging vegetation (_____% of shoreline length)
✓ Riprap (65 % of shoreline length)	___Large woody debris (_____% of shoreline length)
___Bedrock and boulders (_____% of shoreline length)	___Standing timber (_____% of shoreline length)
___Emergent vegetation (_____% of shoreline length)	___Other:______ (_____% of shoreline length)
___Submersed vegetation (_____% of shoreline length)	___Other:______ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MK-15	**Date:** 08-01-19	**Time:** 09:41
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ✓ Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ✓ Residential ____Commercial ____Other		
Weather: cloudy 77°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes X No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	✓ Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	✓ 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ____No **(check all that apply):**

✓ Seawall/bulkhead only (30 % of site)	✓ Seawall/bulkhead and riprap combined (20 % of site)
✓ Riprap or other large stone only (20 % of site)	✓ Other armoring: boat ramp (5 % of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (15 % of shoreline length)	✓ Overhanging vegetation (10 % of shoreline length)
✓ Riprap (40 % of shoreline length)	✓ Large woody debris (10 % of shoreline length)
✓ Bedrock and boulders (5 % of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-16	**Date:** 8/1/19	**Time:** 9:56
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ✓ Butts ___Henry ___Jasper ___Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ___GPC ✓ Residential ___Commercial ___Other		
Weather: Cloudy	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: ~~Ea~~ Steve L., Dodd, Haibach		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	___Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ______

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	✓ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ___No **(check all that apply):**

~~✓~~ Seawall/bulkhead only (~~45~~ % of site) 0% (NA)	✓ Seawall/bulkhead and riprap combined (95 % of site)
___Riprap or other large stone only (_____% of site)	___Other armoring: ______ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	✓ Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	✓ Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ______

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (5 % of shoreline length)	✓ Overhanging vegetation (<5 % of shoreline length)
✓ Riprap (95 % of shoreline length)	___Large woody debris (_____% of shoreline length)
___Bedrock and boulders (_____% of shoreline length)	___Standing timber (_____% of shoreline length)
___Emergent vegetation (_____% of shoreline length)	___Other: ______ (_____% of shoreline length)
___Submersed vegetation (_____% of shoreline length)	___Other: ______ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-17	**Date:** 08/01/19	**Time:** 16:04
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ✓No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ✓Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓Yes ___No

Length of Assessment Site: ✓500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ✓No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓Residential	✓Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability: All	✓Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	✓Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	✓<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓Yes ____No **(check all that apply):**

✓Seawall/bulkhead only (40 % of site)	____Seawall/bulkhead and riprap combined (_____% of site)
____Riprap or other large stone only (_____% of site)	____Other armoring: ______________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓Residential landscape	✓Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓Docks/piers/boatslips (5 % of shoreline length)	✓Overhanging vegetation (5 % of shoreline length)
____Riprap (_____% of shoreline length)	✓Large woody debris (10 % of shoreline length)
✓Bedrock and boulders (10 % of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-18	**Date:** 8/1/19	**Time:** 17:11
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ✓ No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: cloudy, slight rain 88°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	✓ Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	✓ 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ____No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	✓ Seawall/bulkhead and riprap combined (60 % of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (______% of shoreline length)	✓ Overhanging vegetation (5 % of shoreline length)
✓ Riprap (60 % of shoreline length)	✓ Large woody debris (<5 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
✓ Submersed vegetation (<5 % of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-19	**Date:** 8/1/19	**Time:** 17:07
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton	
Site Description:		**GPS?:** ___Yes ✓ No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: cloudy/rainy, 88°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:___feet		**Active Erosion Problem Present?:** ___Yes ✓ No		
Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
✓ Residential	___Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ___

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	✓ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ___No **(check all that apply):**			
✓ Seawall/bulkhead only (30 % of site)	✓ Seawall/bulkhead and riprap combined (70 % of site)		
✓ Riprap or other large stone only (1 % of site)	___Other armoring: ___ (___% of site)		
Potential Sources of Active Shoreline Erosion (check all that apply):			
___Land-disturbing activity	___Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ___

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
✓ Docks/piers/boatslips (10 % of shoreline length)	___Overhanging vegetation (___% of shoreline length)
✓ Riprap (71 % of shoreline length)	___Large woody debris (___% of shoreline length)
___Bedrock and boulders (___% of shoreline length)	___Standing timber (___% of shoreline length)
___Emergent vegetation (___% of shoreline length)	___Other: ___ (___% of shoreline length)
___Submersed vegetation (___% of shoreline length)	___Other: ___ (___% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MB-20	**Date:** 08/01/19	**Time:** 15:56
Waterbody: √ Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** X Yes √ No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: cloudy. slight rain 92°	**Reservoir Pool Level:** √ Full ____Medium ____Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** √ Yes ____No

Length of Assessment Site: √ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ____No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	√ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

√ Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	√ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	√ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? √ Yes ____No **(check all that apply):**

X Seawall/bulkhead only (80 % of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	√ Other armoring: boat ramp (5 % of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	√ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

√ Docks/piers/boatslips (10 % of shoreline length)	____Overhanging vegetation (______% of shoreline length)
____Riprap (______% of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MB-21	**Date:** 08/01/19	**Time:** 1546
Waterbody: _✓_ Lake Jackson ____ Tailrace	**County:** ____ Butts ____ Henry ____ Jasper ____ Newton	
Site Description:		**GPS?:** ___ Yes _✓_ No
Adjacent Land Ownership: ____ GPC ____ Residential ____ Commercial ____ Other		
Weather: Cloudy 95°	**Reservoir Pool Level:** _✓_ Full ___ Medium ___ Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** _✓_ Yes ___ No

Length of Assessment Site: _✓_ 500 feet ____ Other: ____ feet	**Active Erosion Problem Present?:** ____ Yes _✓_ No
Shoreline Vegetative Buffer Zone Condition:	____ Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____ Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	_✓_ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

_✓_ Residential	____ Forested	____ Golf Course	____ Open	____ Transportation
____ Recreation/access	____ Agricultural	____ Commercial	____ Logging	____ Other: ________

Bank Stability:	_✓_ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____ Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____ Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____ Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____ >90% of bank surfaces covered by healthy, living vegetation
	____ 70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____ 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	_✓_ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? _✓_ Yes ____ No **(check all that apply):**

_✓_ Seawall/bulkhead only (95 % of site)	____ Seawall/bulkhead and riprap combined (______% of site)
____ Riprap or other large stone only (______% of site)	_✓_ Other armoring: boat ramp (5 % of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____ Land-disturbing activity	_✓_ Residential landscape	____ Reservoir fluctuations	____ Wave action from watercraft/wind
____ Impervious surfaces	____ Roads and bridges	____ Lack of buffer vegetation	____ Tributary inflow
____ Stormwater runoff	____ Recreation/access	____ Livestock activity	____ Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

_✓_ Docks/piers/boatslips (5 % of shoreline length)	____ Overhanging vegetation (______% of shoreline length)
____ Riprap (______% of shoreline length)	____ Large woody debris (______% of shoreline length)
____ Bedrock and boulders (______% of shoreline length)	____ Standing timber (______% of shoreline length)
____ Emergent vegetation (______% of shoreline length)	____ Other: ________ (______% of shoreline length)
____ Submersed vegetation (______% of shoreline length)	____ Other: ________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MK-22	**Date:** 8/1/19	**Time:** 15:37
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Cloudy 90°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ____No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	____Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	✓ Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	✓ 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ____No **(check all that apply):**

✓ Seawall/bulkhead only (30 % of site)	____Seawall/bulkhead and riprap combined (______% of site)
✓ Riprap or other large stone only (5 % of site)	✓ Other armoring: boat ramp (0.2 % of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

✓ Land-disturbing activity	✓ Residential landscape	✓ Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (5 % of shoreline length)	✓ Overhanging vegetation (5 % of shoreline length)
✓ Riprap (5 % of shoreline length)	✓ Large woody debris (5 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:________________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:________________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-23	**Date:** 8/1/19	**Time:** 15:25
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton	
Site Description:		**GPS?:** ___Yes ✓ No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: Cloudy 90°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:___feet			**Active Erosion Problem Present?:** ___Yes ✓ No	
Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
✓ Residential	___Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	✓ 70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	___<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ___No (check all that apply):

✓ Seawall/bulkhead only (90 % of site)	___Seawall/bulkhead and riprap combined (______% of site)
___Riprap or other large stone only (______% of site)	___Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	✓ Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (5 % of shoreline length)	___Overhanging vegetation (______% of shoreline length)
___Riprap (______% of shoreline length)	___Large woody debris (______% of shoreline length)
✓ Bedrock and boulders (10 % of shoreline length)	___Standing timber (______% of shoreline length)
___Emergent vegetation (______% of shoreline length)	___Other:____________ (______% of shoreline length)
___Submersed vegetation (______% of shoreline length)	___Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-24	**Date:** 8/1/19	**Time:** 15:23
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton	
Site Description:		**GPS?:** ___Yes ✓ No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: cloudy 90°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	✓ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ___No **(check all that apply):**

___Seawall/bulkhead only (____% of site)	✓ Seawall/bulkhead and riprap combined (85% of site)
✓ Riprap or other large stone only (10% of site)	___Other armoring: ________ (____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	✓ Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (5% of shoreline length)	✓ Overhanging vegetation (<5% of shoreline length)
✓ Riprap (95% of shoreline length)	✓ Large woody debris (<1% of shoreline length)
✓ Bedrock and boulders (15% of shoreline length)	___Standing timber (____% of shoreline length)
___Emergent vegetation (____% of shoreline length)	___Other:________ (____% of shoreline length)
___Submersed vegetation (____% of shoreline length)	___Other:________ (____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: MR-25	**Date:** 8/1/19	**Time:** 15:18
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: cloudy 90°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:____feet	**Active Erosion Problem Present?:** ___Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	___Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ___________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	✓ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ___No **(check all that apply):**

___Seawall/bulkhead only (_____% of site)	✓ Seawall/bulkhead and riprap combined (50 % of site)
✓ Riprap or other large stone only (40 % of site)	___Other armoring: ______________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	✓ Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ___________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (5 % of shoreline length)	✓ Overhanging vegetation (01 % of shoreline length)
✓ Riprap (90 % of shoreline length)	✓ Large woody debris (01 % of shoreline length)
___Bedrock and boulders (_____% of shoreline length)	___Standing timber (_____% of shoreline length)
___Emergent vegetation (_____% of shoreline length)	___Other:______________ (_____% of shoreline length)
___Submersed vegetation (_____% of shoreline length)	___Other:______________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR-1	**Date:** 8-1-19	**Time:** 10:12 am
Waterbody: X Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC X Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes X No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	X Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

X Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	X <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? X Yes ____No **(check all that apply):**

X Seawall/bulkhead only (40 % of site)	____Seawall/bulkhead and riprap combined (_____% of site)
X Riprap or other large stone only (60 % of site)	____Other armoring: ______________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	X Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	X Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

X Docks/piers/boatslips (5 % of shoreline length)	X Overhanging vegetation (10 % of shoreline length)
X Riprap (60 % of shoreline length)	X Large woody debris (5 % of shoreline length)
X Bedrock and boulders (2 % of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR-2	**Date:** 8-1-19	**Time:** 10:23
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet	**Active Erosion Problem Present?:** X Yes ____No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	X Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

X Residential	X Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	X <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? X Yes ____No **(check all that apply):**

X Seawall/bulkhead only (90 % of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

X Land-disturbing activity	X Residential landscape	____Reservoir fluctuations	X Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
X Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

X Docks/piers/boatslips (5 % of shoreline length)	X Overhanging vegetation (10 % of shoreline length)
____Riprap (______% of shoreline length)	X Large woody debris (5 % of shoreline length)
X Bedrock and boulders (2 % of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

small area active erosion between seawalls of adjacent properties.
approx. 15 feet

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR-3	**Date:** 8-1-19	**Time:** 10:45
Waterbody: _X_ Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:	**GPS?:** ___Yes ___No	
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:	**Photos Taken?:** _X_Yes ___No	

Length of Assessment Site: _X_500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes _X_No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	_X_Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

_X_Residential	_X_Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	_X_70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes _X_No **(check all that apply):**

____Seawall/bulkhead only (_____% of site)	____Seawall/bulkhead and riprap combined (_____% of site)
____Riprap or other large stone only (_____% of site)	____Other armoring: ______________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	_X_Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

_X_Docks/piers/boatslips (_5_% of shoreline length)	_X_Overhanging vegetation (_10_% of shoreline length)
____Riprap (_____% of shoreline length)	_X_Large woody debris (_5_% of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
_X_Emergent vegetation (_50_% of shoreline length)	____Other:______________ (_____% of shoreline length)
_~~X~~_Submersed vegetation (_~~50~~_% of shoreline length)	____Other:______________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR-4	**Date:** 8-1-19	**Time:** 10:59
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes _X_No	
Shoreline Vegetative Buffer Zone Condition:	_X_Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
____Residential	_X_Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	_X_>90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? ____Yes _X_No **(check all that apply):**			
____Seawall/bulkhead only (_____% of site)		____Seawall/bulkhead and riprap combined (_____% of site)	
____Riprap or other large stone only (_____% of site)		____Other armoring: ______________ (_____% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
____Docks/piers/boatslips (_____% of shoreline length)	_X_Overhanging vegetation (_50_% of shoreline length)
____Riprap (_____% of shoreline length)	_X_Large woody debris (_1_% of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
_X_Emergent vegetation (_90_% of shoreline length)	____Other:________________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:________________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR 5		**Date:** 8-1-19	**Time:** 11:10
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton		
Site Description:		**GPS?:** ___Yes ___No	
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other			
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low		
Investigators:		**Photos Taken?:** X Yes ___No	

Length of Assessment Site: X 500 feet ____Other:____feet		**Active Erosion Problem Present?:** ____Yes ____No		
Shoreline Vegetative Buffer Zone Condition:	X Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
____Residential	X Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	X >90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? ____Yes X No **(check all that apply):**			
____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)		
____Riprap or other large stone only (______% of site)	____Other armoring: ________________ (______% of site)		
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
____Docks/piers/boatslips (______% of shoreline length)	X Overhanging vegetation (80 % of shoreline length)
____Riprap (______% of shoreline length)	X Large woody debris (5 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
X Emergent vegetation (95 % of shoreline length)	____Other:________________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:________________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR-6	**Date:** 8-1-19	**Time:** 11:21
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** ___Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet			**Active Erosion Problem Present?:** _X_Yes ____No	
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	_X_Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
_X_Residential	_X_Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	____Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	_X_Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	_X_50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? ____Yes _X_No **(check all that apply):**			
____Seawall/bulkhead only (_____% of site)		____Seawall/bulkhead and riprap combined (_____% of site)	
____Riprap or other large stone only (_____% of site)		____Other armoring: ____________ (_____% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	_X_Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
_X_Docks/piers/boatslips (_1_% of shoreline length)	_X_Overhanging vegetation (_50_% of shoreline length)
____Riprap (_____% of shoreline length)	_X_Large woody debris (_9_% of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR-7	**Date:** 8-1-19	**Time:** 12:10
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet	**Active Erosion Problem Present?:** X Yes ____No
Shoreline Vegetative Buffer Zone Condition:	X Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

____Residential	X Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	X >90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes X No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	X Other: wildlife trails

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (______% of shoreline length)	X Overhanging vegetation (100 % of shoreline length)
____Riprap (______% of shoreline length)	X Large woody debris (50 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR-8	**Date:** 8-1-19	**Time:** 12:37
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes _X_No	
Shoreline Vegetative Buffer Zone Condition:	_X_Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
____Residential	_X_Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	_X_>90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? ____Yes _X_No **(check all that apply):**			
____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)		
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)		
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
____Docks/piers/boatslips (______% of shoreline length)	_X_Overhanging vegetation (_100_% of shoreline length)
____Riprap (______% of shoreline length)	_X_Large woody debris (_10_% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR-9	**Date:** 8-1-19	**Time:** 12:42
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes X No
Shoreline Vegetative Buffer Zone Condition:	X Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

____Residential	X Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	X >90% of bank surfaces covered by healthy, living vegetation
SS	~~X~~ 70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes X No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (______% of shoreline length)	X Overhanging vegetation (100 % of shoreline length)
____Riprap (______% of shoreline length)	X Large woody debris (25 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR10	**Date:** 8-1-19	**Time:** 12:53
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes _X_No
Shoreline Vegetative Buffer Zone Condition:	_X_Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

____Residential	_X_Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	_X_>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes _X_No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (______% of shoreline length)	_X_Overhanging vegetation (_100_% of shoreline length)
____Riprap (______% of shoreline length)	_X_Large woody debris (_20_% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR-11		**Date:** 8-1-19	**Time:** 1:05
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton		
Site Description:			**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other			
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low		
Investigators:			**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes X No	
Shoreline Vegetative Buffer Zone Condition:	X Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
____Residential	X Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	X >90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? ____Yes X No **(check all that apply):**			
____Seawall/bulkhead only (______% of site)		____Seawall/bulkhead and riprap combined (______% of site)	
____Riprap or other large stone only (______% of site)		____Other armoring: ______________ (______% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	X Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
____Docks/piers/boatslips (______% of shoreline length)	X Overhanging vegetation (90 % of shoreline length)
____Riprap (______% of shoreline length)	X Large woody debris (5 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:________________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:________________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR-12	**Date:**	**Time:** 1:10
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet		**Active Erosion Problem Present?:** ____Yes X No		
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	X Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
X Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	X <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? X Yes ____No **(check all that apply):**			
____Seawall/bulkhead only (_____% of site)	____Seawall/bulkhead and riprap combined (_____% of site)		
X Riprap or other large stone only (80 % of site)	____Other armoring: ____________ (_____% of site)		
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	X Residential landscape	____Reservoir fluctuations	X Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
X Docks/piers/boatslips (5 % of shoreline length)	X Overhanging vegetation (5 % of shoreline length)
X Riprap (80 % of shoreline length)	____Large woody debris (_____% of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
X Emergent vegetation (2 % of shoreline length)	____Other:____________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR 13	**Date:**	**Time:** 1:16
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** _✓_Yes ___No

Length of Assessment Site: _✓_500 feet ____Other:____feet	**Active Erosion Problem Present?:** _X_Yes ____No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	_X_Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

_X_Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	_X_50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes _X_No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring ________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	_X_Residential landscape	____Reservoir fluctuations	_X_Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

_X_Docks/piers/boatslips (_3_% of shoreline length)	_X_Overhanging vegetation (_20_% of shoreline length)
____Riprap (______% of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
_X_Emergent vegetation (_2_% of shoreline length)	____Other:________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR 14	**Date:**	**Time:** 1:25
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet		**Active Erosion Problem Present?:** ____Yes X No		
Shoreline Vegetative Buffer Zone Condition:	X Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
____Residential	X Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	X >90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? ____Yes X No **(check all that apply):**			
____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)		
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)		
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	X Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
____Docks/piers/boatslips (______% of shoreline length)	X Overhanging vegetation (90 % of shoreline length)
____Riprap (______% of shoreline length)	X Large woody debris (20 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR 15 *	**Date:**	**Time:** 1:37
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes ____No	
Shoreline Vegetative Buffer Zone Condition:	_X_Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
____Residential	_X_Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	_X_>90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? ____Yes _X_No **(check all that apply):**			
____Seawall/bulkhead only (_____% of site)	____Seawall/bulkhead and riprap combined (_____% of site)		
____Riprap or other large stone only (_____% of site)	____Other armoring: ______________ (_____% of site)		
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	_X_Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
____Docks/piers/boatslips (_____% of shoreline length)	_X_Overhanging vegetation (_100_% of shoreline length)
____Riprap (_____% of shoreline length)	_X_Large woody debris (_10_% of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:
* site moved to mainstem bank

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR 16	**Date:**	**Time:** 1:43
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes X No	
Shoreline Vegetative Buffer Zone Condition:	X Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
____Residential	X Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	X >90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? ____Yes X No **(check all that apply):**			
____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)		
____Riprap or other large stone only (______% of site)	____Other armoring: ______________ (______% of site)		
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
____Docks/piers/boatslips (______% of shoreline length)	X Overhanging vegetation (100 % of shoreline length)
____Riprap (______% of shoreline length)	X Large woody debris (15 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR 17	**Date:**	**Time:** 1:51
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes X No	
Shoreline Vegetative Buffer Zone Condition:	X Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
____Residential	X Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	X >90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? ____Yes X No **(check all that apply):**			
____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)		
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)		
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
____Docks/piers/boatslips (______% of shoreline length)	X Overhanging vegetation (95 % of shoreline length)
____Riprap (______% of shoreline length)	X Large woody debris (10 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR 18	**Date:**	**Time:** 1:57
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes _X_No
Shoreline Vegetative Buffer Zone Condition:	_X_Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

____Residential	_X_Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	_X_>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes _X_No **(check all that apply):**

____Seawall/bulkhead only (_____% of site)	____Seawall/bulkhead and riprap combined (_____% of site)
____Riprap or other large stone only (_____% of site)	____Other armoring: ______________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (_____% of shoreline length)	_X_Overhanging vegetation (_90_% of shoreline length)
____Riprap (_____% of shoreline length)	_X_Large woody debris (_40_% of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR 19*	**Date:**	**Time:**
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** ___Yes ___No

Length of Assessment Site: ____500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes ____No	
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
____Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	____Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes ____No **(check all that apply):**			
____Seawall/bulkhead only (_____% of site)		____Seawall/bulkhead and riprap combined (_____% of site)	
____Riprap or other large stone only (_____% of site)		____Other armoring: ______________ (_____% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
____Docks/piers/boatslips (_____% of shoreline length)	____Overhanging vegetation (_____% of shoreline length)
____Riprap (_____% of shoreline length)	____Large woody debris (_____% of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:
*replaced with SR29

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR 20 *	**Date:**	**Time:** 2:10
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes _X_No
Shoreline Vegetative Buffer Zone Condition:	_X_Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

____Residential	_X_Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	_X_>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes _X_No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (______% of shoreline length)	_X_Overhanging vegetation (90 % of shoreline length)
____Riprap (______% of shoreline length)	_X_Large woody debris (5 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:
* moved to mainstem bank

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR 21	**Date:** 8/1/19	**Time:** 2:30
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:	**GPS?:** ___Yes ___No	
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:	**Photos Taken?:** X Yes ___No	

Length of Assessment Site: X 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes X No
Shoreline Vegetative Buffer Zone Condition:	X Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

X Residential	X Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	X >90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes X No **(check all that apply):**

____Seawall/bulkhead only (_____% of site)	____Seawall/bulkhead and riprap combined (_____% of site)
____Riprap or other large stone only (_____% of site)	____Other armoring: ______________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (_____% of shoreline length)	X Overhanging vegetation (80 % of shoreline length)
____Riprap (_____% of shoreline length)	X Large woody debris (20 % of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR 22	**Date:** 8/1/19	**Time:** 2:40
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: ____500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes _X_No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	_X_Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

_X_Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	_X_<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? _X_Yes ____No **(check all that apply):**

_X_Seawall/bulkhead only (95 % of site)	_X_Seawall/bulkhead and riprap combined (5 % of site)
____Riprap or other large stone only (_____% of site)	____Other armoring: ______________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

_X_Docks/piers/boatslips (15 % of shoreline length)	____Overhanging vegetation (_____% of shoreline length)
____Riprap (_____% of shoreline length)	_X_Large woody debris (10 % of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
_X_Emergent vegetation (5 % of shoreline length)	____Other:________________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:________________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR 23	**Date:** 8/1/19	**Time:** 2:45
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** ___Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet	**Active Erosion Problem Present?:** _X_Yes ____No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	_X_Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

_X_Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	____Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	_X_Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	_X_<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? _X_Yes ____No **(check all that apply):**

_X_Seawall/bulkhead only (90 % of site)	_X_Seawall/bulkhead and riprap combined (8 % of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

_X_Docks/piers/boatslips (10 % of shoreline length)	_X_Overhanging vegetation (10 % of shoreline length)
_X_Riprap (8 % of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Failing Seawall

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR 24		**Date:** 8/1/19	**Time:** 2:51
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton		
Site Description:		**GPS?:** ___Yes ___No	
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other			
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low		
Investigators:		**Photos Taken?:** X Yes ___No	

Length of Assessment Site: X 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes X No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	X Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

X Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	X <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes ____No **(check all that apply):**

X Seawall/bulkhead only (30 % of site)	X Seawall/bulkhead and riprap combined (30 % of site)
____Riprap or other large stone only (_____% of site)	____Other armoring: ____________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

X Docks/piers/boatslips (5 % of shoreline length)	X Overhanging vegetation (10 % of shoreline length)
X Riprap (30 % of shoreline length)	____Large woody debris (_____% of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR25	**Date:** 8/1/19	**Time:** 2:59
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: ____500 feet ____Other:____feet	**Active Erosion Problem Present?:** _X_Yes ____No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	_X_Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

_X_Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	____Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	_X_Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	_X_50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? _X_Yes ____No **(check all that apply):**

_X_Seawall/bulkhead only (_85_% of site)	_X_Seawall/bulkhead and riprap combined (_15_% of site)
____Riprap or other large stone only (_____% of site)	____Other armoring: ____________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	_X_Residential landscape	____Reservoir fluctuations	_X_Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	_X_Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

_X_Docks/piers/boatslips (_10_% of shoreline length)	_X_Overhanging vegetation (_5_% of shoreline length)
_X_Riprap (_15_% of shoreline length)	____Large woody debris (_____% of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Failing seawall

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: SR 29	**Date:**	**Time:** 2:19
Waterbody: ____Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators:		**Photos Taken?:** X Yes ___No

Length of Assessment Site: X 500 feet ____Other:____feet		**Active Erosion Problem Present?:** ____Yes ____No		
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	X Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
X Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	X Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	X <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? X Yes ____No **(check all that apply):**			
____Seawall/bulkhead only (_____% of site)		____Seawall/bulkhead and riprap combined (_____% of site)	
X Riprap or other large stone only (40 % of site)		____Other armoring: ____________ (_____% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
X Docks/piers/boatslips (10 % of shoreline length)	X Overhanging vegetation (5 % of shoreline length)
X Riprap (40 % of shoreline length)	X Large woody debris (25 % of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TR-1	**Date:** 8/15/19	**Time:** 10:55
Waterbody: ____Lake Jackson __X__Tailrace	**County:** ____Butts ____Henry __X__Jasper ____Newton	
Site Description: East Side of tailrace		**GPS?:** ___Yes ___No
Adjacent Land Ownership: __X__GPC ____Residential ____Commercial ____Other		
Weather: Sunny + Hot	**Reservoir Pool Level:** _X_Full ___Medium ___Low	
Investigators: Jason Moak		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes ____No	
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	_X_Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
____Residential	____Forested	____Golf Course	____Open	_X_Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	_X_Other: tailrace

Bank Stability:	____Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	_X_Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	_X_70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes _X_No **(check all that apply):**	
____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	_X_Other: spillway releases

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
____Docks/piers/boatslips (______% of shoreline length)	____Overhanging vegetation (______% of shoreline length)
____Riprap (______% of shoreline length)	____Large woody debris (______% of shoreline length)
_X_Bedrock and boulders (100 % of shoreline length)	_X_Standing timber (50 % of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TR-2	**Date:** 8-15-19	**Time:** 12:30
Waterbody: ___Lake Jackson _X_Tailrace	**County:** ___Butts ___Henry _X_Jasper ___Newton	
Site Description: Tailrace @ OR Park		**GPS?:** ___Yes _X_No
Adjacent Land Ownership: _X_GPC ___Residential ___Commercial ___Other		
Weather: Sunny & Hot	**Reservoir Pool Level:** _X_Full ___Medium ___Low	
Investigators: Jason Moak		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: _X_500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes _X_No
Shoreline Vegetative Buffer Zone Condition:	_X_Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	___Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

___Residential	___Forested	___Golf Course	___Open	___Transportation
_X_Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	_X_Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	_X_70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	___<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ___Yes _X_No **(check all that apply):**

___Seawall/bulkhead only (_____% of site)	___Seawall/bulkhead and riprap combined (_____% of site)
___Riprap or other large stone only (_____% of site)	___Other armoring: ________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	___Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	_X_Recreation/access	___Livestock activity	_X_Other: Generation

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

___Docks/piers/boatslips (_____% of shoreline length)	_X_Overhanging vegetation (40% of shoreline length)
___Riprap (_____% of shoreline length)	_X_Large woody debris (10% of shoreline length)
_X_Bedrock and boulders (10% of shoreline length)	___Standing timber (_____% of shoreline length)
___Emergent vegetation (_____% of shoreline length)	___Other:________ (_____% of shoreline length)
___Submersed vegetation (_____% of shoreline length)	___Other:________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TR-3	**Date:** 8-15-14	**Time:** 12:25
Waterbody: ____Lake Jackson __X__Tailrace	**County:** ____Butts ____Henry __X__Jasper ____Newton	
Site Description: Tailrace @ Boatramp		**GPS?:** ____Yes __X__No
Adjacent Land Ownership: __X__GPC ____Residential ____Commercial ____Other		
Weather: Sunny + Hot	**Reservoir Pool Level:** __X__Full ____Medium ____Low	
Investigators: Jason Monk		**Photos Taken?:** __X__Yes ____No

Length of Assessment Site: __X__500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes __X__No
Shoreline Vegetative Buffer Zone Condition:	__X__Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

____Residential	____Forested	____Golf Course	____Open	____Transportation
__X__Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	__X__Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	__X__>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? __X__Yes ____No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
__X__Riprap or other large stone only (__10__% of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	__X__Other: Generation

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (______% of shoreline length)	__X__Overhanging vegetation (__75__% of shoreline length)
__X__Riprap (__10__% of shoreline length)	__X__Large woody debris (__10__% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TR-4	**Date:** 6-15-19	**Time:** 1200
Waterbody: ____Lake Jackson _X_Tailrace	**County:** _X_Butts ____Henry ____Jasper ____Newton	
Site Description: East side of tailrace		**GPS?:** ___Yes _X_No
Adjacent Land Ownership: _X_GPC ____Residential ____Commercial ____Other		
Weather: Sunny + Hot	**Reservoir Pool Level:** _X_Full ___Medium ___Low	
Investigators: Jason Mock		**Photos Taken?:** ___Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ____No
Shoreline Vegetative Buffer Zone Condition:	_✓_Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

____Residential	_X_Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	_X_>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes _X_No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	_X_Other: generation

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (______% of shoreline length)	_X_Overhanging vegetation (_75_% of shoreline length)
____Riprap (______% of shoreline length)	_X_Large woody debris (_10_% of shoreline length)
_X_Bedrock and boulders (_30_% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TR-5	**Date:** 6-15-15	**Time:** 12:37
Waterbody: ____Lake Jackson _X_Tailrace	**County:** _X_Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes _X_No
Adjacent Land Ownership: _X_GPC ____Residential ____Commercial ____Other		
Weather: Sunny + Hot	**Reservoir Pool Level:** _X_Full ___Medium ___Low	
Investigators: Jason Moak		**Photos Taken?:** _X_Yes ___No

Length of Assessment Site: _X_500 feet ____Other:____feet		**Active Erosion Problem Present?:** ____Yes ____No		
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	_X_Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
____Residential	____Forested	____Golf Course	____Open	____Transportation
_X_Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	_X_Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	_X_50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? ____Yes _X_No **(check all that apply):**			
____Seawall/bulkhead only (______% of site)		____Seawall/bulkhead and riprap combined (______% of site)	
____Riprap or other large stone only (______% of site)		____Other armoring: ____________ (______% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	_X_Recreation/access	____Livestock activity	_X_Other: generation

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
____Docks/piers/boatslips (______% of shoreline length)	_X_Overhanging vegetation (_10_% of shoreline length)
____Riprap (______% of shoreline length)	____Large woody debris (______% of shoreline length)
_X_Bedrock and boulders (_90_% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TR-6	**Date:** 8-15-19	**Time:** 12:45
Waterbody: ____Lake Jackson __X__Tailrace	**County:** __X__Butts ____Henry ____Jasper ____Newton	
Site Description: Tailrace upstream of Pier		**GPS?:** ___Yes __X__No
Adjacent Land Ownership: __X__GPC ____Residential ____Commercial ____Other		
Weather: Sunny + Hot	**Reservoir Pool Level:** __X__Full ___Medium ___Low	
Investigators: Jason Mosh		**Photos Taken?:** __X__Yes ___No

Length of Assessment Site: __X__500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes __X__No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	__X__Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

____Residential	____Forested	____Golf Course	____Open	____Transportation
__X__Recreation/access	____Agricultural	____Commercial	____Logging	__X__Other: Project Ops

Bank Stability:	__X__Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	__X__<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? __X__Yes ____No **(check all that apply):**

__X__Seawall/bulkhead only (__5__% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	__X__Other: generation

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (______% of shoreline length)	____Overhanging vegetation (______% of shoreline length)
____Riprap (______% of shoreline length)	____Large woody debris (______% of shoreline length)
__X__Bedrock and boulders (__95__% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	__X__Other: Fishing Pier (__30__% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-01	**Date:** 08/01/19	**Time:** 12:59
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton	
Site Description:	**GPS?:** ___Yes ___No	
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: Sunny 86°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, dodd	**Photos Taken?:** ✓ Yes ___No	

Length of Assessment Site: ✓ 500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	✓ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ___No **(check all that apply):**

✓ Seawall/bulkhead only (85 % of site)	___Seawall/bulkhead and riprap combined (_____% of site)
✓ Riprap or other large stone only (15 % of site)	___Other armoring: ________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	✓ Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (15 % of shoreline length)	✓ Overhanging vegetation (10 % of shoreline length)
✓ Riprap (15 % of shoreline length)	✓ Large woody debris 02 % of shoreline length)
___Bedrock and boulders (_____% of shoreline length)	___Standing timber (_____% of shoreline length)
___Emergent vegetation (_____% of shoreline length)	___Other: ________ (_____% of shoreline length)
___Submersed vegetation (_____% of shoreline length)	___Other: ________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-02	**Date:** 8/1/19	**Time:** 12:50
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Sunny 86°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes ____No	
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	✓ Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
✓ Residential	✓ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	✓ 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ____No **(check all that apply):**			
____Seawall/bulkhead only (______% of site)		✓ Seawall/bulkhead and riprap combined (5 % of site)	
✓ Riprap or other large stone only (25 % of site)		____Other armoring: ______________ (______% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	✓ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
✓ Docks/piers/boatslips (10 % of shoreline length)	✓ Overhanging vegetation (20 % of shoreline length)
✓ Riprap (30 % of shoreline length)	✓ Large woody debris (<5 % of shoreline length)
✓ Bedrock and boulders (<5 % of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-03	**Date:** 08/01/19	**Time:** 12:46
Waterbody: √ Lake Jackson ___Tailrace	**County:** √ Butts ___Henry ___Jasper ___Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: Sunny 86°	**Reservoir Pool Level:** √ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd	**Photos Taken?:** √ Yes ___No	

Length of Assessment Site: √ 500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes √ No
Shoreline Vegetative Buffer Zone Condition:	√ Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	___Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

___Residential	√ Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ________

Bank Stability:	√ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	√ >90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	___<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ___Yes √ No **(check all that apply):**

___Seawall/bulkhead only (_____% of site)	___Seawall/bulkhead and riprap combined (_____% of site)
___Riprap or other large stone only (_____% of site)	___Other armoring: ________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	___Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	√ Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

___Docks/piers/boatslips (_____% of shoreline length)	√ Overhanging vegetation (70 % of shoreline length)
___Riprap (_____% of shoreline length)	√ Large woody debris (15 % of shoreline length)
___Bedrock and boulders (_____% of shoreline length)	___Standing timber (_____% of shoreline length)
___Emergent vegetation (_____% of shoreline length)	___Other: ________ (_____% of shoreline length)
___Submersed vegetation (_____% of shoreline length)	___Other: ________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes: blue green algae
lyngbya present

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-04	**Date:** 08/01/19	**Time:** 12:32
Waterbody: √ Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: Sunny 86°	**Reservoir Pool Level:** √ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd	**Photos Taken?:** √ Yes ___No	

Length of Assessment Site: √ 500 feet ___Other:___feet		**Active Erosion Problem Present?:** ___Yes √ No		
Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	√ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
√ Residential	√ Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ________

Bank Stability:	√ Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation		
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	√ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? √ Yes ___No **(check all that apply):**			
√ Seawall/bulkhead only (20 % of site)		√ Seawall/bulkhead and riprap combined (40 % of site)	
___Riprap or other large stone only (_____% of site)		___Other armoring: ________ (_____% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
___Land-disturbing activity	√ Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
√ Docks/piers/boatslips (<5 % of shoreline length)	√ Overhanging vegetation (15 % of shoreline length)
√ Riprap (40 % of shoreline length)	√ Large woody debris (<5 % of shoreline length)
___Bedrock and boulders (_____% of shoreline length)	___Standing timber (_____% of shoreline length)
___Emergent vegetation (_____% of shoreline length)	___Other:________ (_____% of shoreline length)
___Submersed vegetation (_____% of shoreline length)	___Other:________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-05	**Date:** 08/01/19	**Time:** 12:22
Waterbody: ____Lake Jackson ____Tailrace	**County:** ✓ Butts ____Henry ____Jasper ____Newton	
Site Description:	**GPS?:** ___Yes ___No	
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd	**Photos Taken?:** ✓ Yes ___No	

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ✓ No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	✓ Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	✓ 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ____No **(check all that apply):**

✓ Seawall/bulkhead only (20 % of site)	✓ Seawall/bulkhead and riprap combined (45 % of site)
✓ Riprap or other large stone only (~~20~~ 15 % of site)	____Other armoring: ____________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (10 % of shoreline length)	✓ Overhanging vegetation (15 % of shoreline length)
✓ Riprap (60 % of shoreline length)	____Large woody debris (_____% of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-06	**Date:** 08/01/19	**Time:** 12:18
Waterbody: √ Lake Jackson ____Tailrace	**County:** √ Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Sunny	**Reservoir Pool Level:** √ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd	**Photos Taken?:** √ Yes ___No	

Length of Assessment Site: √ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes √ No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	√ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

√ Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________________

Bank Stability:	√ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	√ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? √ Yes ____No **(check all that apply):**

√ Seawall/bulkhead only (10 % of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ________________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	√ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

√ Docks/piers/boatslips (5 % of shoreline length)	____Overhanging vegetation (______% of shoreline length)
____Riprap (______% of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
√ Emergent vegetation (10 % of shoreline length)	____Other:________________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:________________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes: granite outcropping

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-07	**Date:** 08/01/19	**Time:** 12:11
Waterbody: ____Lake Jackson ____Tailrace	**County:** √ Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** √ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** √ Yes ___No

Length of Assessment Site: √ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes √ No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	√ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

√ Residential	√ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	√ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	√ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? √ Yes ____No **(check all that apply):**

√ Seawall/bulkhead only (80 % of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	√ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

√ Docks/piers/boatslips (<5 % of shoreline length)	√ Overhanging vegetation (<5 % of shoreline length)
____Riprap (______% of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other: ______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other: ______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-8		**Date:** 01/8/19	**Time:** 11:54
Waterbody: √ Lake Jackson ___Tailrace	**County:** √ Butts ___Henry ___Jasper ___Newton		
Site Description:			**GPS?:** ___Yes ___No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other			
Weather: Sunny		**Reservoir Pool Level:** √ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd			**Photos Taken?:** √ Yes ___No

Length of Assessment Site: √ 500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes √ No
Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	√ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

√ Residential	___Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ___

Bank Stability:	√ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	√ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? √ Yes ___No **(check all that apply):**

___Seawall/bulkhead only (___% of site)	X Seawall/bulkhead and riprap combined (85 % of site)
___Riprap or other large stone only (___% of site)	√ Other armoring: boat ramp (25 % of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	√ Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ___

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

√ Docks/piers/boatslips (25 % of shoreline length)	___Overhanging vegetation (___% of shoreline length)
√ Riprap (85 % of shoreline length)	___Large woody debris (___% of shoreline length)
___Bedrock and boulders (___% of shoreline length)	___Standing timber (___% of shoreline length)
___Emergent vegetation (___% of shoreline length)	___Other:___ (___% of shoreline length)
___Submersed vegetation (___% of shoreline length)	___Other:___ (___% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-9	**Date:** 8/1/19	**Time:** 11:34
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ✓ Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Sunny	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	✓ Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	✓ 70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	N ~~✓~~ 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ____No **(check all that apply):**

✓ Seawall/bulkhead only (10 % of site)	____Seawall/bulkhead and riprap combined (_____% of site)
✓ Riprap or other large stone only (50 % of site)	____Other armoring: ______________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (15 % of shoreline length)	✓ Overhanging vegetation (10 % of shoreline length)
✓ Riprap (50 % of shoreline length)	____Large woody debris (_____% of shoreline length)
✓ Bedrock and boulders (05 % of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:______________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-10	**Date:** 8/1/19	**Time:** 11:28
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ✓ Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Sunny 81°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd	**Photos Taken?:** ✓ Yes ___No	

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ✓ No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	✓ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ____No **(check all that apply):**

✓ Seawall/bulkhead only (50 % of site)	✓ Seawall/bulkhead and riprap combined (45 % of site)
✓ Riprap or other large stone only (5 % of site)	____Other armoring: ________ (____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (10 % of shoreline length)	____Overhanging vegetation (____% of shoreline length)
✓ Riprap (50 % of shoreline length)	____Large woody debris (____% of shoreline length)
____Bedrock and boulders (____% of shoreline length)	____Standing timber (____% of shoreline length)
____Emergent vegetation (____% of shoreline length)	____Other:________ (____% of shoreline length)
____Submersed vegetation (____% of shoreline length)	____Other:________ (____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-11	**Date:** 8/1/19	**Time:** 10:18
Waterbody: ____Lake Jackson ____Tailrace	**County:** ✓ Butts ____Henry ____Jasper ____Newton	
Site Description: next to Pearsoes Landing		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ✓ Residential ____Commercial ____Other		
Weather: partly cloudy	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: SL, Dodd, NSH		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes ✓ No	
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
✓ Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability: NH	~~✓~~ Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	✓ Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation		
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	✓ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? ✓ Yes ____No **(check all that apply):**			
____Seawall/bulkhead only (______% of site)		✓ Seawall/bulkhead and riprap combined (50 % of site)	
____Riprap or other large stone only (______% of site)		____Other armoring: ______________ (______% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	✓ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	✓ Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
✓ Docks/piers/boatslips (10 % of shoreline length)	____Overhanging vegetation (______% of shoreline length)
✓ Riprap (50 % of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-12	**Date:** 8/1/19	**Time:** 11:04
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ✓ Butts ___Henry ___Jasper ___Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: Sunny 81°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	✓ Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	___Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):				
___Residential	✓ Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ___

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	✓ >90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	___<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ___Yes ✓ No **(check all that apply):**	
___Seawall/bulkhead only (___% of site)	___Seawall/bulkhead and riprap combined (___% of site)
___Riprap or other large stone only (___% of site)	___Other armoring: ___ (___% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):			
___Land-disturbing activity	___Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ___

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
___Docks/piers/boatslips (___% of shoreline length)	✓ Overhanging vegetation (90 % of shoreline length)
___Riprap (___% of shoreline length)	✓ Large woody debris (20 % of shoreline length)
___Bedrock and boulders (___% of shoreline length)	✓ Standing timber (01 % of shoreline length)
___Emergent vegetation (___% of shoreline length)	___Other: ___ (___% of shoreline length)
___Submersed vegetation (___% of shoreline length)	___Other: ___ (___% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-13		**Date:** 8/5/2019	**Time:** 4:00p.m.
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ✓ Butts ___Henry ___Jasper ___Newton		
Site Description: Tussahaw Creek, unboatable upper reach			**GPS?:** ___Yes ___No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other			
Weather: NA - assessment using Google Earth	**Reservoir Pool Level:** ___Full ___Medium ___Low		
Investigators: S. R. Layman			**Photos Taken?:** ___Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	✓ Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	___Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

___Residential	✓ Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ______

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	✓ >90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	___<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ___Yes ✓ No **(check all that apply):**

___Seawall/bulkhead only (___% of site)	___Seawall/bulkhead and riprap combined (___% of site)
___Riprap or other large stone only (___% of site)	___Other armoring ______ (___% of site)

Potential Sources of Active Shoreline Erosion (check all that apply): none evident on imagery

___Land-disturbing activity	___Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ______

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply): estimated from imagery

___Docks/piers/boatslips (___% of shoreline length)	✓ Overhanging vegetation (~70 % of shoreline length)
___Riprap (___% of shoreline length)	✓ Large woody debris (~30 % of shoreline length)
___Bedrock and boulders (___% of shoreline length)	___Standing timber (___% of shoreline length)
___Emergent vegetation (___% of shoreline length)	___Other: ______ (___% of shoreline length)
___Submersed vegetation (___% of shoreline length)	___Other: ______ (___% of shoreline length)

Other Observations and Aquatic Habitat Notes: Site was inaccessible by boat on 8/1/2019. This assessment based on 11/2018, 3/2018, and 3/2017 aerial photos on Google Earth along with consideration of visual observations and ratings of the nearest downstream sites surveyed on 8/1/2019 (TC-15, TC-12).

S.R. Layman 8/5/2019

Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-14	**Date:** 8/5/2019	**Time:** 3:30pm
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ✓ Butts ____Henry ____Jasper ____Newton	
Site Description: Tussahaw Creek in upper reach; unboatable	**GPS?:** ___Yes ___No	
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: NA - assessment by aerial photos on Google Earth	**Reservoir Pool Level:** ___Full ___Medium ___Low	
Investigators: S.R. Layman	**Photos Taken?:** ___Yes ___No	

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	✓ Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

____Residential	✓ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	✓ >90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes ✓ No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply): none evident on imagery

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply): estimated from imagery

____Docks/piers/boatslips (______% of shoreline length)	✓ Overhanging vegetation ~60 % of shoreline length)
____Riprap (______% of shoreline length)	✓ Large woody debris ~20 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes: We could not access this upper reach by boat on 8/1/2019. This assessment based on 11/2018, 3/2018, and 3/2017 aerial photos on Google Earth along with consideration of ratings from nearest downstream sites accessible by boat (TC-15 and TC-12).

S.R. Layman 8/5/2019

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-15	**Date:** 8/1/19	**Time:** 11:08
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ✓ Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Sunny 81°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: SL, NSH, Dodd	**Photos Taken?:** ✓ Yes ___No	

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	✓ Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

____Residential	✓ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	✓ >90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes ✓ No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	____Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

____Docks/piers/boatslips (______% of shoreline length)	✓ Overhanging vegetation (20 % of shoreline length)
____Riprap (______% of shoreline length)	✓ Large woody debris (10 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
✓ Emergent vegetation (50 % of shoreline length)	____Other: ____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other: ____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-16	**Date:** 8/1/19	**Time:** 10:54
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Sunny 81°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd	**Photos Taken?:** ✓ Yes ___No	

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	✓ Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ______________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	✓ 70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ____No **(check all that apply):**

✓ Seawall/bulkhead only (5 % of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	✓ Other: boat Ramp <5%

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (<5 % of shoreline length)	✓ Overhanging vegetation (70 % of shoreline length)
____Riprap (______% of shoreline length)	✓ Large woody debris (5 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other: ______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other: ______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-17	**Date:** 8/1/19	**Time:** 10:40
Waterbody: _✓_Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Sunny 81°	**Reservoir Pool Level:** _✓_Full ___Medium ___Low	
Investigators: NSH, SL, Dodd	**Photos Taken?:** _✓_Yes ___No	

Length of Assessment Site: _✓_500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes _✓_No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	_✓_Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

_✓_Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: __________

Bank Stability:	_✓_Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	_✓_<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? _✓_Yes ____No **(check all that apply):**

____Seawall/bulkhead only (______% of site)	_✓_Seawall/bulkhead and riprap combined (_100_% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: __________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	_✓_Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	_✓_Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: __________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

_✓_Docks/piers/boatslips (_5_% of shoreline length)	_✓_Overhanging vegetation (_01_% of shoreline length)
_✓_Riprap (_100_% of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:__________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:__________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-18	**Date:** 8/1/19	**Time:** 10:32
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ✓ Butts ___Henry ___Jasper ___Newton	
Site Description: Forested		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: Sunny 81°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: SL, Dodd, NSH		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:___feet		**Active Erosion Problem Present?:** ___Yes ✓ No		
Shoreline Vegetative Buffer Zone Condition:	✓ Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	___Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
___Residential	✓ Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ___

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	✓ >90% of bank surfaces covered by healthy, living vegetation		
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	___<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? ___Yes ✓ No **(check all that apply):**			
___Seawall/bulkhead only (___% of site)		___Seawall/bulkhead and riprap combined (___% of site)	
___Riprap or other large stone only (___% of site)		___Other armoring: ___ (___% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
___Land-disturbing activity	___Residential landscape	✓ Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ___

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
___Docks/piers/boatslips (___% of shoreline length)	✓ Overhanging vegetation (40 % of shoreline length)
___Riprap (___% of shoreline length)	✓ Large woody debris (10 % of shoreline length)
✓ Bedrock and boulders (5 % of shoreline length)	✓ Standing timber (01 % of shoreline length)
___Emergent vegetation (___% of shoreline length)	___Other: ___ (___% of shoreline length)
___Submersed vegetation (___% of shoreline length)	___Other: ___ (___% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-19	**Date:** 8/1/19	**Time:** 11:40
Waterbody: √ Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Sunny	**Reservoir Pool Level:** √ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** √ Yes ___No

Length of Assessment Site: √ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes √ No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	√ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

√ Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________________

Bank Stability:	√ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	√ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? √ Yes ____No **(check all that apply):**

√ Seawall/bulkhead only (10 % of site)	√ Seawall/bulkhead and riprap combined (10 % of site)
√ Riprap or other large stone only (20 % of site)	____Other armoring: ______________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	√ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

√ Docks/piers/boatslips (5 % of shoreline length)	____Overhanging vegetation (______% of shoreline length)
√ Riprap (30 % of shoreline length)	____Large woody debris (______% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:________________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:________________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TG-20	**Date:** 08/01/19	**Time:** 11:56
Waterbody: ✓ Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: Sunny 81°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ______

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	✓ 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	___<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ___No **(check all that apply):**

___Seawall/bulkhead only (_____% of site)	✓ Seawall/bulkhead and riprap combined (15 % of site)
✓ Riprap or other large stone only (20 % of site)	___Other armoring: ________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	✓ Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (5 % of shoreline length)	✓ Overhanging vegetation (05 % of shoreline length)
✓ Riprap (35 % of shoreline length)	✓ Large woody debris (01 % of shoreline length)
___Bedrock and boulders (_____% of shoreline length)	___Standing timber (_____% of shoreline length)
___Emergent vegetation (_____% of shoreline length)	___Other:________ (_____% of shoreline length)
___Submersed vegetation (_____% of shoreline length)	___Other:________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-21	**Date:** 08/01/19	**Time:** 12:01
Waterbody: √ Lake Jackson ___Tailrace	**County:** √ Butts ___Henry ___Jasper ___Newton	
Site Description:		**GPS?:** ___Yes √ No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: Sunny	**Reservoir Pool Level:** √ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** √ Yes ___No

Length of Assessment Site: √ 500 feet ___Other:___feet		**Active Erosion Problem Present?:** ___Yes √ No
Shoreline Vegetative Buffer Zone Condition:	√ Natural: heavily vegetated, less than 20 percent of natural vegetation removed	
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining	
	___Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed	

Land Uses Adjacent to Shoreline (check all that apply):

√ Residential	√ Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ______________

Bank Stability:	√ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	√ 70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	___<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? √ Yes ___No **(check all that apply):**

___Seawall/bulkhead only (_____% of site)	___Seawall/bulkhead and riprap combined (_____% of site)
√ Riprap or other large stone only (10 % of site)	___Other armoring: ______________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

___Land-disturbing activity	√ Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ______________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

___Docks/piers/boatslips (_____% of shoreline length)	√ Overhanging vegetation (5 % of shoreline length)
√ Riprap (10 % of shoreline length)	√ Large woody debris (20 % of shoreline length)
___Bedrock and boulders (_____% of shoreline length)	___Standing timber (_____% of shoreline length)
___Emergent vegetation (_____% of shoreline length)	___Other:______________ (_____% of shoreline length)
___Submersed vegetation (_____% of shoreline length)	___Other:______________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-22	**Date:** 08/01/19	**Time:** 13:09
Waterbody: √ Lake Jackson ___Tailrace	**County:** ___Butts ___Henry ___Jasper ___Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ___GPC ___Residential ___Commercial ___Other		
Weather: Sunny	**Reservoir Pool Level:** √ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** √ Yes ___No

Length of Assessment Site: √ 500 feet ___Other:___feet	**Active Erosion Problem Present?:** ___Yes ___No

Shoreline Vegetative Buffer Zone Condition:	___Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	___Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	√ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
√ Residential	___Forested	___Golf Course	___Open	___Transportation
___Recreation/access	___Agricultural	___Commercial	___Logging	___Other: ______

Bank Stability:	√ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	___Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	___Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	___Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	___>90% of bank surfaces covered by healthy, living vegetation
	___70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	___50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	√ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ___Yes ___No **(check all that apply):**	
___Seawall/bulkhead only (_____% of site)	___Seawall/bulkhead and riprap combined (_____% of site)
√ Riprap or other large stone only (95 % of site)	√ Other armoring: boat ramp (5 % of site)

Potential Sources of Active Shoreline Erosion (check all that apply):			
___Land-disturbing activity	√ Residential landscape	___Reservoir fluctuations	___Wave action from watercraft/wind
___Impervious surfaces	___Roads and bridges	___Lack of buffer vegetation	___Tributary inflow
___Stormwater runoff	___Recreation/access	___Livestock activity	___Other: ______

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
√ Docks/piers/boatslips (01 % of shoreline length)	___Overhanging vegetation (_____% of shoreline length)
√ Riprap (95 % of shoreline length)	√ Large woody debris (01 % of shoreline length)
___Bedrock and boulders (_____% of shoreline length)	___Standing timber (_____% of shoreline length)
___Emergent vegetation (_____% of shoreline length)	___Other:________ (_____% of shoreline length)
___Submersed vegetation (_____% of shoreline length)	___Other:________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-23	**Date:** 08/01/19	**Time:** 13:17
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ✓ No

Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	✓ Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	✓ 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ✓ Yes ____No **(check all that apply):**

✓ Seawall/bulkhead only (70 % of site)	____Seawall/bulkhead and riprap combined (______% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (05 % of shoreline length)	✓ Overhanging vegetation (20 % of shoreline length)
____Riprap (______% of shoreline length)	✓ Large woody debris (01 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-24	**Date:** 08/01/19	**Time:** 13:20
Waterbody: _✓_Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Sunny 86°	**Reservoir Pool Level:** _✓_Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** _✓_Yes ___No

Length of Assessment Site: _✓_500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes _✓_No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	_✓_Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

_✓_Residential	_✓_Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ________

Bank Stability:	_✓_Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	_✓_<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? _✓_Yes ____No **(check all that apply):**

_✓_Seawall/bulkhead only (~~100~~% of site) 50%	_✓_Seawall/bulkhead and riprap combined (_50_% of site)
____Riprap or other large stone only (______% of site)	____Other armoring: ____________ (______% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	_✓_Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

_✓_Docks/piers/boatslips (_10_% of shoreline length)	_✓_Overhanging vegetation (_5_% of shoreline length)
_✓_Riprap (_50_% of shoreline length)	_✓_Large woody debris (_<5_% of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:____________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-25	**Date:** 08/01/19	**Time:** 13:24
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:	**GPS?:** ___Yes ___No	
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather:	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd	**Photos Taken?:** ✓ Yes ___No	

Length of Assessment Site: ✓ 500 feet ____Other:____feet	**Active Erosion Problem Present?:** ____Yes ✓ No
Shoreline Vegetative Buffer Zone Condition:	____Natural: heavily vegetated, less than 20 percent of natural vegetation removed
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining
	✓ Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed

Land Uses Adjacent to Shoreline (check all that apply):

✓ Residential	____Forested	____Golf Course	____Open	____Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	____Other: ____________

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	____>90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	✓ <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes ____No **(check all that apply):**

____Seawall/bulkhead only (_____% of site)	✓ Seawall/bulkhead and riprap combined (90 % of site)
____Riprap or other large stone only (_____% of site)	____Other armoring: ____________ (_____% of site)

Potential Sources of Active Shoreline Erosion (check all that apply):

____Land-disturbing activity	✓ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	____Other: ____________

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):

✓ Docks/piers/boatslips (5 % of shoreline length)	____Overhanging vegetation (_____% of shoreline length)
✓ Riprap (90 % of shoreline length)	____Large woody debris (_____% of shoreline length)
____Bedrock and boulders (_____% of shoreline length)	____Standing timber (_____% of shoreline length)
____Emergent vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)
____Submersed vegetation (_____% of shoreline length)	____Other:____________ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.: TC-30	**Date:** 8/1/19	**Time:** 11:00
Waterbody: ✓ Lake Jackson ____Tailrace	**County:** ____Butts ____Henry ____Jasper ____Newton	
Site Description:		**GPS?:** ___Yes ___No
Adjacent Land Ownership: ____GPC ____Residential ____Commercial ____Other		
Weather: Sunny 81°	**Reservoir Pool Level:** ✓ Full ___Medium ___Low	
Investigators: NSH, SL, Dodd		**Photos Taken?:** ✓ Yes ___No

Length of Assessment Site: ✓ 500 feet ____Other:____feet			**Active Erosion Problem Present?:** ____Yes ✓ No	
Shoreline Vegetative Buffer Zone Condition:	✓ Natural: heavily vegetated, less than 20 percent of natural vegetation removed			
	____Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining			
	____Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed			
Land Uses Adjacent to Shoreline (check all that apply):				
✓ Residential	✓ Forested	____Golf Course	____Open	✓ Transportation
____Recreation/access	____Agricultural	____Commercial	____Logging	✓ Other: transmission line

Bank Stability:	✓ Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	____Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	____Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	____Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	✓ >90% of bank surfaces covered by healthy, living vegetation
	____70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	____50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	____<50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? ____Yes ✓ No **(check all that apply):**			
____Seawall/bulkhead only (______% of site)		____Seawall/bulkhead and riprap combined (______% of site)	
____Riprap or other large stone only (______% of site)		____Other armoring: ______________ (______% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
____Land-disturbing activity	✓ Residential landscape	____Reservoir fluctuations	____Wave action from watercraft/wind
____Impervious surfaces	____Roads and bridges	____Lack of buffer vegetation	____Tributary inflow
____Stormwater runoff	____Recreation/access	____Livestock activity	✓ Other: adjacent Hwy 36

Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
____Docks/piers/boatslips (______% of shoreline length)	✓ Overhanging vegetation (40 % of shoreline length)
____Riprap (______% of shoreline length)	✓ Large woody debris (25 % of shoreline length)
____Bedrock and boulders (______% of shoreline length)	____Standing timber (______% of shoreline length)
____Emergent vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)
____Submersed vegetation (______% of shoreline length)	____Other:______________ (______% of shoreline length)

Other Observations and Aquatic Habitat Notes:

APPENDIX B

RECONNAISSANCE SURVEY SITE PHOTOS

South River Shoreline Reconnaissance Survey Sites

SR-01

SR-02

South River Shoreline Reconnaissance Survey Sites

SR-03

SR-04

South River Shoreline Reconnaissance Survey Sites

SR-05

SR-06

South River Shoreline Reconnaissance Survey Sites

SR-07

SR-08

South River Shoreline Reconnaissance Survey Sites

SR-09

SR-10

South River Shoreline Reconnaissance Survey Sites

SR-11

SR-12

South River Shoreline Reconnaissance Survey Sites

SR-13

SR-14

South River Shoreline Reconnaissance Survey Sites

SR-15

SR-16

South River Shoreline Reconnaissance Survey Sites

SR-17

SR-18

South River Shoreline Reconnaissance Survey Sites

SR-20

SR-29 (Alternate for SR-19)

South River Shoreline Reconnaissance Survey Sites

SR-21

SR-22

South River Shoreline Reconnaissance Survey Sites

SR-23

SR-24

South River Shoreline Reconnaissance Survey Sites

SR-25

Alcovy River Shoreline Reconnaissance Survey Sites

AR-01

AR-02

Alcovy River Shoreline Reconnaissance Survey Sites

AR-03

AR-04

Alcovy River Shoreline Reconnaissance Survey Sites

AR-05

AR-06

Alcovy River Shoreline Reconnaissance Survey Sites

AR-07

AR-08

Alcovy River Shoreline Reconnaissance Survey Sites

AR-09

AR-10

Alcovy River Shoreline Reconnaissance Survey Sites

AR-11

AR-12

Alcovy River Shoreline Reconnaissance Survey Sites

AR-14

AR-15

Alcovy River Shoreline Reconnaissance Survey Sites

AR-16

AR-17

Alcovy River Shoreline Reconnaissance Survey Sites

AR-19

AR-20

Alcovy River Shoreline Reconnaissance Survey Sites

AR-21

AR-22

Alcovy River Shoreline Reconnaissance Survey Sites

AR-23

AR-24

Alcovy River Shoreline Reconnaissance Survey Sites

AR-25

AR-27

Alcovy River Shoreline Reconnaissance Survey Sites

AR-28

Main Reservoir Shoreline Reconnaissance Survey Sites

MR-01

MR-02

Main Reservoir Shoreline Reconnaissance Survey Sites

MR-03

MR-04

Main Reservoir Shoreline Reconnaissance Survey Sites

MR-05

MR-11

Main Reservoir Shoreline Reconnaissance Survey Sites

MR-12

MR-13

Main Reservoir Shoreline Reconnaissance Survey Sites

MR-14

MR-15

Main Reservoir Shoreline Reconnaissance Survey Sites

MR-16

MR-17

Main Reservoir Shoreline Reconnaissance Survey Sites

MR-18

MR-19

Main Reservoir Shoreline Reconnaissance Survey Sites

MR-20

MR-21

Main Reservoir Shoreline Reconnaissance Survey Sites

MR-22

MR-23

Main Reservoir Shoreline Reconnaissance Survey Sites

MR-24

MR-25

Tussahaw Creek Shoreline Reconnaissance Survey Sites

TC-01

TC-02

Tussahaw Creek Shoreline Reconnaissance Survey Sites

TC-03

TC-04

Tussahaw Creek Shoreline Reconnaissance Survey Sites

TC-05

TC-06

Tussahaw Creek Shoreline Reconnaissance Survey Sites

TC-07

TC-08

Tussahaw Creek Shoreline Reconnaissance Survey Sites

TC-09

TC-10

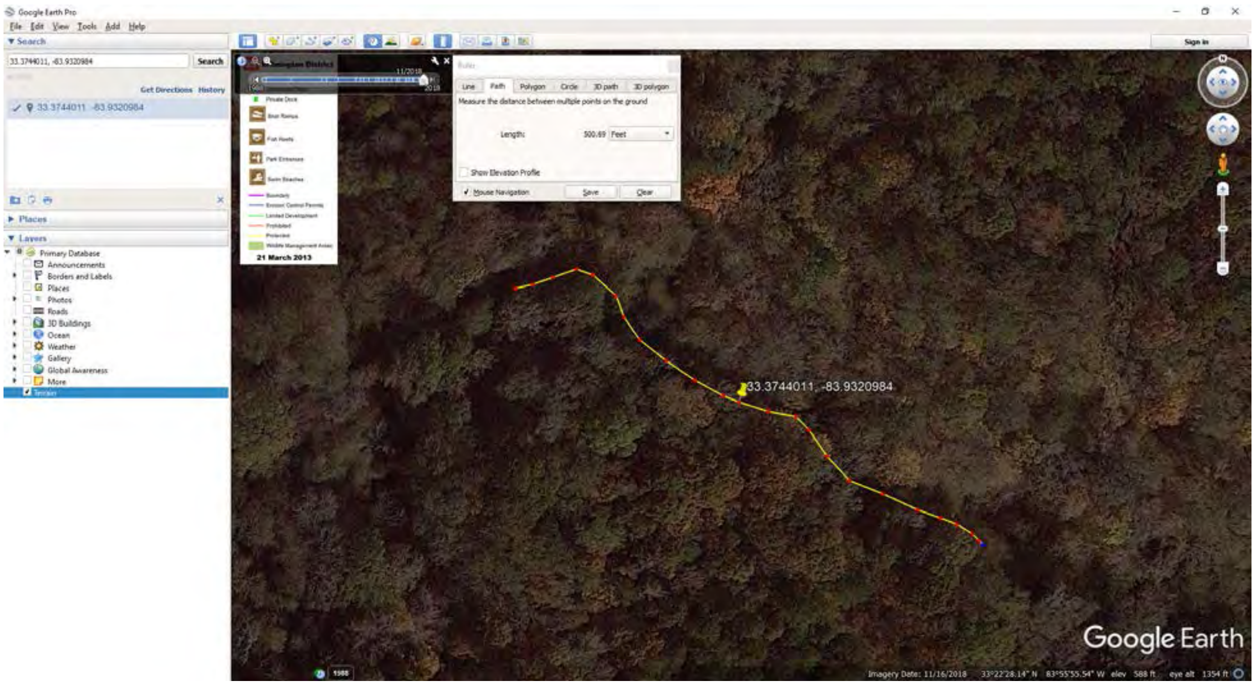
Tussahaw Creek Shoreline Reconnaissance Survey Sites

TC-11

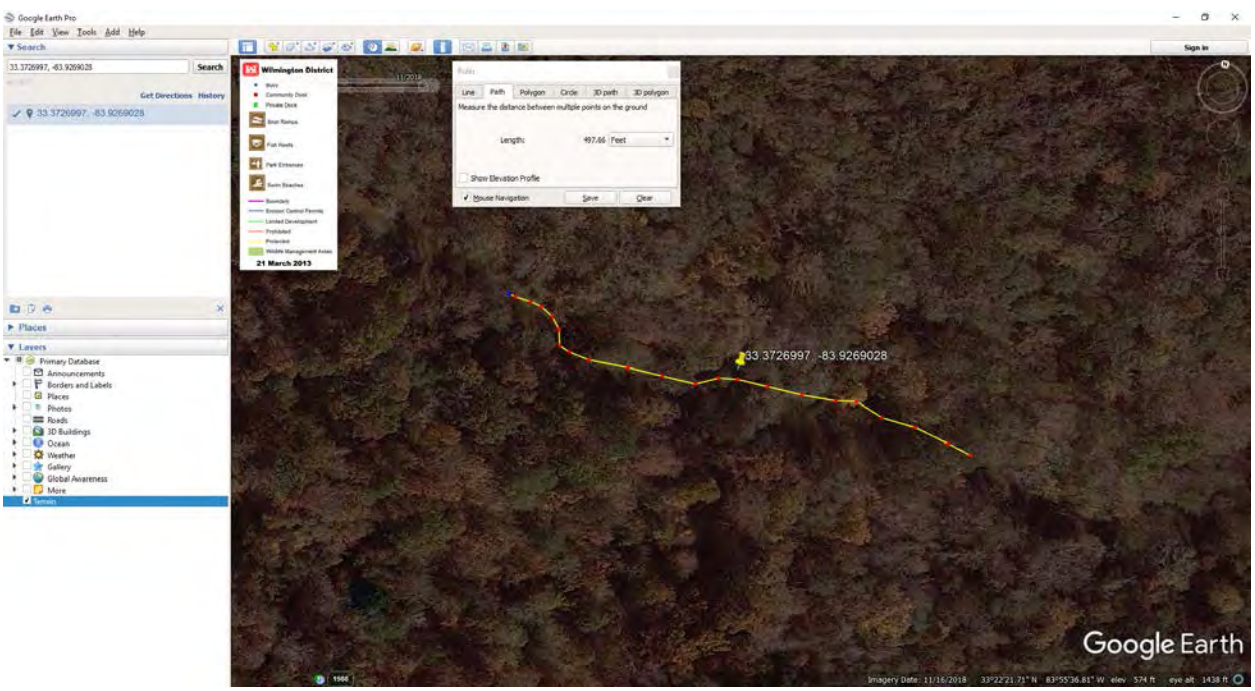
TC-12

Tussahaw Creek Shoreline Reconnaissance Survey Sites

TC-13



TC-14



Tussahaw Creek Shoreline Reconnaissance Survey Sites

TC-15

TC-16

Tussahaw Creek Shoreline Reconnaissance Survey Sites

TC-17

TC-18

Tussahaw Creek Shoreline Reconnaissance Survey Sites

TC-19

TC-20

Tussahaw Creek Shoreline Reconnaissance Survey Sites

TC-21

TC-22

Tussahaw Creek Shoreline Reconnaissance Survey Sites

TC-30

Tailrace Area Shoreline Reconnaissance Survey Sites

TR-01

TR-02

Tailrace Area Shoreline Reconnaissance Survey Sites

TR-03

Tailrace Area Shoreline Reconnaissance Survey Sites

TR-04

Tailrace Area Shoreline Reconnaissance Survey Sites

TR-05

Tailrace Area Shoreline Reconnaissance Survey Sites

TR-06

STUDY REPORT

WATER RESOURCES

LLOYD SHOALS HYDROELECTRIC PROJECT
(FERC NO. 2336)

Prepared with:

Lexington, South Carolina
www.Kleinschmidtgroup.com

May 2020

STUDY REPORT
WATER RESOURCES
LLOYD SHOALS HYDROELECTRIC PROJECT
(FERC NO. 2336)

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STUDY REPORT
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LLOYD SHOALS HYDROELECTRIC PROJECT
(FERC NO. 2336)

1.0 INTRODUCTION

This report presents the findings of the Water Resources Study conducted for the Federal Energy Regulatory Commission (FERC) relicensing of Georgia Power Company's (Georgia Power's) Lloyd Shoals Hydroelectric Project (FERC No. 2336) (Lloyd Shoals Project, the Project). The study was conducted according to the approved study plan for the Lloyd Shoals Project. The approved study plan consists of Georgia Power's Revised Study Plan (Georgia Power 2019) and the Study Plan Determination issued by FERC's Director of the Office of Energy Projects on May 20, 2019 (FERC 2019). Georgia Power will use the information generated by the study to evaluate the environmental effects of its proposed action in the Preliminary Licensing Proposal, to be filed with FERC by July 1, 2021.

The 18-megawatt Lloyd Shoals Project consists of a dam, powerhouse, and 4,750-acre reservoir (Lake Jackson, or Jackson Lake) on the Ocmulgee River in Butts, Henry, Jasper, and Newton Counties, Georgia (Figure 1 and Figure 2). Georgia Power operates the Project in a modified run-of-river mode for generation during peak power demand hours to meet electrical system demand. Georgia Power is not proposing to make any major modifications to the Project under the new license. The Project does not occupy federal lands. The current license expires December 31, 2023.

Georgia Power proposes to continue operating the Lloyd Shoals Project as currently operated. The Pre-Application Document (PAD) describes the existing project facilities and current operations and presents information characterizing the affected environment (Georgia Power 2018). Scoping Document 2 (FERC 2018) summarizes the environmental issues identified during FERC's public scoping process pursuant to the National Environmental Policy Act (NEPA).

1.1 OBJECTIVE

The goal of this study was to develop information for characterizing existing water resources in the study area and evaluating the water resource issues identified during FERC's public scoping process pursuant to NEPA that have a nexus with project operations.

The specific objectives of the study were to:

- Characterize water use, availability, and water quality in the Lloyd Shoals Project study area.
- Characterize the effects of continued project operation on water quality in Lake Jackson and the tailrace area within the project boundary.
- Review the substantial amount of existing water resources information and data available for the Ocmulgee River, along with the findings of Georgia Power's water quality monitoring in the study area, to evaluate the effects of continued project operation on water quality, including water temperature and dissolved oxygen (DO) concentrations, in Lake Jackson and the tailrace area.

1.2 STUDY AREA

The study area included Lake Jackson and the Lloyd Shoals tailrace area within the project boundary, the tailrace area in the Ocmulgee River between the project boundary and the Georgia Highway (Hwy) 16 bridge, and the Lake Jackson drainage area. New water quality monitoring field studies were conducted in the Lloyd Shoals tailrace area. Existing data characterizing water quality in Lake Jackson and in the Ocmulgee River downstream of the project boundary are summarized for evaluating downstream water quality effects.

The project boundary around Lake Jackson generally follows the full-pool elevation contour of 530 feet (ft) plant datum (PD)[1] except in some areas where it follows metes-and-bounds property lines, including areas for public recreation and around the powerhouse. Lake Jackson has 135 miles of shoreline and extends upstream from the dam about 13 river miles into the South and Yellow Rivers each, 11 miles into the Alcovy River, and 8 miles into Tussahaw Creek. The project boundary extends downstream of Lloyd Shoals Dam approximately 0.4 river mile to encompass Ocmulgee River Park, a project recreation facility. The Hwy 16 bridge is located about 1.1 river miles downstream of Lloyd Shoals Dam.

[1] Plant datum = mean sea level elevation (NAVD88) + 0.45 feet.

The term “project vicinity” used herein refers to the four-county area surrounding the project, including Butts, Henry, Jasper, and Newton Counties.

2.0 STUDY METHODS

The study approach followed the approved study plan (Georgia Power 2019; FERC 2019) and consisted of the elements described below.

2.1 WATER QUALITY MONITORING IN THE TAILRACE

Georgia Power installed a continuous water quality monitoring buoy in the Ocmulgee River below Lloyd Shoals Dam on July 24, 2019. Georgia Power determined the location of the buoy in consultation with the Georgia Environmental Protection Division (GEPD). The buoy was placed about 0.1 mile downstream of the project boundary (0.5 mi downstream of the dam) in a pool between the Ocmulgee River Park boat ramp and the Butts County public water supply intake (Figure 3). A field reconnaissance survey determined this area to be well mixed, of sufficient depth, and safely accessible by boat for maintenance. A multiparameter water quality instrument (YSI EXO 3) was placed beneath the buoy at a depth of approximately one meter and set to record measurements of water temperature, DO, pH, specific conductance, and turbidity at one-hour intervals. The instrument was equipped with a central antifouling wiper system that was programmed to perform a cleaning of the sensor prior to each measurement. Specifications for the individual probes are provided in Table 1.

Georgia Power collected monthly discrete water samples from the tailrace area at a depth of one meter. Samples were collected near the continuous monitoring buoy during periods when the river was boatable (July 2019 – January 2020). Samples were collected from the Tailrace Fishing Pier during high flows and while COVID-19 restrictions were in place (February – April 2020). Samples in November 2019 were collected from both locations for comparison. All samples were analyzed for 5-day biochemical oxygen demand (BOD5), ammonia, inorganic nitrogen (nitrate + nitrite), total Kjeldahl nitrogen (TKN), ortho-phosphate, and total phosphorus.

2.2 ANALYSIS OF INFORMATION AND DATA

Existing seasonal water quality data from 1986 to present, including vertical profile measurements of temperature, DO, pH, specific conductance, and turbidity, and water chemistry data including nutrients and were analyzed to evaluate water quality within Lake Jackson. Monthly vertical profiles of temperature and DO measured in Lake Jackson by Georgia Power were plotted to depict vertical stratification patterns and describe the relationship between the project intake's invert elevation and typical depth at which summer thermal and DO stratification occurs in Lake Jackson. Other data sources, including Adopt-a-Lake volunteer data, were used to augment the existing data record. Summary tables were prepared for comparison of historical and recent data sets. Continuous temperature and DO data collected in the tailrace in 2019-2020 were summarized in tables and graphs and combined with plots of corresponding turbine operations. Data were plotted to demonstrate the effects of generation during summer critical conditions.

Monitoring trends and data, and existing information and literature on water use, quantity, quality, and cyanobacteria occurrence and blooms in Lake Jackson and the Ocmulgee River were used to evaluate the water resource issues identified during scoping. The review of cyanobacteria blooms in Lake Jackson included factors that could lead to harmful algal blooms, and their relationship, if any, to project operations. Literature review of cyanobacteria occurrence included the following sources:

- GEPD information and data;
- Georgia Power algal reports and sampling information;
- Research program of phycologist Dr. Kalina Manoylov of Georgia College and State University pertaining to Georgia reservoirs;
- Research of community ecologist Dr. Alan Wilson of Auburn University pertaining to algal blooms, sedimentation, and nutrients in reservoirs;
- Scientific literature.

3.0 RESULTS

3.1 WATER QUANTITY

3.1.1 STREAM FLOW

This section updates stream flow information presented in the PAD (Georgia Power 2018). The U.S. Geological Survey (USGS) maintains a stream gage located approximately 1 mile downstream of Lloyd Shoals Dam on the Ocmulgee River at the Georgia Hwy 16 bridge (USGS No. 02210500, Ocmulgee River near Jackson, Georgia). The gage represents a watershed area of 1,420 square miles (sq mi). Drainage area accretion between the dam and the USGS gage is small, about 20 sq mi, and consists mainly of one tributary stream (Herds Creek) entering from the east. Monthly minimum, average, and maximum flows at this gage for the 30-year period from January 1989 through December 2018 are listed for each month in Table 2. Average monthly flows ranged from a low of 1,109 cubic feet per second (cfs) in August to a high of 3,075 cfs in March. The minimum flows usually occurred in late summer/early fall, and high flows tended to occur in winter/early spring.

3.1.2 WATER WITHDRAWALS

Surface-water withdrawals for public supply comprise the majority of water uses in the Ocmulgee River basin upstream of the Project (Lawrence 2016). The 19 permitted surface water withdrawals within the drainage area of Lake Jackson are listed in Table 3. There are no existing permitted surface-water withdrawals for public water supply on Lake Jackson. Butts County et al. Water and Sewer Authority (WSA) (a county partnership with the cities of Jackson and Jenkinsburg) operates a public water supply intake on the Ocmulgee river 0.7 mile downstream of Lloyd Shoals Dam outside of the project boundary. The permitted monthly average daily withdrawal is 9.7 MGD (GEPD 2020a). Withdrawals are treated at the Emerson L. Burford plant, which has a capacity of 4.0 MGD (Butts County et al. WSA 2019).

Other permitted surface-water withdrawals on the mainstem Ocmulgee River downstream of the Project between the Lloyd Shoals dam and the City of Macon include the following (GEPD 2020a):

- Georgia Power, Plant Scherer – intake about 25 river miles downstream of Project in Monroe County; permitted for monthly average withdrawal of 231 MGD; water is pumped to Lake Juliette for use in a closed-cycle recirculating cooling water system.
- Macon Water Authority (MWA) – public water supply intake about 38 river miles downstream of Project in Bibb County, upstream of Macon; permitted for monthly average withdrawal of 110 MGD; water is pumped to MWA's Javors Lucas Lake water storage reservoir, which has an area of 589 acres and an estimated storage capacity of 5.8 billion gallons of raw water at normal full pool.

Water demand in the Metropolitan North Georgia Water Planning District (Metro Water District), which includes 982 sq mi of the upper Ocmulgee River basin draining to Lake Jackson, is projected to increase by approximately 50 percent by the year 2050 (CH2M and Black & Veatch 2017). Water demand within the Middle Ocmulgee Water Planning District, which begins downstream of the Metro Water District and includes Butts, Newton, and Jasper Counties around Lake Jackson and nine counties downstream of the Project, is projected to increase by approximately 35 percent by the year 2050 (GEPD 2017a). Surface water resources within the region are considered adequate to meet future water demands (GEPD 2017b).

3.1.3 Wastewater Discharges

As of January 2020, there were 41 GEPD-permitted discharges within the drainage basin of Lake Jackson and the Lloyd Shoals Project. These included seven water treatment plants, 17 land application systems, nine National Pollution Discharge Elimination System (NPDES) permitted discharges, six mining and processing facilities, one general cooling water, and one animal feed operation (GEPD 2020a). GEPD's 2017 assessment indicates the current and future (2050) assimilative capacity of waters in the project vicinity is very good (GEPD 2017b).

3.2 Water Quality Monitoring in the Lloyd Shoals Tailrace

Flows in the Ocmulgee River below Lloyd Shoals Dam, as measured at the USGS gage at Hwy 16, varied widely during the study period (Figure 4). Prolonged periods of below-normal flow during the late summer and fall of 2019 were followed by periods of high flows in January and February 2020.

Georgia Power conducted continuous DO, water temperature, conductivity, pH, and turbidity monitoring in the Ocmulgee River below Lloyd Shoals Dam beginning July 24, 2019. Since deploying the tailrace water quality measurement sonde and data recorder, the instrument had collected data covering 283 days (July 24, 2019 – April 30, 2020) and valid measurements covering 99.5 percent of that span (6,757 of 6,792 total hours). Monthly minimum, average, and maximum values for each parameter for this period are presented in Table 4. Georgia Power will continue collecting continuous monitoring data at the tailrace buoy location through July 2020 and will prepare an Updated Water Resources Study Report by May 2021, in accordance with the master schedule in the approved study plan.

Georgia Power operates a passive draft tube aeration system that was installed on Units 2, 3, and 4 (two per unit) in 2006 to improve tailrace DO concentrations in downstream releases during the summer critical period. Monitoring data collected by Georgia Power in 2006 and 2007, as presented in the PAD (Georgia Power 2018), showed the aeration system to be effective in increasing and stabilizing summer DO levels in the tailrace. The draft tube aeration system is typically operated from May 15 through September 30 unless dry conditions extend into October. In 2019, draft tube aeration continued into mid-October because low flows persisted through this time.

The daily averages of water temperature and DO concentration recorded in the tailrace are plotted in Figure 5. For the period from July 24, 2019 to April 30, 2020, over 6,700 readings were collected. The average water temperature was 18.47°C and the average DO concentration was 7.99 milligrams per liter (mg/L). Throughout these nine months of monitoring, which included the latter half of the 2019 summer critical period, tailrace DO concentrations met the Georgia criteria of no less than 4.0 mg/L instantaneous 100 percent of the time and 5.0 mg/L daily average on all but one day. The daily average DO value for October 23, 2019 was 4.95 mg/L; this was the date that Georgia Power discontinued passive draft tube aeration for the year. The 2019 summer DO monitoring data demonstrate the effective performance of the passive draft tube aeration system in maintaining DO levels above the applicable criteria.

A comparison of hourly project discharge and DO measurements is presented in Figure 6. During late summer when the lake is strongly stratified, generation resulted in slight decreases in downstream DO levels (see early August 2019 period in Figure 6). During periods when powerhouse capacity was exceeded and flows were passed over the spillway, DO levels were increased due to physical aeration.

The water chemistry results for grab samples taken at one-meter depth in the tailrace area near the buoy location or from the Tailrace Fishing Pier are presented in Table 5. Of the ten samples collected to date, none had detections for BOD5 or ortho-phosphate. Total phosphorus concentrations were also below the detection limit for seven of the ten samples (Table 5). Levels of nitrate-nitrite (0.43 – 0.85 mg/L) and TKN (0.23 – 1.5 mg/L) were similar to ecoregional averages of 0.7 mg/L and 0.45 mg/L, respectively; while levels of total phosphorus (0.055 – 0.073 mg/L) were below the ecoregional average of 0.12 mg/L (EPA 2000). There was little difference in parameter values between the buoy and fishing pier when both locations were sampled in November 2019.

3.3 WATER QUALITY IN LAKE JACKSON

At normal full-pool elevation of 530 ft PD, Lake Jackson covers 4,750 acres and has 135 miles of shoreline. The mean depth of the reservoir 22.5 ft and retention time (i.e., residence time of lake water) is 32 days. The 12-foot tall intake openings for the powerhouse have an invert elevation of 495 ft PD, which is approximately 35 ft below the normal full-pool elevation. The 1,400 sq mi of drainage area upstream of Lloyd Shoals Dam includes about 982 sq mi (70 percent) within the Metro Water District in southeastern and eastern metropolitan Atlanta. According to 2016 land use data, approximately 38 percent of the Lake Jackson drainage is developed, with approximately 42 percent forested (Multi-Resolution Land Characteristics Consortium 2020).

The South River, Yellow River, Alcovy River, and Tussahaw Creek are the main tributaries draining the Metro Water District. They converge downstream at Lake Jackson to form the Ocmulgee River. Watershed imperviousness is high throughout much of the Metro Water District and 80 percent of the stream miles assessed (406 miles) do not support their designated uses for one or more parameters (CH2M and Black & Veatch 2017). Seventy percent (354 miles) do not meet water quality standards for fecal coliform bacteria as a result of nonpoint source pollution and urban runoff. Twenty-nine percent (146 miles) do not meet water quality standards for biota, indicative of high sediment loads degrading habitat for benthic macroinvertebrates and fish. Increased imperviousness from urbanization increases the volume of runoff entering streams, which in turn causes stream erosion and downstream transport of sediment.

Four segments of the South River (51 stream miles) upstream of Lake Jackson in the Metro Water District do not support their designated use due to elevated concentrations of legacy polychlorinated biphenyls (PCBs) detected in fish tissue (Fish Consumption Guidelines) (GEPD 2018a). The PCB contamination has been attributed to urban runoff and combined sewer overflows (GEPD 2002). The use of PCBs was banned in the U.S. in the late 1970s, loadings have been removed or reduced to zero, and levels are decreasing in the water column, sediments, and fish tissues over time. The current fish consumption guidelines (Georgia Department of Natural Resources [GDNR] 2018) for the South River upstream of the Project recommend limiting consumption of three sport-fish species tested (Bluegill, Snail Bullhead, Largemouth Bass) to one meal per week.

Within the Middle Ocmulgee Water Planning Region, land use transitions from suburban near the Metro Water District to more rural and residential surrounding Lake Jackson. The lower segments of the South River, Yellow River, and Tussahaw Creek, before they enter Lake Jackson, do not meet water quality standards due to fecal coliform bacteria from nonpoint sources and urban runoff (GEPD 2018a). Tussahaw Creek is also impaired for biota due to sedimentation.

As described in the PAD, Lake Jackson historically exhibited accelerating eutrophication caused by an excessive input of nutrients, mainly from point-source discharges upstream of the Project (EPA 1975). As major improvements were made to wastewater treatment systems through the 1980s, primarily through phosphorus reduction and diversions of treated wastewater, Lake Jackson water quality made a remarkable recovery (Kamps 1989). However, continued contributions of nutrients from point and non-point sources led to the 1997 implementation of site-specific criteria for chlorophyll a (< 20 µg/L April-October), total phosphorus (< 5.5 lbs/acre-foot/year), and total nitrogen (<4.0 mg/L as nitrogen in the photic zone) (GEPD 2018b). These site-specific standards have helped to further control nutrient loading and reduce associated seasonal problems with water quality and algal blooms. Subsequent reservoir monitoring results have indicated compliance with the site-specific water quality standards for Lake Jackson (GEPD 2003, 2018a).

GEPD (2018a) lists Lake Jackson as not supporting its designated use due to elevated concentrations of legacy PCBs in fish tissue, attributed to urban runoff and nonpoint source pollution. A total maximum daily load (TMDL) was completed for PCBs in Lake Jackson to address the impairment (U.S. Environmental Protection Agency [EPA] 1998a). However, even without the TMDL, PCBs have been banned in the U.S., and their levels in the environment are declining and will continue to decline. Their detection in fish tissue at Lake Jackson was unrelated to Lloyd Shoals project operations. Furthermore, there is no longer a fish consumption advisory for Lake Jackson due to PCBs (GDNR 2018), reflecting the declining trend.

A fish consumption advisory remains for Lake Jackson due to mercury for limiting consumption of larger size classes of Largemouth Bass to one meal per week (GDNR 2018). EPA (2002) developed a TMDL for mercury in Lake Jackson. The predominant source of mercury loading to the lake is air deposition, which is unrelated to Lloyd Shoals project operations. Current fish consumption advisories for Largemouth Bass and other sport fishes due to mercury are widespread in Georgia reservoirs (GDNR 2018).

EPA (1998b) also completed a TMDL for chlordane (a pesticide) in Lake Jackson. Similar to PCBs, chlordane use has been banned, its levels in water and sediment have been declining, and its detection in fish tissue was unrelated to project operations. There is no longer any fish consumption advisory for Lake Jackson due to chlordane.

3.3.1 Water Quality Monitoring Data

As described in the PAD, Georgia Power has collected water quality data at several locations in Lake Jackson since the 1980s, as depicted in Figure 7. A subset of vertical profile data collected in the forebay during summer from 2008-2017 was presented in the PAD. To supplement that characterization, all water temperature and DO profile data collected in the forebay (1986 – 2017) were aggregated by month and depth to produce composite (average) profiles for each month. These composite profiles are plotted along with shading to indicate the intake depths in Figure 8 and Figure 9. The average monthly profile values for water temperature and DO concentration within the intake zone (495 to 507 ft PD, or 23 to 35 ft below full-pool surface) are presented in Figure 10.

GEPD has collected monthly water vertical profile and water chemistry data at several locations in Lake Jackson for many years, typically from April to October (GEPD 2020b). Vertical profile data from measurements of water temperature and DO concentration in the forebay (LK_04_897) and mid-lake (LK_04_893) are provided in Figure 11 to Figure 14.

Box plots of key water chemistry parameter results from the forebay and mid-lake sampling locations are presented in Figure 15 and Figure 16. These box plots provide a graphical depiction of the distribution of the data. The boxes represent the middle 50 percent of the data, with the horizontal line within the box representing the median value. The vertical lines on the top and bottom of each box represent the upper and lower 25 percent of the data, respectively.

Georgia Power obtained data collected at nine locations by Lake Jackson Homeowners Association through the Georgia Adopt-A-Lake citizen monitoring program (Georgia AAS 2020). Available data from 2014 to present for Lake Jackson included measurements of surface water temperature, DO concentration, pH, conductivity, and Secchi depth, and *Escherichia coli*. A tabular summary of these data is presented in Table 6.

The profiles measurements in Lake Jackson clearly show typical reservoir vertical stratification, with warmer surface temperatures, a pronounced thermocline, and cooler, low-DO water below 10 m. Although the wintertime profile measurements were limited to three years, the seasonally mixed nature of the reservoir is evident in these non-summertime profiles. This seasonal pattern of summertime vertical stratification and mixing in the winter is typical of southeastern reservoirs. Chemical analyses on water quality grab samples collected at Lake Jackson indicate overall reservoir water quality is good except for occasional elevated concentrations of fecal coliform bacteria and chlorophyll *a* related to nutrient inputs and nonpoint sources in the upstream watershed.

3.3.2 ALGAL BLOOMS

Algal blooms can occur naturally with regularity, but their frequency, duration, and intensity are increased by nutrient enrichment, particularly nitrogen and phosphorous, from point and non-point sources (Pearl et al. 2001; Anderson et al. 2002; EPA 2016). Nutrient enrichment, together with a combination of increased temperatures, light availability (sunlight), and low flow create conditions favorable for algae growth (EPA 2016). As of January 2020, there were 41 GEPD-permitted discharges within the drainage area of Lake Jackson and Lloyd Shoals Dam. These included seven water treatment plants, 17 land application systems, nine NPDES permitted discharges, six mining and processing facilities, one general cooling water, and one animal feed operation (GEPD 2020a). These discharges are primary sources of nutrients to the reservoir and led to the eutrophication of the reservoir documented since the 1970s (EPA 1975). Increased nutrient levels when coupled with the physiochemical conditions often occurring during summer months, can lead to increased algal growth in areas of Lake Jackson.

Advances in wastewater treatment systems in the watershed upstream of Lake Jackson have substantially reduced nutrient concentrations in the reservoir from the early 1980's. However, cyanobacteria blooms have occasionally occurred in the reservoir since then when certain antecedent conditions persist. Numerous genera of phytoplankton can form blooms; however, cyanobacteria, or blue-green algae, are the most notorious group forming blooms in freshwater systems because their blooms tend to be highly visible and can be toxic (Pearl et al. 2001).

A bloom of the cyanobacterium *Microcystis sp.* developed in an area of Lake Jackson in late summer 2007 (PhycoTech 2008). That bloom was preceded by drought, increased water temperature, and dramatically increased retention time. Globally, these factors are often found to be associated with cyanobacteria blooms. Further, cyanobacteria can use nutrients from bottom sediments as well as the water column and air to enhance bloom conditions. A historical review of cyanobacteria occurrence showed that *Cylindrospermopsis raciborskii* was present in Lake Jackson prior to 2007 but *Microcystis aeruginosa* has become the dominant cyanobacterium in the reservoir (PhycoTech 2008). *Microcystis aeruginosa* can produce the toxin microcystin, which when released into the water and ingested, depending on the concentration and individual sensitivities, can produce adverse effects in humans, pets, livestock, and wildlife.

A 2015 bloom at Lake Jackson was confirmed to contain *Microcystis aeruginosa* (Manoylov 2015). It is believed that this bloom and others occur during prolonged periods of high water temperatures (>30°C), low reservoir inflows (i.e., drought), and increased retention time in Lake Jackson (PhycoTech 2008).

Wilson et al. (2020) developed a model to predict blooms of cyanobacterial toxins in the southeastern U.S. based on over 1,500 samples from regional freshwater lakes, reservoirs, ponds, and rivers. The model uses chlorophyll, phosphorus, and nitrogen-to-phosphorus ratios to generate predictions of harmful algal blooms. Using the growing season average chlorophyll, nitrogen, and phosphorus concentrations in GEPD's 2017 assimilative capacity study (GEPD 2017b), the forecasting model predicted low risk for development of toxic cyanobacteria blooms in Lake Jackson (Table 7). However, as mentioned above, the risk level increases during extreme conditions.

3.4 OCMULGEE RIVER DOWNSTREAM OF THE LLOYD SHOALS PROJECT

As presented in Section 3.2, Georgia Power's continuous water quality monitoring in the Lloyd Shoals tailrace area from July 24, 2019 through April 30, 2020 shows that water quality in the tailrace meets applicable criteria for water temperature, DO, and pH. Water chemistry analysis of grab samples collected in the tailrace in 2019 and 2020 are also indicative of good overall water quality (Table 5).

GEPD collected monthly tailrace water quality data in 2009, approximately 30 ft downstream of the powerhouse, including measurements of water temperature, DO, pH, and specific conductance (Table 7). Those data indicated DO levels above applicable criteria in the Lloyd Shoals tailrace area.

During a Robust Redhorse distribution study in the 19-mile reach between Lloyd Shoals Dam and Juliette Dam, Pruitt (2013) measured seasonal water temperature and DO concentrations in spring-fall 2010 and spring 2011 at 25 sample sites. Mean seasonal water temperature varied from 20.90 to 29.89°C and mean DO concentration ranged from 6.33 to 7.55 mg/L, while mean river discharge at the time of measurement ranged from 505 to 1,464 cfs.

GEPD collected monthly water quality data in 2016 and 2018 on the Ocmulgee River at Georgia Hwy 83, approximately 14.5 miles downstream of Lloyd Shoals Dam, including measurements of water temperature, DO, pH, and specific conductance (Table 8). Those data indicated water temperature, pH, and DO meet applicable criteria in the Ocmulgee River at Hwy 83.

Based on GEPD's latest 305(b)/303(d) list, the Ocmulgee River is supporting its designated uses from Lloyd Shoals Dam downstream 17 miles to is confluence with the Towaliga River (GEPD 2018a) (Figure 1).

4.0 SUMMARY

The goal of this study was to develop information for characterizing existing water resources in the study area and evaluate the water resource issues identified during FERC's public scoping process pursuant to NEPA that have a nexus with project operations. This was accomplished by examining existing information as well as collecting new information through continuous monitoring and discrete water chemistry sampling.

Analysis of water use and availability information indicates there are no permitted users that withdraw water directly from the Project. Surface-water withdrawals for public supply comprise the majority of water uses within the Lake Jackson drainage area. Surface water availability in the area is considered adequate for future use. Additionally, waters in the study area have very good current and future capacity to assimilate wastes.

A review of available information pertaining to harmful algal blooms in Lake Jackson indicates a correlation with prolonged high water temperature, low reservoir inflows, and increased retention time. Although a predictive model indicates a low overall risk for cyanobacteria blooms and toxins, these risks likely increase under conditions mentioned above, which are typically associated with summer droughts.

Under current operations, water quality in Lake Jackson is meeting applicable criteria. Mercury remains a concern when considering consumption of some fish from the reservoir; however, levels of mercury detected in fish tissue are similar to many other larger reservoirs in Georgia. A substantial amount of existing water quality monitoring data for Lake Jackson indicates that the reservoir exhibits a seasonal pattern of vertical stratification typical of southeastern reservoirs. Forebay DO levels in the hypolimnion are typically less than 4 mg/L from June through September requiring DO enhancement measures for water releases through the powerhouse. Water chemistry data indicate the site-specific criteria for chlorophyll *a* and total nitrogen are consistently being met.

Under current operations, water quality in the Ocmulgee River downstream of Lloyd Shoals dam is meeting applicable criteria. Georgia Power initially demonstrated the effectiveness of the passive draft tube aeration system in 2006 and 2007. More recent data collected by GEPD and the continuous tailrace monitoring data collected by Georgia Power as part of this study validate the performance of the aeration system in continuing to be effective in raising and maintaining DO levels above applicable standards during summer critical conditions. Additionally, available data from GEPD indicates that the Ocmulgee River downstream of Lloyd Shoals dam is fully supporting its designated uses.

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TABLE 1 PROBE SPECIFICATIONS FOR CONTINUOUS TAILRACE MONITORING INSTRUMENT

PARAMETER	PROBE	SPECIFICATIONS
Temperature	YSI EXO Wiped Conductivity & Temperature Smart Sensor	Range: -5 to 50°C Accuracy: ± 0.2°C Resolution: 0.001°C
Specific Conductance	YSI EXO Wiped Conductivity & Temperature Sensor	Range: -0 to 100 mS/cm Accuracy: ± 1% of the reading or 0.002 mS/cm, whichever is greater Resolution: 0.0001to 0.01 mS/cm (range dependent)
Dissolved Oxygen	YSI EXO Optical Dissolved Oxygen Smart Senor	Range: 0 - 20 mg/L Accuracy: ± 0.1 mg/L or 1% of reading, whichever is greater
pH	EXO pH Smart Sensor	Precision: ± 0.1 pH units within ± 10°C of calibration temp; ± 0.2 pH units for entire temp range
Turbidity	EXO Turbidity Smart Sensor	Precision: 0 to 999 FNU: 0.3 FNU or ± 2% of reading, whichever is greater

TABLE 2 MINIMUM, AVERAGE, AND MAXIMUM FLOWS IN THE OCMULGEE RIVER BELOW LLOYD SHOALS DAM FROM 1989 - 2018

MONTH	MINIMUM FLOW (CFS)	AVERAGE FLOW (CFS)	MAXIMUM FLOW (CFS)
January	888	2,263	5,688
February	951	2,934	6,787
March	944	3,075	6,787
April	632	2,232	4,672
May	443	1,656	7,038
June	275	1,417	3,628
July	339	1,612	7,089
August	321	1,109	3,002
September	241	1,216	4,899
October	277	1,301	4,805
November	259	1,668	5,593
December	513	2,256	8,188

Source: USGS (2020)

TABLE 3 PERMITTED SURFACE WATER WITHDRAWALS IN THE LAKE JACKSON DRAINAGE BASIN

PERMIT HOLDER	COUNTY	SOURCE	PERMIT LIMIT MAX DAY (MGD)	PERMIT LIMIT MONTHLY AVERAGE (MGD)
Butts County, et al. W & S Authority	Butts	Ocmulgee River	10.50	9.70
Clayton County Water Authority	Clayton	Little Cotton Indian Creek/Hooper Reservoir	22.00	20.00
Clayton County Water Authority	Henry	Edgar Blalock, Jr Res on Pates Creek	10.00	10.00
Henry County W & S Authority	Henry	Indian Creek	13.50	8.00
Henry County W & S Authority	Henry	Tussahaw Creek Reservoir	42.00	32.00
Henry County W & S Authority	Henry	Longbranch Creek Reservoir	10.00	10.00
City of Locust Grove	Henry	Brown Branch	0.45	0.30
City of McDonough	Henry	John H. Furgeson Reservoir	2.40	2.40
City of Covington	Newton	Alcovy River	4.50	4.00
Newton County	Newton	Alcovy River	35.00	35.00
Newton County	Newton	Bear Creek Reservoir	42.00	34.00
Newton County	Newton	Cornish Cr. Reservoir	35.00	28.00
Newton County	Newton	Alcovy River	35.00	35.00
Thomas Brothers Hydro, Inc.	Newton	Ocmulgee River	260.00	260.00
Milstead Hydroelectric	Rockdale	Yellow River	194.00	194.00
Rockdale County	Rockdale	Big Haynes Creek	43.70	32.80
City of Monroe	Walton	Alcovy River	10.00	10.00
City of Monroe	Walton	John T. Briscoe. Jr Reservoir	16.00	12.00
City of Social Circle	Walton	Alcovy River	1.00	1.00

Source: GEPD (2020a)

TABLE 4 MONTHLY SUMMARY OF CONTINUOUS WATER QUALITY DATA FROM TAILRACE MONITOR

PARAMETER		2019						2020			
		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR
Water Temperature (degrees C)	min	28.15	27.89	26.97	20.24	13.28	9.68	9.53	9.27	10.53	16.67
	avg	28.56	28.45	28.05	24.30	16.07	11.32	11.70	11.21	14.04	18.45
	max	29.3	29.33	29.24	28.34	20.61	13.88	15.00	13.08	19.18	20.34
Dissolved Oxygen (mg/L)	min	5.42	4.71	5.28	4.65	5.21	6.89	8.54	9.45	7.67	6.13
	avg	6.72	6.65	6.52	6.07	6.71	8.88	9.46	10.5	9.66	7.86
	max	7.36	7.64	7.71	8.37	8.18	10.48	11.05	11.57	11.53	9.64
pH	min	6.26	6.26	6.36	6.46	7.14	7.06	6.71	6.79	6.87	6.99
	avg	6.34	6.38	6.49	6.7	7.25	7.27	6.98	6.97	7.00	7.15
	max	6.49	6.57	6.71	7.19	7.37	7.49	7.25	7.28	7.29	7.49
Specific Conductance (µs/cm)	min	109.8	112.6	124.1	138.6	146.2	95.1	54.8	46.9	44.4	63.3
	avg	113.9	119.2	132.5	147.9	148.7	130.5	75.9	60.4	60.1	75.2
	max	116.1	131.8	150.2	154.8	152.7	152.3	103.3	93	80.1	91.3
Turbidity (FNU)	min	2.9	2	1.6	0.9	1.4	1.6	9.3	10.1	7.1	3.3
	avg	7.2	53.5	3	2.7	2.6	8.3	22.6	32.8	17.4	8.7
	max	21.3	3407	312.3	12.2	8.4	24.8	67.6	80.7	49.9	27.1

TABLE 5 SUMMARY OF DISCRETE WATER CHEMISTRY RESULTS FROM TAILRACE SAMPLES

SAMPLE DATE	AMMONIA (MG/L)	BOD (MG/L)	NITRATE - NITRITE (MG/L)	ORTHO-PHOSPHATE (MG/L)	TOTAL PHOSPHORUS (MG/L)	TKN (MG/L)
7/24/2019	0.1	ND	0.71	ND	ND	0.29
8/22/2019	ND	ND	0.78	ND	ND	0.46
9/26/2019	0.33	ND	0.33	ND	ND	0.64
10/24/2019	0.22	ND	0.63	ND	ND	1.5
11/25/2019	0.21	ND	0.76	ND	ND	0.49
12/16/2019	0.12	ND	0.85	ND	ND	0.4
1/20/2020	ND	ND	0.43	ND	0.068	0.37
2/26/2020	ND	ND	0.48	ND	0.055	0.23
3/11/2020	ND	ND	0.45	ND	ND	0.31
4/27/2020	ND	ND	0.43	ND	0.073	0.33

ND = Not Detected

TABLE 6 SUMMARY OF ADOPT-A-LAKE MONITORING DATA FOR LAKE JACKSON, 2014 – PRESENT

PARAMETER		LOCATION								
		3306	3324	3327	3951	4269	4294	4617	5057	5197
Water Temperature (degrees Celsius)	Count	49	44	14	30	19	23	14	9	10
	Min	7.6	7.5	10.9	2.8	7.9	8.4	9.4	9.8	10.2
	Avg	20.3	19.2	20.1	18.4	21.6	22.8	23.5	20.3	18.3
	Max	43.0	28.7	31.5	27.2	30.9	31.1	30.8	31.2	30.5
Dissolved Oxygen (mg/L)	Count	48	44	13	30	19	23	13	9	10
	Min	5.30	5.30	5.30	6.10	5.84	6.00	6.70	7.70	7.80
	Avg	8.07	7.81	8.04	8.37	8.77	8.18	8.92	8.97	9.24
	Max	11.70	11.70	10.50	12.00	11.70	10.60	10.70	10.40	11.50
pH	Count	48	44	13	30	19	23	13	9	10
	Min	5.31	6.28	6.74	5.24	6.80	6.50	6.00	4.53	6.28
	Avg	6.95	7.09	7.19	6.99	7.53	7.29	7.52	6.52	6.99
	Max	7.46	8.55	8.11	7.50	9.22	8.25	9.20	7.46	8.50
Conductivity (µs/cm)	Count	47	41	14	29	19	23	14	9	10
	Min	3	62	84	11	73	11	51	43	33
	Avg	142	156	139	68	123	106	99	72	70
	Max	353	783	359	173	398	155	171	130	132
Secchi Depth (m)	Count	46	43	13	28	19	23	14	9	10
	Min	0.1	0.1	0.1	0.3	0.7	0.2	0.4	0.4	0.2
	Avg	0.6	0.6	0.7	0.7	1.2	0.7	1.4	1.2	0.8
	Max	1.2	1.2	1.1	1.0	2.3	1.2	2.1	1.8	1.6
E. coli (CFU/100 mL)	Count	47	44	15	32	20	23	18	10	9
	Min	0	0	0	0	0	0	0	0	0
	Avg	131	130	67	125	37	19	24	37	148
	Max	933	500	400	1033	467	300	100	200	733

TABLE 7 CYANOBACTERIA FORECASTING MODEL RESULTS

PARAMETERS	MID-LAKE[1]	DAM FOREBAY
Inputs		
Chlorophyll a (ug/L)	7.83	7.92
Total Phosphorus (ug/L)	87	96
Nitrogen to Phosphorus molar ratio	72	52
Prediction Results		
Cyanobacteria		
Phycocyanin (ug/L)	2	2
Risk Level	Low Risk	Low Risk
Toxic Cyanobacteria		
Microcystin (ug/L)	0.00726	0.00683
Risk Level	Low Risk	Low Risk

[1]At confluence of Alcovy River and Yellow/South Rivers

TABLE 8 GEPD WATER QUALITY MEASUREMENTS IN THE LLOYD SHOALS TAILRACE

DATE	WATER TEMPERATURE (DEGREES C)	DO (MG/L)	PH	SPECIFIC CONDUCTANCE (µS/CM)
1/27/2009	7.7	9.9	7.4	119
2/24/2009	9.8	11.2	7.4	136
3/31/2009	14.42	9.72	7.19	60
4/28/2009	18.7	7.8	6.8	83
5/26/2009	22	6.1	6.8	101
6/30/2009	25.3	5.7	6.5	101
7/28/2009	27.1	4.8	6.4	118
8/25/2009	28.2	6	6.6	138
9/29/2009	23.5	7	6.2	62
10/28/2009	16.4	8.2	7	60
11/30/2009	13.1	7.8	7	79
12/7/2009	10.4	11.3	6.7	61

Source: GEPD 2020

TABLE 9 GEPD WATER QUALITY MEASUREMENTS IN THE OCMULGEE RIVER AT HWY 83

DATE	WATER TEMPERATURE (DEGREES C)	DO (MG/L)	pH	SPECIFIC CONDUCTANCE (µS/CM)
01/11/2016	10.05	9.14	7.58	58.0
02/04/2016	9.96	10.02	6.46	69.0
03/03/2016	11.85	9.83	5.88	65.0
04/07/2016	17.31	7.25	7.27	81.0
05/10/2016	21.32	7.22	6.25	96.0
06/23/2016	26.96	6.70	6.80	119.1
07/13/2016	27.95	6.50	7.12	130.1
08/02/2016	29.44	6.47	7.08	147.0
09/06/2016	27.36	7.17	7.01	143.1
10/06/2016	24.07	7.70	7.42	155.0
11/01/2016	19.84	8.40	7.12	159.2
12/01/2016	15.49	8.83	6.92	170.6
01/23/2018	8.03	11.14	6.02	112.0
02/21/2018	14.11	9.80	7.12	70.2
03/14/2018	12.29	9.72	6.47	96.6
04/18/2018	17.12	8.95	6.92	99.1
05/10/2018	15.71	8.84	5.97	83.3
06/07/2018	25.47	7.29	6.30	79.5
07/26/2018	28.79	7.05	7.12	99.6
08/21/2018	27.47	7.12	6.98	87.1
10/04/2018	26.69	7.39	7.11	135.4
11/07/2018	17.61	8.66	7.07	117.8
12/12/2018	8.17	9.86	6.32	57.5

Source: GEPD 2020

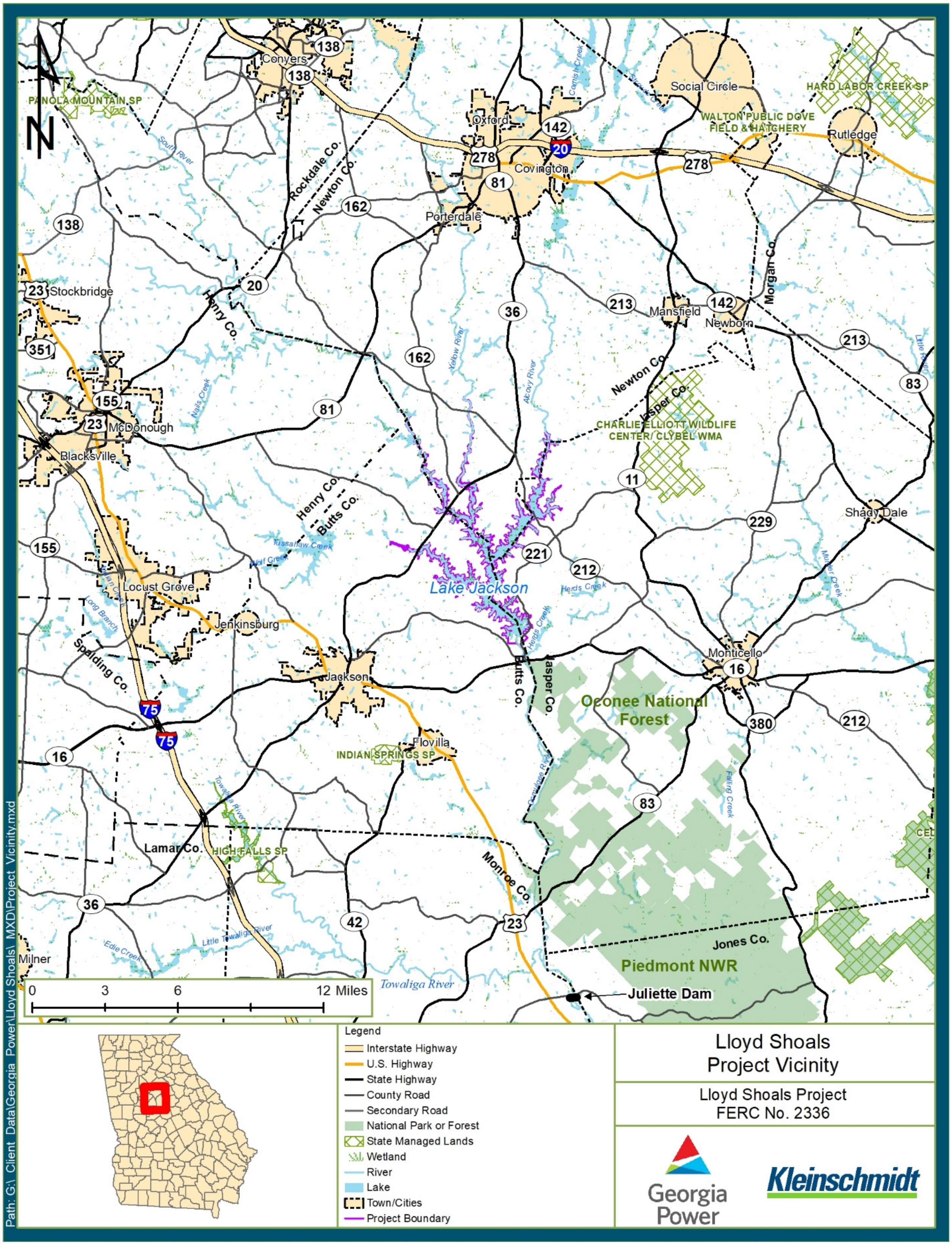

FIGURE 1 LLOYD SHOALS PROJECT VICINITY

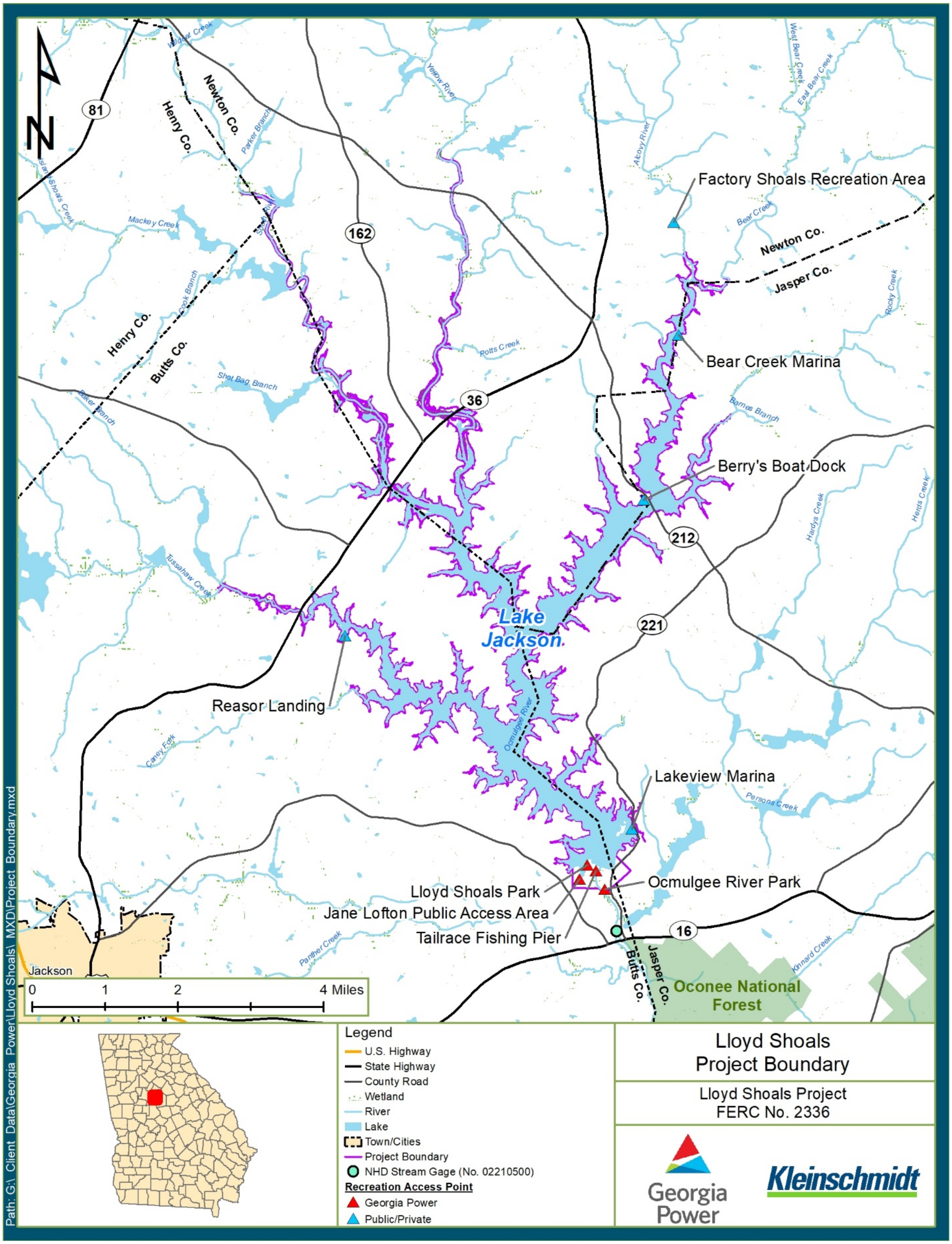

FIGURE 2 LLOYD SHOALS PROJECT BOUNDARY

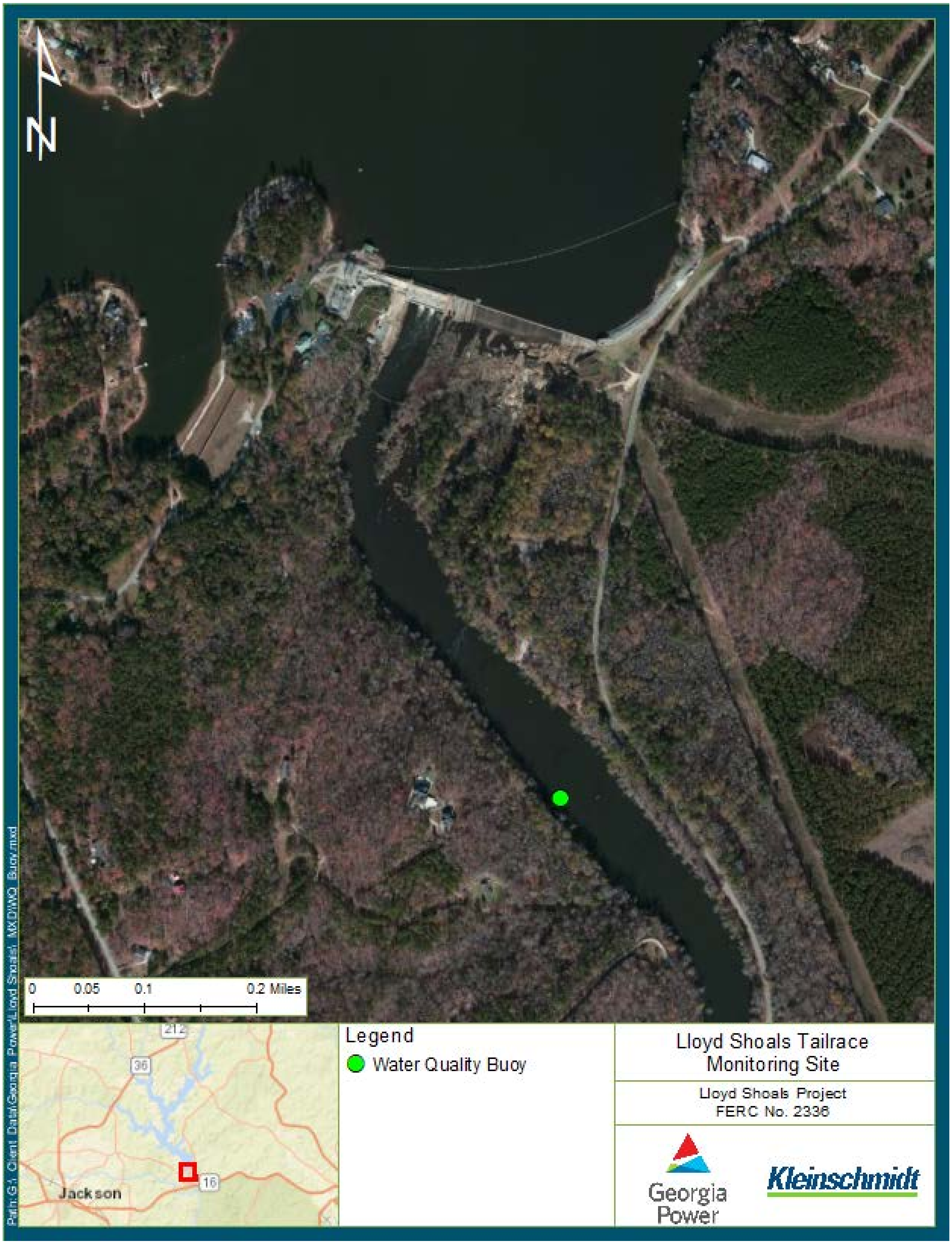

FIGURE 3　　LLOYD SHOALS TAILRACE MONITORING SITE

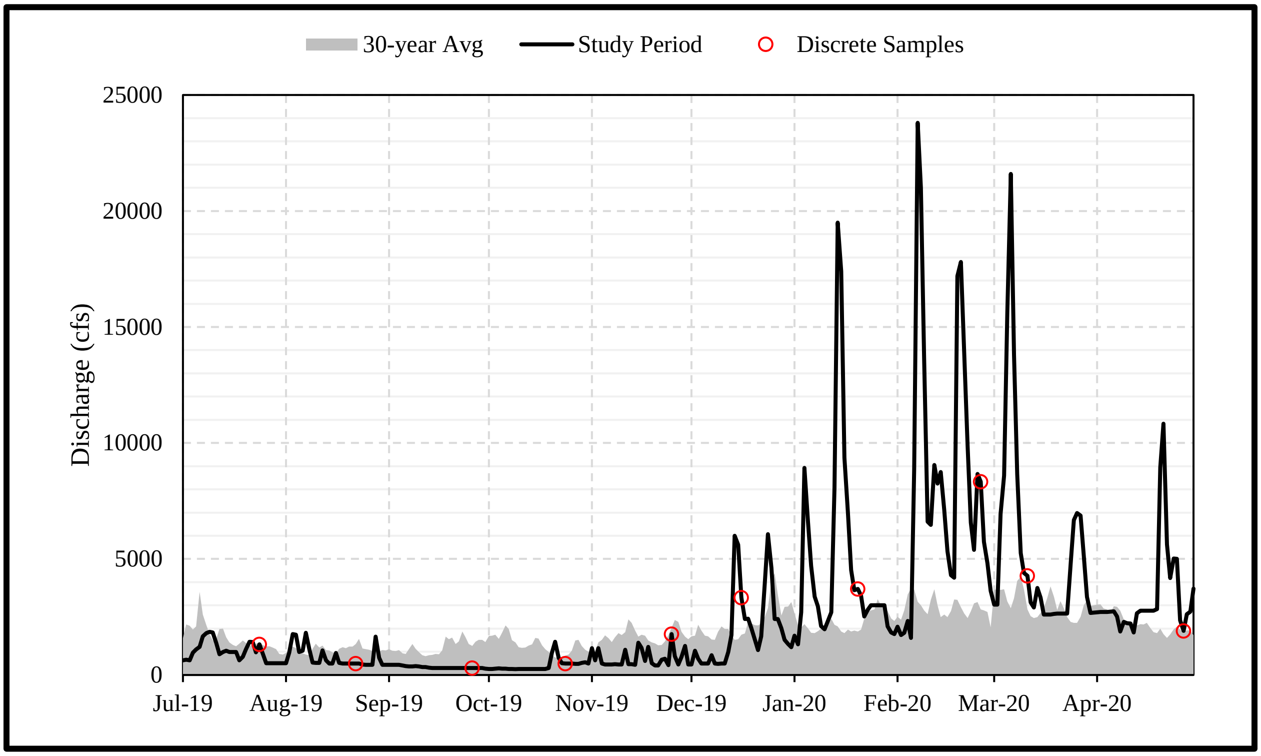

FIGURE 4 STUDY PERIOD AND LONG-TERM AVERAGE DAILY DISCHARGE FOR THE OCMULGEE RIVER AT JACKSON, GA

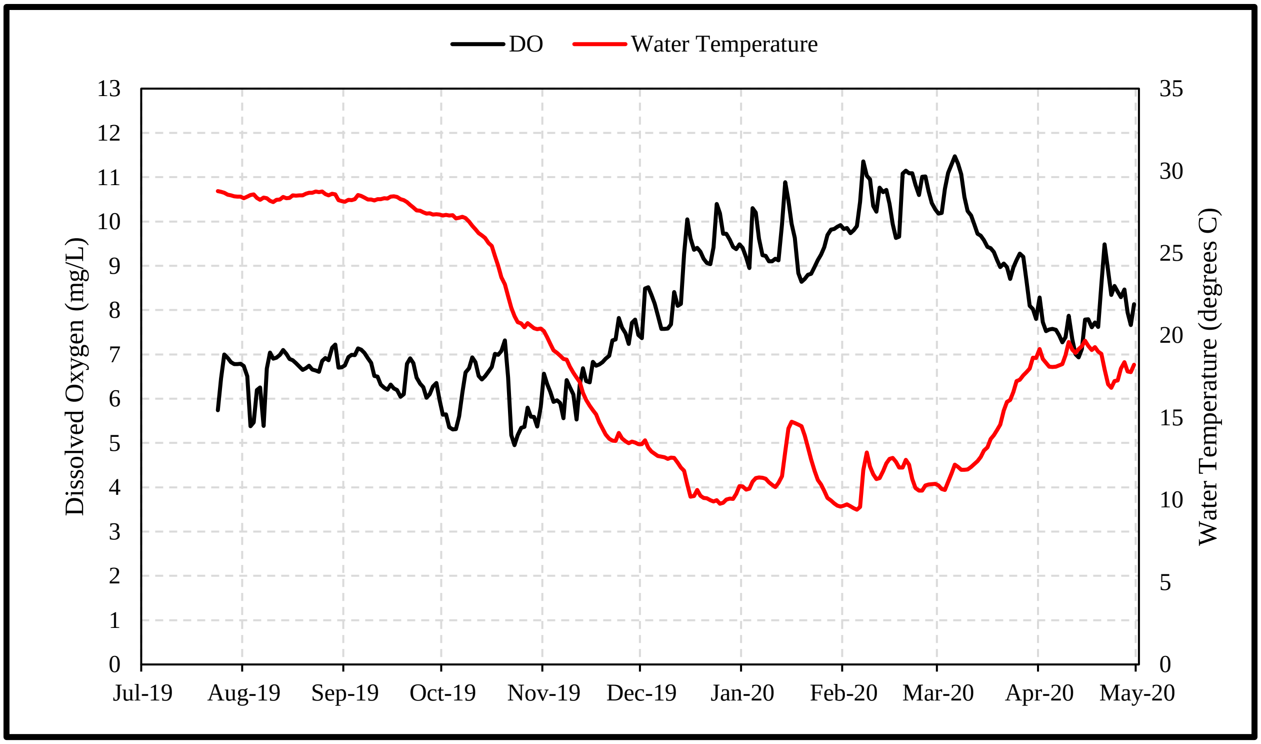

FIGURE 5 LINE PLOT OF DAILY AVERAGE DO AND WATER TEMPERATURE FROM TAILRACE MONITOR

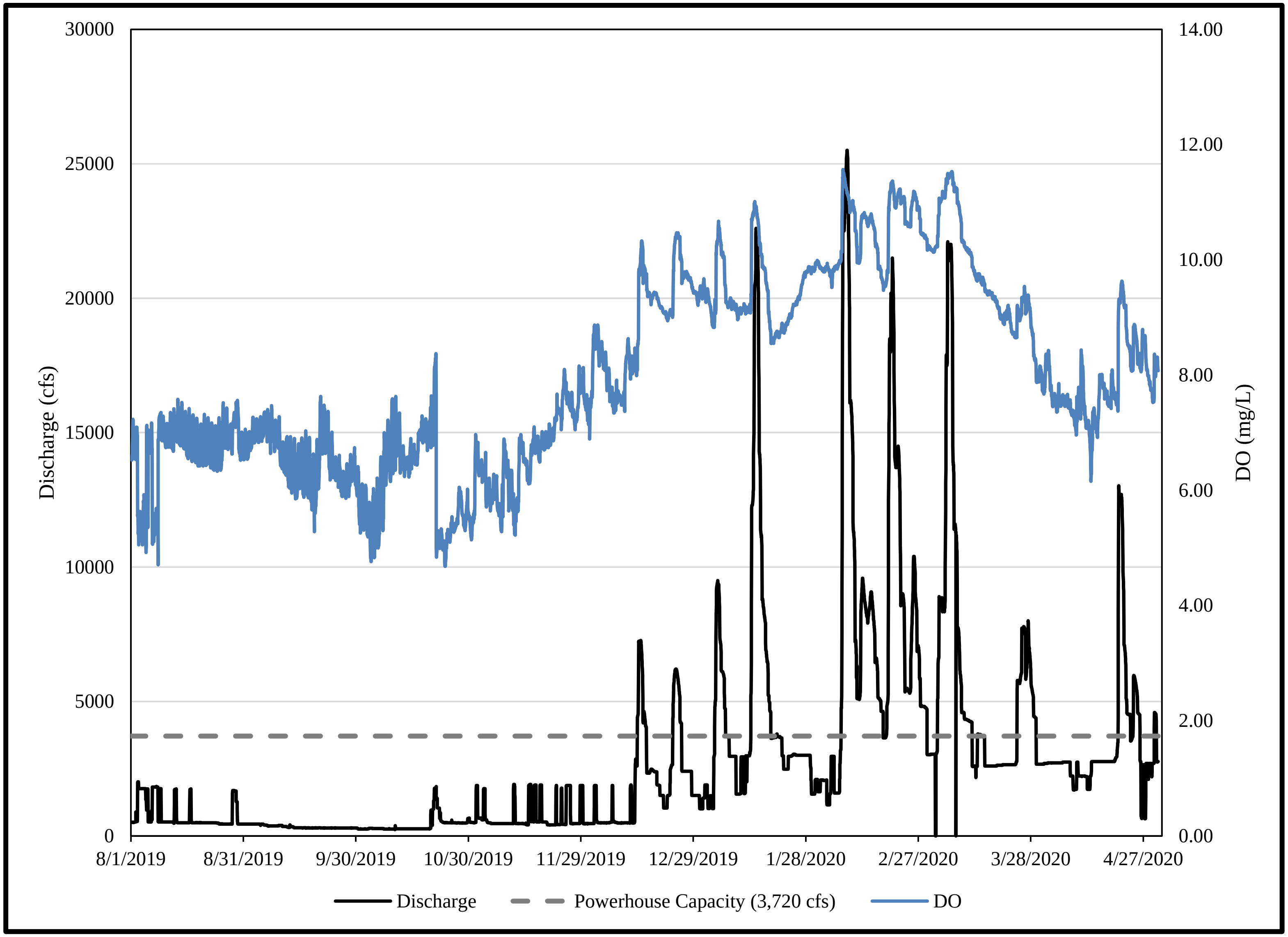

FIGURE 6 COMPARISON OF HOURLY PROJECT DISCHARGE AND DO MEASUREMENTS

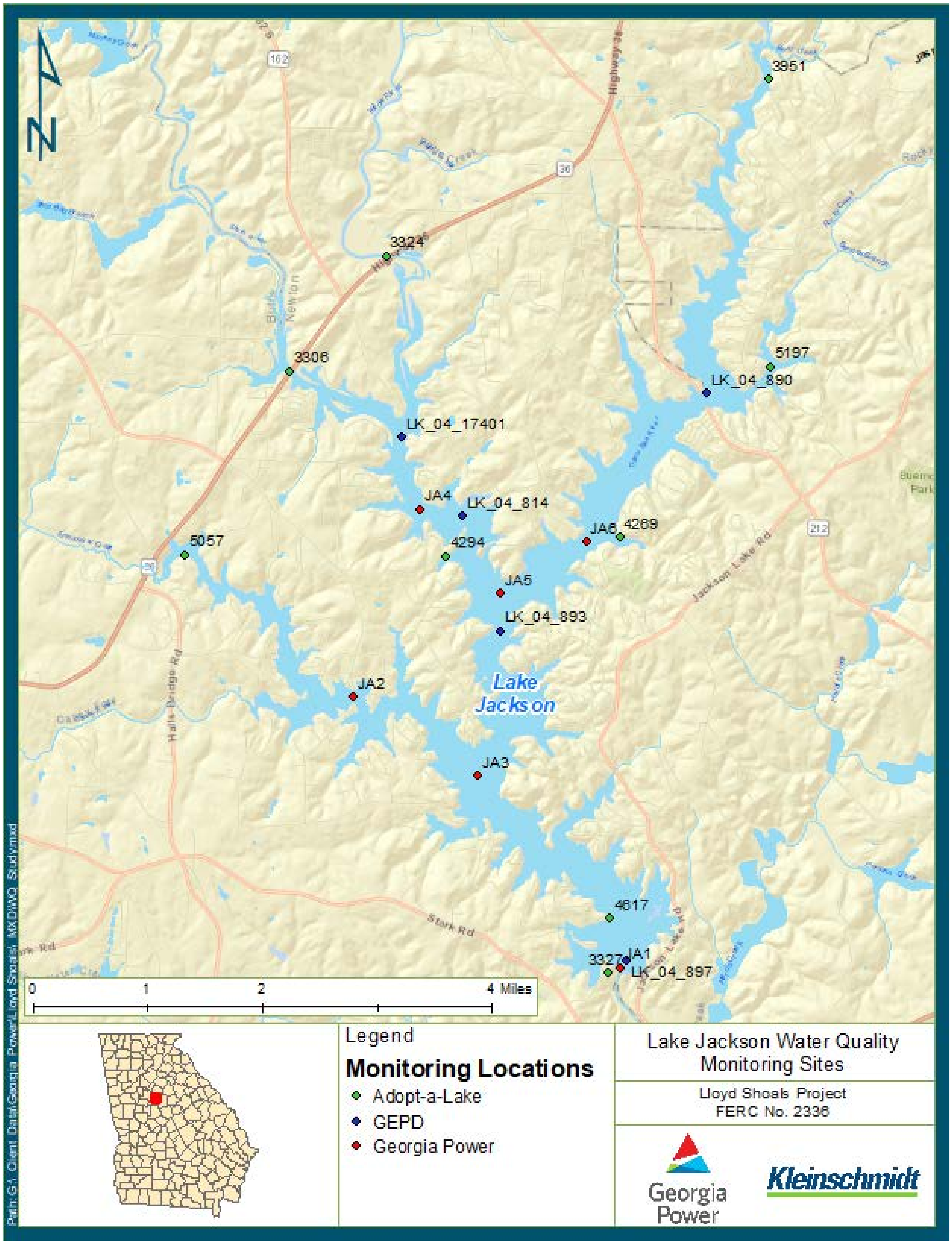

FIGURE 7 WATER QUALITY MONITORING LOCATIONS ON LAKE JACKSON

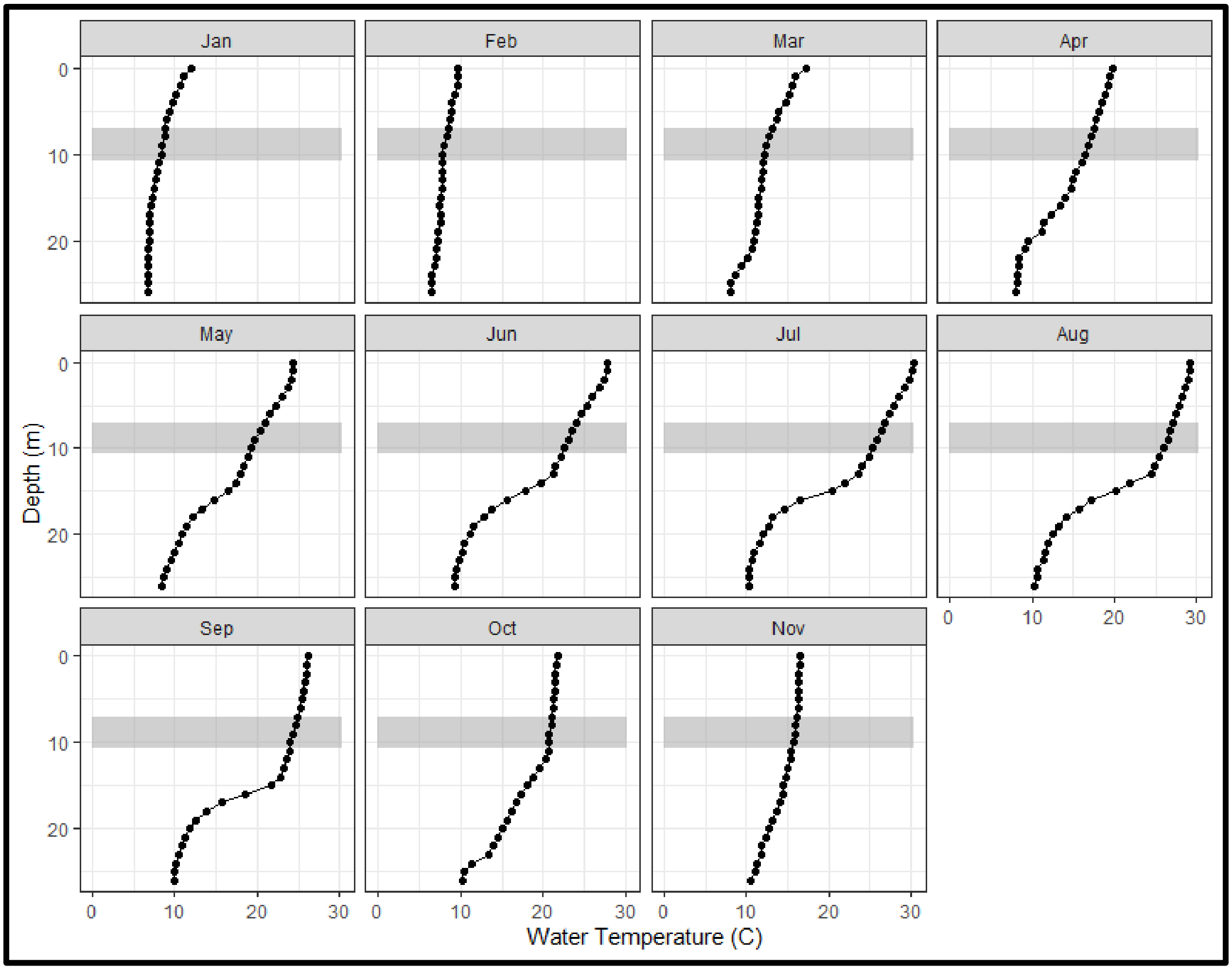

FIGURE 8 AVERAGE TEMPERATURE VALUES FROM VERTICAL PROFILES IN THE FOREBAY COLLECTED FROM 1986 – 2017

Note: Gray band indicates intake location in water column

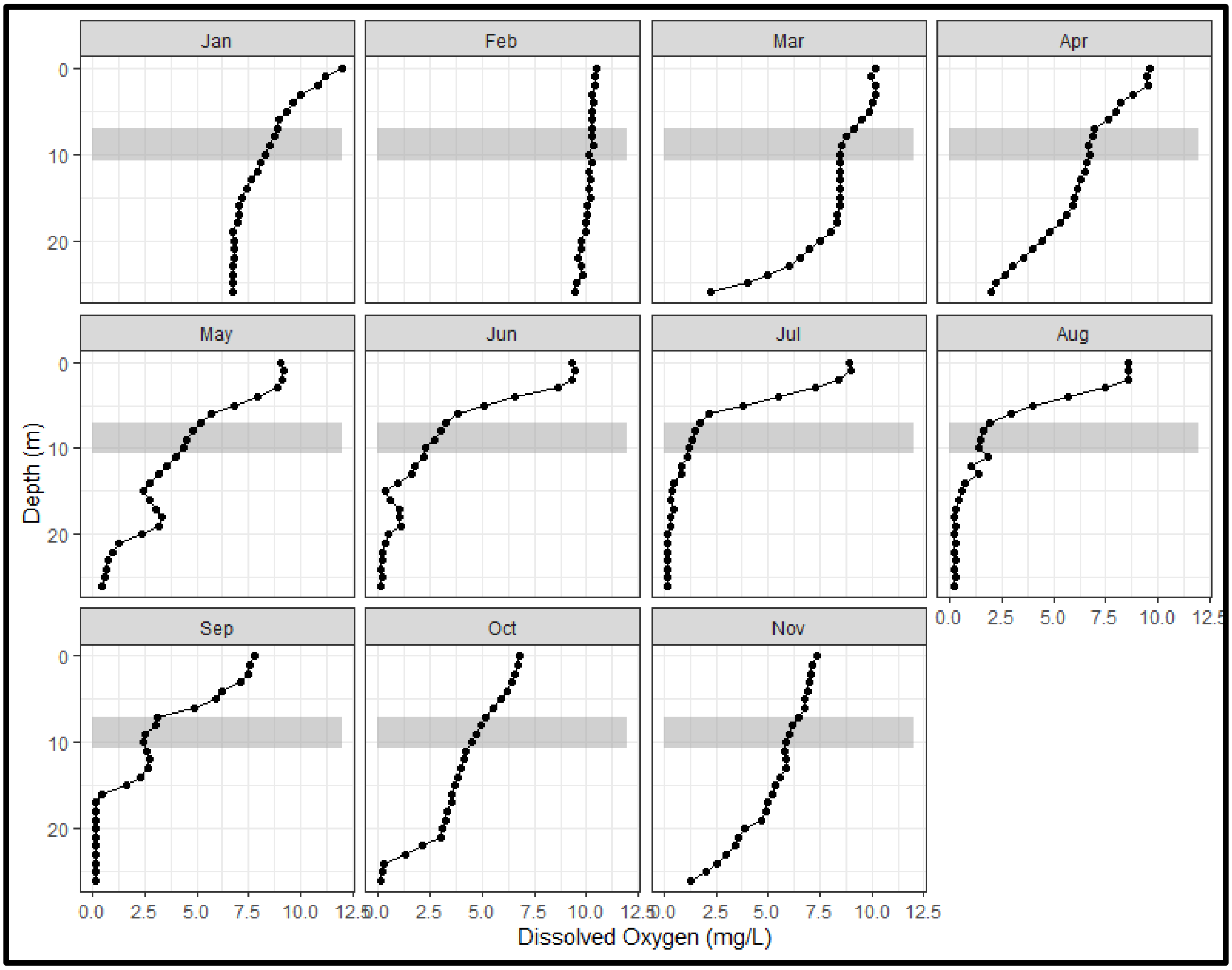

FIGURE 9 AVERAGE DISSOLVED OXYGEN VALUES FROM VERTICAL PROFILES IN THE FOREBAY COLLECTED FROM 1986 – 2017

Note: Gray band indicates intake location in water column

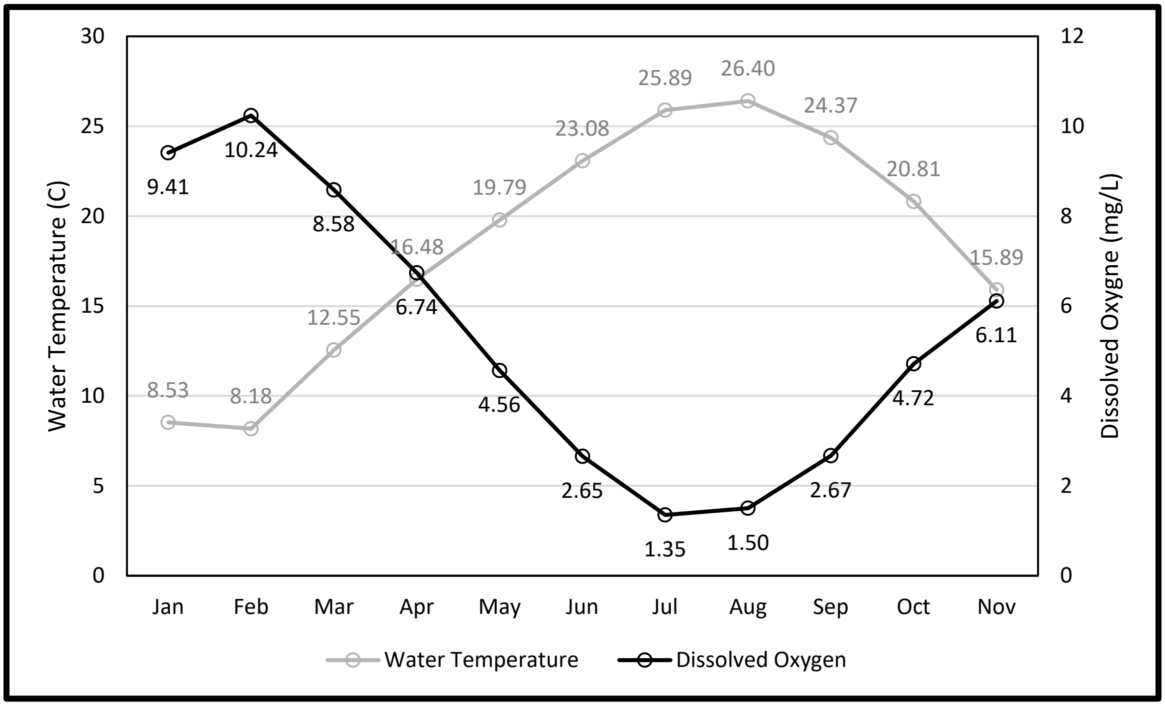

FIGURE 10 **AVERAGE WATER TEMPERATURE AND DISSOLVED OXYGEN FROM VERTICAL PROFILE MEASUREMENTS AT INTAKE DEPTH, 1986 - 2017**

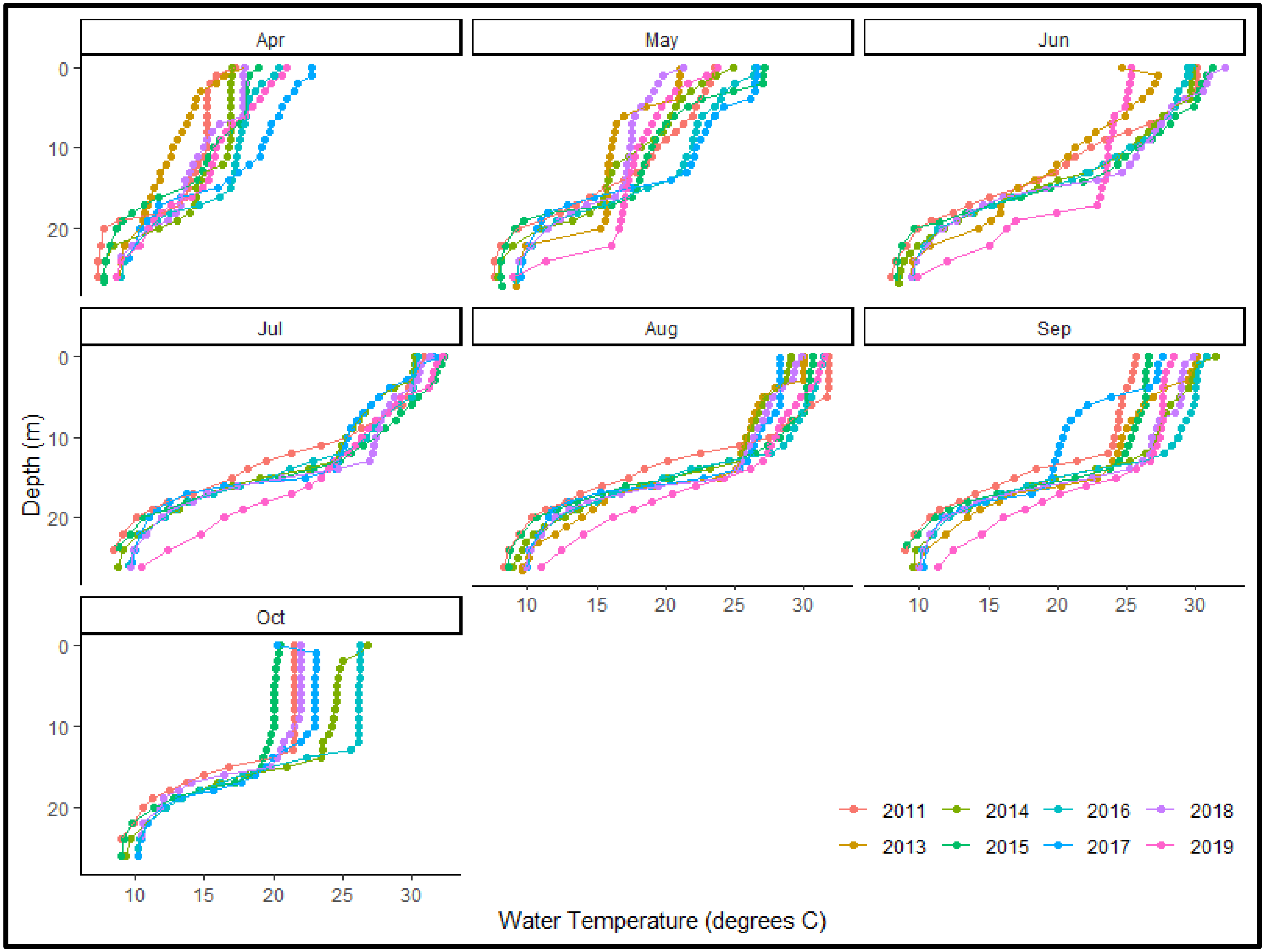

Figure 11 Vertical Profiles of Water Temperature Collected by GEPD in the Forebay from 2011 - 2019

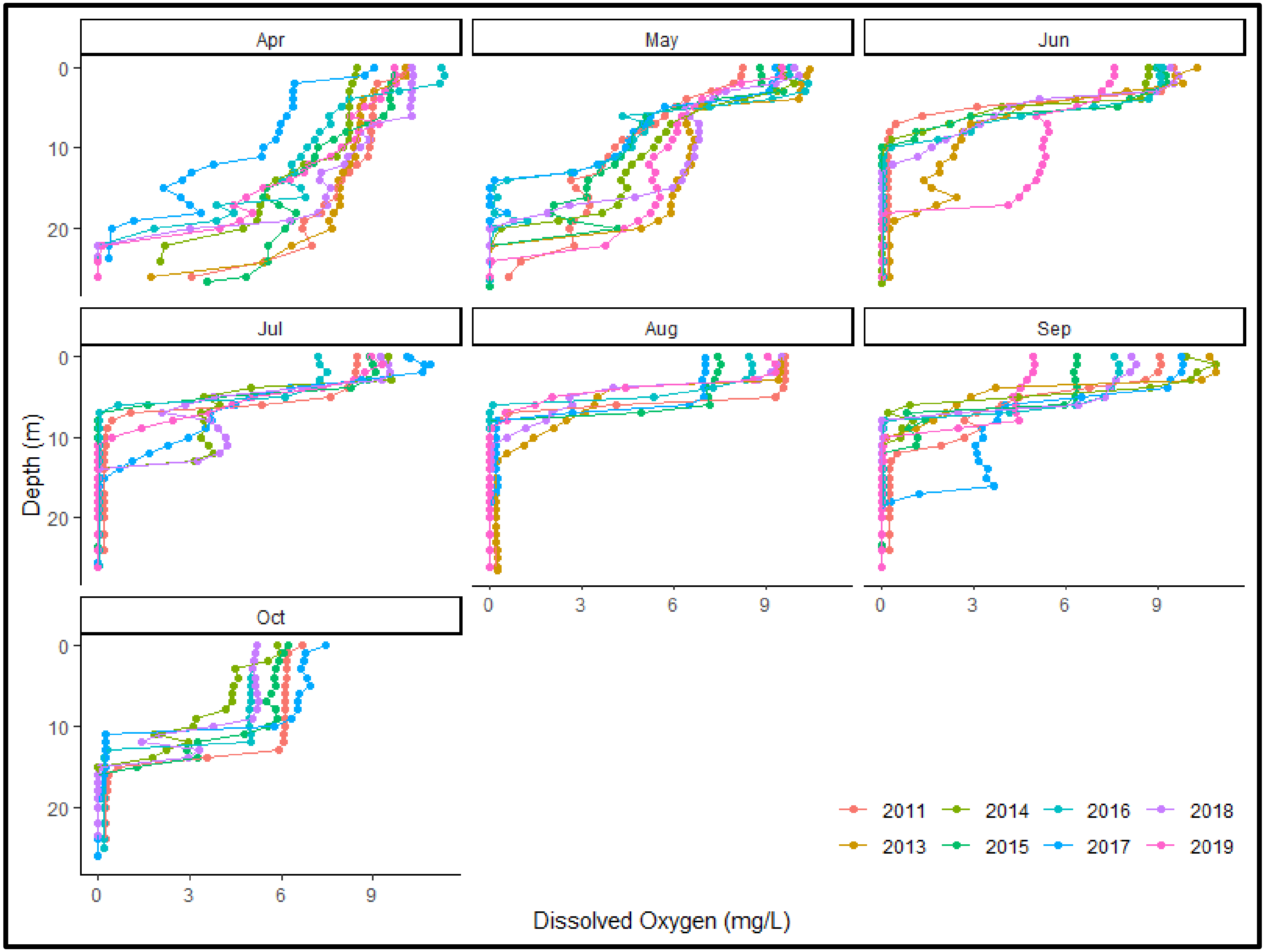

FIGURE 12 VERTICAL PROFILES OF DISSOLVED OXYGEN COLLECTED BY GEPD IN THE FOREBAY FROM 2011 - 2019

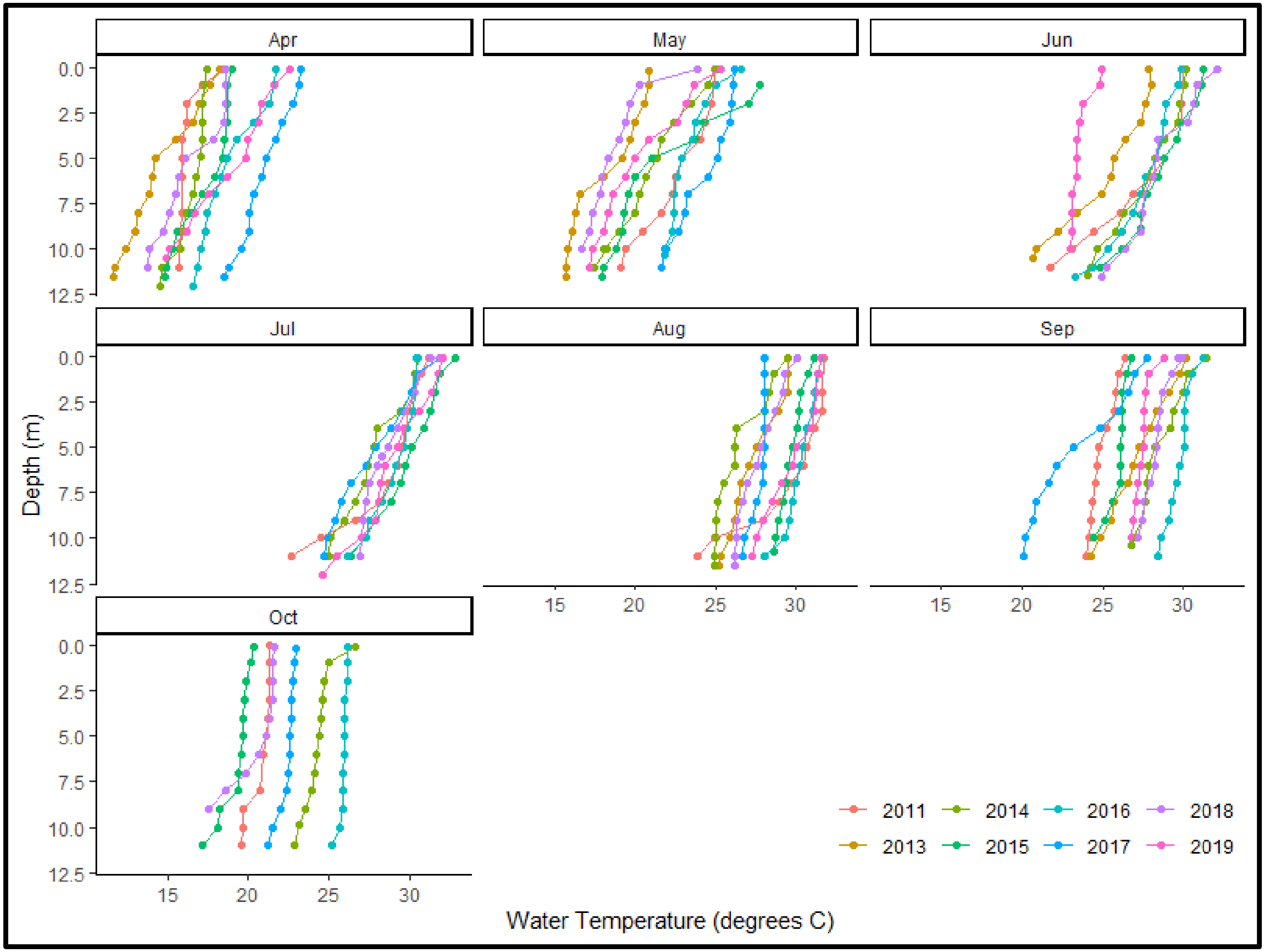

FIGURE 13 VERTICAL PROFILES OF WATER TEMPERATURE COLLECTED BY GEPD IN THE MIDLAKE FROM 2011 - 2019

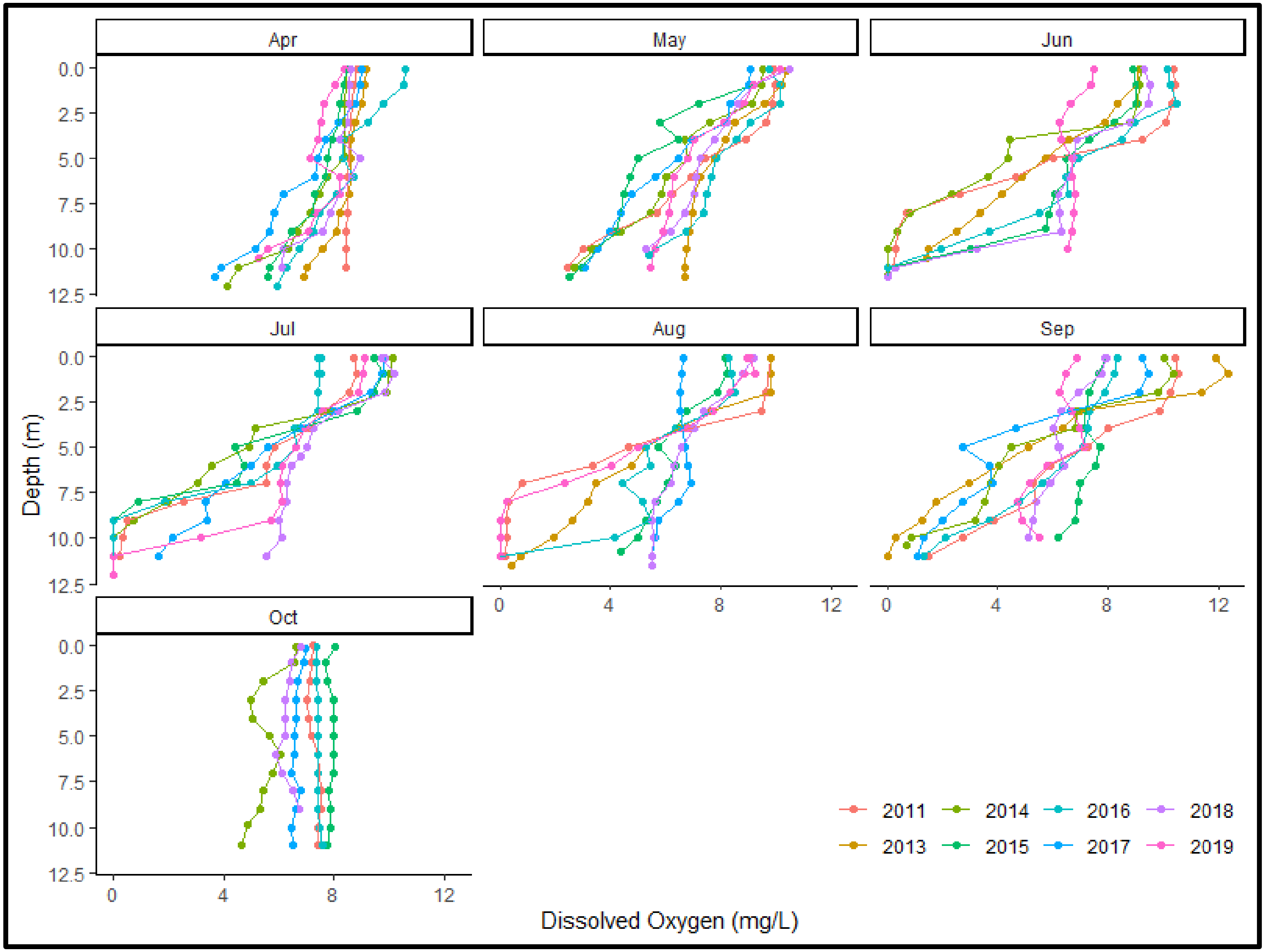

FIGURE 14 VERTICAL PROFILES OF DISSOLVED OXYGEN COLLECTED BY GEPD IN THE MIDLAKE FROM 2011 - 2019

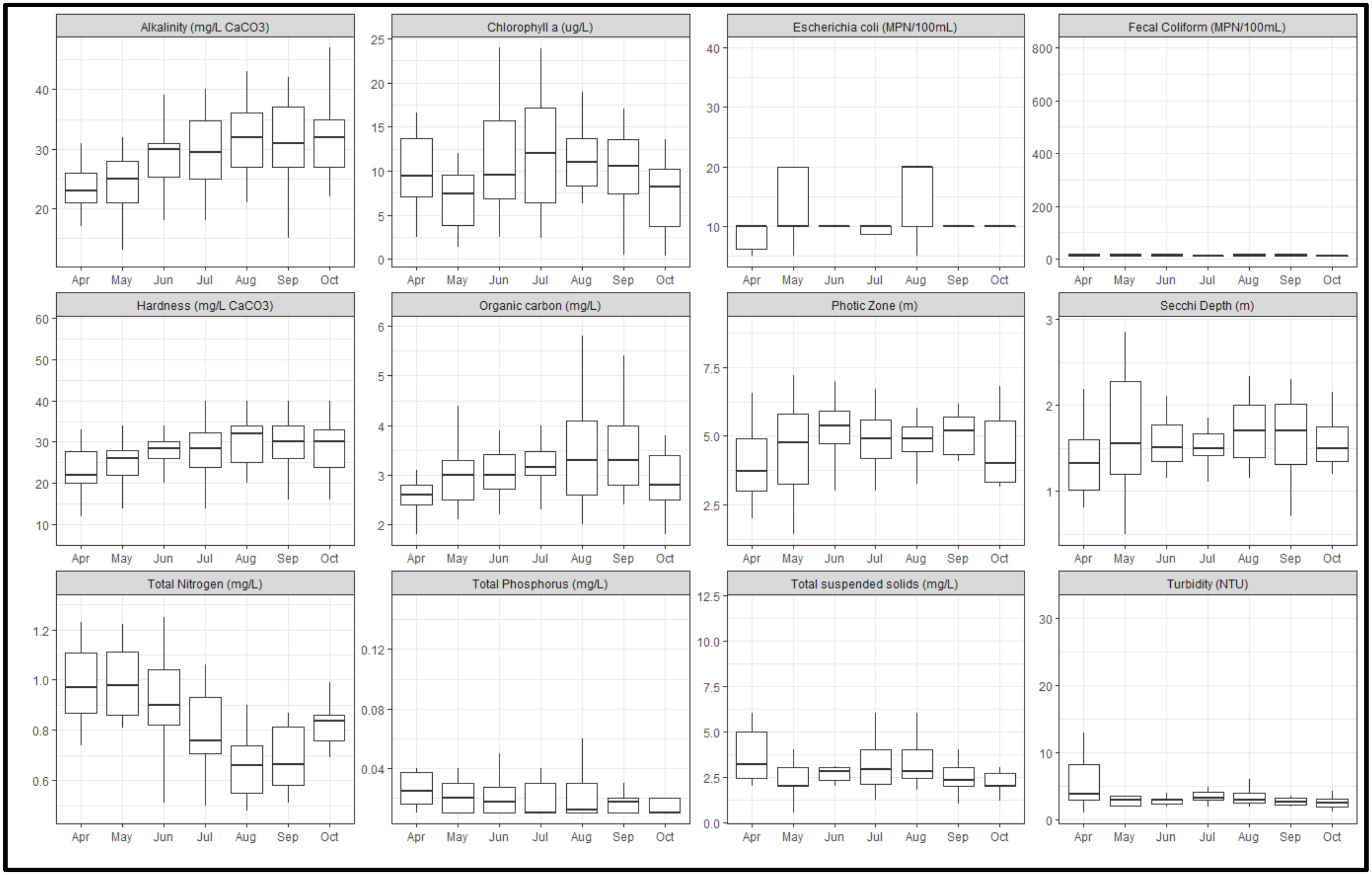

FIGURE 15 BOX PLOTS OF WATER CHEMISTRY RESULTS FROM SAMPLES COLLECTED IN THE FOREBAY BY GEPD FROM 2000 - 2019

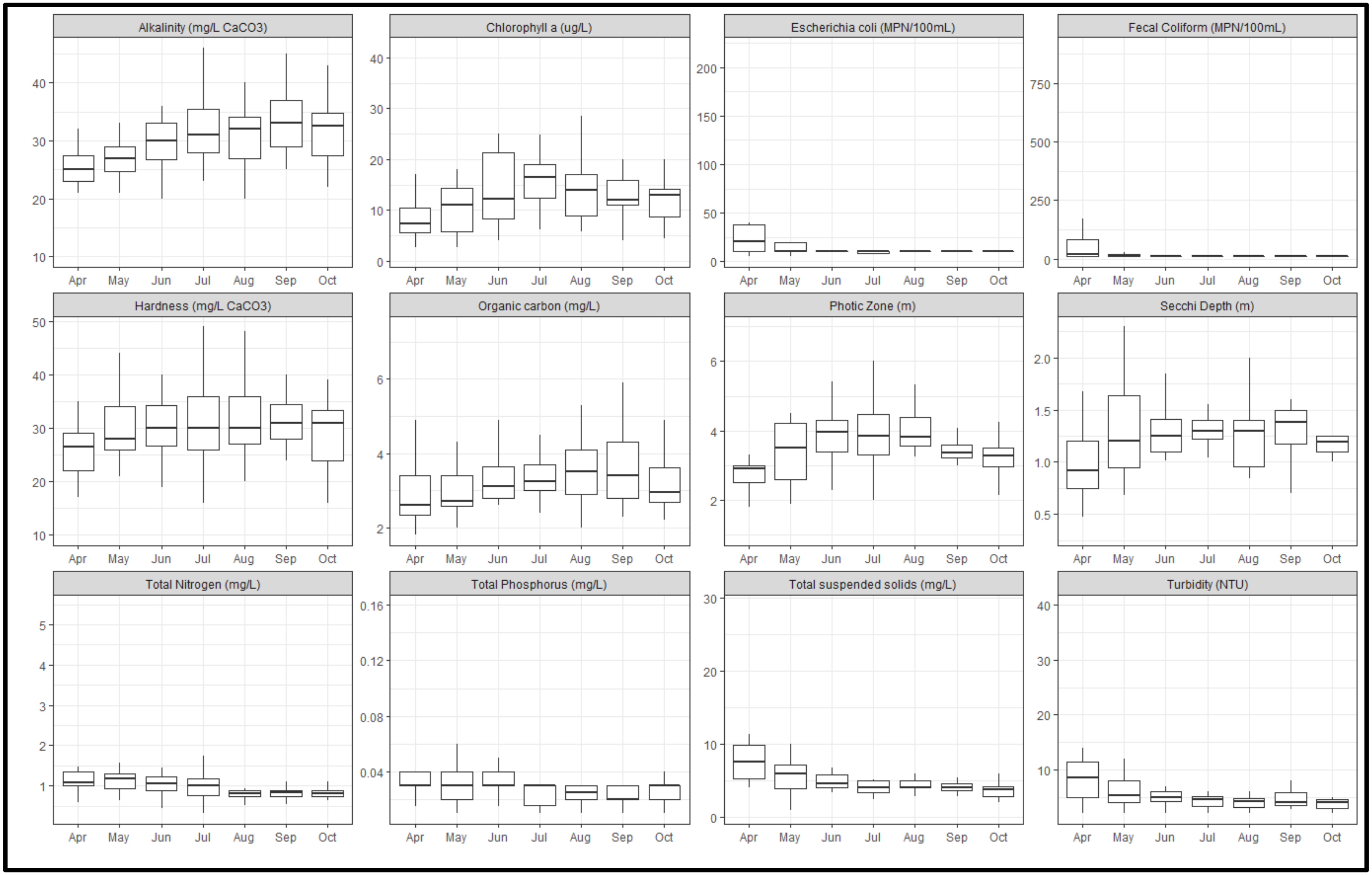

FIGURE 16 BOX PLOTS OF WATER CHEMISTRY RESULTS FROM SAMPLES COLLECTED IN THE MIDLAKE BY GEPD FROM 2000 - 2019

STUDY REPORT

FISH AND AQUATIC RESOURCES

LLOYD SHOALS HYDROELECTRIC PROJECT
(FERC NO. 2336)

Prepared with:

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May 2020

STUDY REPORT
FISH AND AQUATIC RESOURCES
LLOYD SHOALS HYDROELECTRIC PROJECT
(FERC NO. 2336)

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1.0 INTRODUCTION

This report presents the findings of the Fish and Aquatic Resources Study conducted for the Federal Energy Regulatory Commission (FERC) relicensing of Georgia Power Company's (Georgia Power's) Lloyd Shoals Hydroelectric Project (FERC No. 2336) (Lloyd Shoals Project, the Project). The study was conducted according to the approved study plan for the Lloyd Shoals Project. The approved study plan consists of Georgia Power's Revised Study Plan (Georgia Power 2019) and the Study Plan Determination issued by FERC's Director of the Office of Energy Projects on May 20, 2019 (FERC 2019). Georgia Power will use the information generated by the study to evaluate the environmental effects of its proposed action in the Preliminary Licensing Proposal, to be filed with FERC by July 1, 2021.

The 18-megawatt Lloyd Shoals Project consists of a dam, powerhouse, and 4,750-acre reservoir (Lake Jackson, or Jackson Lake) on the Ocmulgee River in Butts, Henry, Jasper, and Newton Counties, Georgia (Figures 1 and 2). Georgia Power operates the Project in a modified run-of-river mode for generation during peak power demand hours to meet electrical system demand. Georgia Power is not proposing to make any major modifications to the Project under the new license. The Project does not occupy federal lands. The current license expires December 31, 2023.

1.1 OBJECTIVES

The goal of this study was to characterize the existing aquatic environment and evaluate the fisheries-related aquatic resource issues identified during FERC's public scoping process pursuant to the National Environmental Policy Act that have a nexus with project operations. The specific objectives of the study were to:

- Characterize representative shoreline and littoral-zone aquatic habitats occurring in the project reservoir (Lake Jackson);

- Conduct a freshwater mollusk survey within the project boundary to characterize the occurrence and distribution of native mussels and aquatic snails;
- Evaluate the effects of continued project operations on habitat for primary sport fish species in Lake Jackson, including Largemouth Bass and stocked Striped Bass;
- Evaluate the effects of continued project operations on riverine aquatic habitat downstream of the Project using the previously conducted Instream Flow Incremental Methodology (IFIM) study, ongoing conservation efforts for the state endangered Robust Redhorse (*Moxostoma robustum*), and other relevant existing information and data; and
- Evaluate the potential for fish entrainment and turbine-induced mortality by applying trends and data from entrainment studies completed at other hydroelectric projects to the physical, operational, and fisheries characteristics of the Lloyd Shoals Project.

1.2 STUDY AREA

The study area included the FERC project boundary around Lake Jackson and the Lloyd Shoals tailrace area, and the Ocmulgee River downstream to Juliette Dam (Figures 1 and 2).

2.0 STUDY METHODS

The study approach followed the approved study plan (Georgia Power 2019; FERC 2019) and consisted of the elements described below.

2.1 SHORELINE HABITAT SURVEY

Georgia Power conducted a shoreline reconnaissance survey of Lake Jackson and the Lloyd Shoals tailrace area in August 2019 to characterize existing sources of erosion and sedimentation within the project boundary. The survey sites were also qualitatively characterized with respect to shoreline aquatic habitat and available sources of littoral-zone cover for fish. The detailed methods are described in the Geology and Soils Study Report.

A total of 107 representative shoreline segments, or sites, were surveyed on August 1 and 15, 2019. The sites were each 500 feet (ft) long. Twenty-five sites were selected in each of the four reservoir sections (South River (SR), Alcovy River (AR), Tussahaw Creek (TC), Mainstem Reservoir (MR)) for a total of 100 sites on Lake Jackson (Figure 2). Six sites were selected in the tailrace area (TR). One extra site was surveyed in Tussahaw Creek, bringing the total number of surveyed sites to 107. See the Geology and Soils Study Report for the specific shoreline site locations.

Two survey teams of three investigators each visually assessed the reservoir sites by boat, with the exception of two sites in the upper reach of the Tussahaw Creek embayment, which were too shallow to readily access, and therefore, were assessed using aerial imagery. The teams inventoried and rated shoreline attributes, including vegetative buffer zone condition (rated as either natural, landscaped-natural, or landscaped); adjacent land uses; bank stability and vegetative protections; shoreline structural stabilization practices (e.g., seawalls, riprap, etc.); potential causes of erosion; and sources of littoral-zone fish cover.

The shoreline habitat portion of the survey included identifying all sources of shoreline fish cover/habitat to 50 ft from the shoreline. Habitat categories included docks/piers/boatslips (docks and piers), riprap, bedrock and boulders, emergent and submersed vegetation, overhanging vegetation, large woody debris, standing timber, and any other types identified by the teams. The proportional length of each available fish cover/habitat type was visually estimated and recorded for each site. Other aquatic habitat observations were noted on the survey form where appropriate, and digital photographs were taken of survey sites.

2.2 Freshwater Mollusk Survey

Freshwater mussel surveys were conducted within the Lloyd Shoals project boundary and in the Ocmulgee River downstream of the Project in fall 2019 to characterize the occurrence, distribution, relative abundance, and species richness of the native freshwater mussel community. The survey effort was conducted by the Georgia Department of Natural Resources (GDNR) Wildlife Resources Division (WRD) and funded by Georgia Power under the Altamaha Mollusk Candidate Conservation Agreement (CCA). The CCA is a collaborative and cooperative agreement between Georgia Power, GDNR WRD, and U.S. Fish and Wildlife Service (FWS) to implement conservation measures for certain mollusk species in the Altamaha River basin, which includes the Ocmulgee River basin.

The freshwater mollusk survey includes three components: (1) Lake Jackson mussel survey; (2) Lloyd Shoals tailrace area mussel survey; and (3) survey for Reverse Pebblesnail, a rare gastropod mollusk under review for federal listing, in the Alcovy River upstream of the project boundary. In fall 2019, WRD completed a major portion of the Lake Jackson mussel survey and all of the Lloyd Shoals tailrace area mussel survey. WRD had planned to complete the Lake Jackson mussel survey and the Alcovy River snail survey in spring-summer 2020 but the surveys were delayed in the spring due to high flows and subsequently postponed due to the Covid-19 pandemic and the need to mitigate against transmission of the coronavirus. The surveys are now planned to occur in summer-fall 2020, pending the easing of Covid-19 mitigation efforts. The survey findings will be presented in an Updated Fish and Aquatic Resources Study Report by May 2021, in accordance with the master schedule in the approved study plan.

The following freshwater mussel surveys were conducted in fall 2019 according to the approved study plan. The WRD mussel survey report (GDNR 2019) is provided in Appendix A.

2.2.1 Lake Jackson

A mussel survey of Lake Jackson was conducted from September 24 to November 22, 2019. The survey effort concentrated primarily on the northern tributary embayments of the Alcovy River, South River, and Yellow River. The remaining survey effort to be completed in 2020 will focus on the southern portion of the reservoir. The survey used an occupancy-based sampling design which estimates the probability of species occurrence while accounting for incomplete species detection (Wisniewski et al. 2013; MacKenzie et al. 2018). Twenty-two sites were surveyed within coves, tributary embayments, and along the margins of historic river channels. The survey targeted areas containing potentially suitable habitat and habitats previously documented to harbor native species.

The effort spent searching for native mussels at each site was determined on site by the team leader. The search effort at the 22 sites totaled 21.3 person-hours. The survey methods were tailored to site-specific conditions of depth, accessibility, water clarity, and safety. Survey methods included visual observations while wading, hand grubbing while on hands and knees, snorkeling, self-contained underwater breathing apparatus (SCUBA), and surface-supplied air in deeper water.

The survey team identified and enumerated all live mussels and shells of dead mussels found. All mussel specimens were measured (length in millimeters [mm]), unless a large number of live specimens was encountered, in which case representative subsamples of shells were measured. The location of all survey areas was documented using a hand-held Global Positioning System (GPS) unit. Representative live specimens of each species were digitally photographed. The survey team recorded field notes and general habitat information about the survey area.

2.2.2 LLOYD SHOALS TAILRACE AREA

A mussel survey of the Lloyd Shoals tailrace area was conducted in representative habitats from October 1 to October 23, 2019. The search reach extended from Lloyd Shoals Dam downstream a distance of about 3 river miles. It encompassed habitats within the project boundary and habitats downstream, including the island-and-shoal complex beginning just downstream of the Georgia Hwy 16 bridge. The survey used the occupancy-based sampling design (Wisniewski et al. 2013; MacKenzie et al. 2018). Twenty sites were surveyed for the presence of native mussels.

The search effort spent at each site was determined on site by the team leader and recorded in person-hours. The search effort in the tailrace area totaled 18.3 person-hours. The survey methods were tailored to site-specific conditions and included visual observations while wading, hand grubbing, snorkeling, and SCUBA. All live mussels and shells of dead native mussels found were identified and enumerated. All mussel specimens were measured (length in mm), or a representative subsample was measured if a large number of live specimens was encountered. Each survey location was documented using a hand-held GPS unit, digital photographs were taken of representative live specimens, and field notes and general habitat information were recorded.

Under the Altamaha Mollusk CCA, WRD also surveyed for mussels at seven sites in the Ocmulgee River downstream of the tailrace area, in the reach between the Hwy 16 bridge and Juliette Dam (GDNR 2019). Juliette Dam is located about 19 river miles downstream of Lloyd Shoals Dam. The survey sites began over 3 river miles downstream of the Hwy 16 bridge. The surveys were conducted on September 26 and October 10, 2019 and used the same survey methods as described above. The search effort totaled 7.3 person-hours. The survey results section refers separately to the "Ocmulgee River between Hwy 16 bridge and Juliette Dam" because this reach was not included in the approved study plan. Sampling in the reach brought the total survey effort for the Ocmulgee River downstream of Lloyd Shoals Dam to 25.6 person-hours, which met the target of 20 person-hours or more in the study plan.

2.3 HABITAT FOR PRIMARY SPORT FISH SPECIES

The availability of suitable summer water quality for sport fish species in Lake Jackson, including Largemouth Bass and Striped Bass, was assessed using reservoir water quality data collected annually by Georgia Power, standardized fisheries survey data for primary sport fishes collected annually by GDNR, and Largemouth Bass and Striped Bass temperature and dissolved oxygen (DO) preference criteria reported in the scientific literature. Georgia Power collected seasonal water quality data at up to six sampling stations throughout Lake Jackson on an annual basis from 2000 to 2017, including vertical profile measurements of water temperature and DO at multiple locations. These data provided the basis for characterizing summer reservoir water quality and habitat for Largemouth Bass and Striped Bass as two popular sport fisheries in the project reservoir.

Vertical profile data for the warmest months, including April through September, was aggregated and depicted in graphs of depth versus water temperature and depth versus DO concentration to characterize the spatial and temporal extent of summer vertical stratification that occurs in Lake Jackson. This analysis was used to delineate those areas of the reservoir which vertically stratify during the summer and those areas which may tend to mix.

Existing fisheries survey data for Lake Jackson was analyzed for the abundance and growth characteristics of Largemouth Bass, Striped Bass, and other primary sport fish species. Data available from the standardized fisheries survey database included sampling procedures and effort information, species abundance, length, weight, and other sampling or reservoir specific details. Georgia Power coordinated with WRD at the outset of the study to obtain the most updated version of the database and associated metadata defining station locations, parameters, units, species-specific weight-length relationships used as the basis for relative condition factors, and other relevant data fields.

The fisheries data were analyzed to characterize the abundance and well-being and condition of Largemouth Bass and Striped Bass relative to other Georgia reservoirs. Population attributes to be compared may include length-frequency distribution, relative condition factors, species numerical abundance, catch per unit effort (CPUE), and other descriptive statistics.

Habitat suitability for Largemouth Bass and Striped Bass between different areas of the reservoir was evaluated on the basis of temperature, DO concentration, and time of year with consideration for ranges defined by scientific literature sources as appropriate for each species. For Largemouth Bass, which is a habitat-generalist species, areas were compared as to the ranges and stability of summer water quality conditions. Documented temperature and DO habitat suitability criteria for adult Striped Bass were compared to the summer vertical profiles to identify and approximate the areas of the reservoir providing suitable habitat under representative summer conditions.

In addition, existing information and WRD reports on fish kill events occurring in the project waters during the current license term were described and summarized.

2.4 DOWNSTREAM RIVERINE HABITAT

The suitability of summer water temperatures and DO concentrations for fish and other aquatic organisms in the Lloyd Shoals tailrace area was evaluated using a combination of newly collected water quality monitoring data and literature review. Continuous water temperature and DO monitoring data collected for the Water Resources Study (Section 3.0) was plotted against contemporaneous generation flows and compared to known water quality tolerance and habitat suitability criteria for representative species as determined from literature sources.

The effects of continued project operations on riverine aquatic habitat downstream of the Project was evaluated by reviewing the habitat-discharge relationships developed in the previously conducted IFIM study for 12 species and life stages in a 17-mile reach of the Ocmulgee River downstream of Lloyd Shoals Dam (EA 1990c). The study was summarized and the results presented in tables and graphs to allow comparison of the physical habitat available, expressed as weighted usable area, across discharge ranging from 50 to 3,500 cubic feet per second (cfs). Available evidence suggests that the river channel in the IFIM study reach has not changed appreciably in dimensions or stability over the past 30 years. A geomorphic analysis of stream-gage data for streams within the Piedmont physiographic province of Georgia conducted by the U.S. Geological Survey (Riley and Jacobson 2009) found that the Ocmulgee River near Jackson, Georgia exhibited long-term channel stability. Nevertheless, existing information pertaining to land cover, riparian conditions, discharge characteristics, channel morphology, and/or physical habitat was reviewed to evaluate whether any changes may have occurred that would influence the habitat-discharge relationships previously modeled.

In addition, existing literature and available study information were reviewed for Robust Redhorse, other riverine fish and invertebrate species, and diadromous fishes to further characterize the current condition of potential for impacts to the riverine aquatic community downstream of the Project.

2.5 FISH ENTRAINMENT EVALUATION

The potential for fish entrainment and turbine-induced mortality at the Lloyd Shoals Project was evaluated using a literature-based approach that draws upon entrainment field studies completed at numerous other hydroelectric projects east of the Mississippi River, including several in the southeastern U.S. Common trends and data from these other studies were applied with consideration of the site-specific physical, operational, and fisheries characteristics of the Lloyd Shoals Project.

The primary source of turbine entrainment field study information was the database prepared by the Electric Power Research Institute (EPRI 1997a). The EPRI database includes test data from 43 hydroelectric sites and provides detailed information on the species and size classes of fish collected in monthly entrainment samples. All of these sites are located east of the Mississippi River, and seven are located in the southeastern U.S. (South Carolina, Georgia, and Virginia).

Other sources of turbine entrainment information and data included comprehensive reviews prepared by EPRI (1992) and FERC (1995a). The FERC (1995a) review provides information for two additional sites in South Carolina and Georgia. Entrainment sampling data for the Stevens Creek Project (Dames and Moore 1993; FERC` 1995b) on the Savannah River also were examined for species composition, relative abundance, and size distribution.

The primary source of turbine mortality field study information was the turbine passage survival database prepared by EPRI (1997a). The database includes test data from studies conducted at 51 different turbines (41 hydroelectric sites), including Francis turbines.

Common trends and data from field studies completed at other hydroelectric sites were applied to the Lloyd Shoals Project to:

> Characterize potential turbine entrainment that could be occurring at the Project, including fish size distribution, species composition and relative abundance, seasonal variation in entrainment rates, and the magnitude of total annual entrainment, and
>
> Evaluate potential mortality rates of fish passing through the turbines based on turbine survival tests conducted at other projects with head and turbine design characteristics similar to those at Lloyd Shoals.

The potential magnitude of annual entrainment was estimated by applying monthly entrainment rates from a representative site in the EPRI database to Lloyd Shoals monthly generation data. Turbine passage survival rates derived for Francis turbines from the EPRI database and the scientific/technical literature were applied to annual entrainment to estimate the potential magnitude of annual turbine-induced mortality at the Project.

The potential impacts and implications of losses of fish due to entrainment mortality were assessed based upon fishery survey data for the project reservoir, natural mortality rates of young fish, and other relevant factors. In addition, the potential implications of entrainment were assessed with respect to WRD's Striped Bass and White Bass-Striped Bass hybrid (Hybrid Bass) management in Lake Jackson and experimental stocking of American Shad in the reservoir.

3.0 SHORELINE HABITAT

The detailed results of the shoreline reconnaissance survey, including the locations of individual numbered survey sites, tables and graphics, and copies of the completed survey forms are presented in the separate Geology and Soils Study Report. This section further evaluates the results of the shoreline habitat survey component.

The 101 shoreline sites surveyed on Lake Jackson represented 50,500 ft of shoreline. The six tailrace sites represented 3,000 ft of shoreline below Lloyd Shoals Dam. Visual observations of shoreline habitat and estimation of the proportional length of each type of fish cover/habitat present were made to a distance of 50 ft from the shoreline. The habitat survey area included the littoral zone, the peripheral shallows where light usually penetrates to the bottom allowing rooted vegetation to grow, and which are subject to fluctuating temperatures and water levels and provide important habitat for many fish and other aquatic organisms. Fishes using littoral-zone habitats in southeastern reservoirs for spawning and rearing of young include Largemouth Bass, Bluegill, Black Crappie, Redear Sunfish, and a variety of other species and life stages.

3.1 HABITAT BY RESERVOIR AND TAILRACE SECTIONS

A variety of natural and man-made habitat features were inventoried as potential sources of littoral zone fish cover along the Lake Jackson and tailrace area shorelines (Table 1). The most frequently observed sources of littoral zone fish cover across the study area, in descending frequency, were overhanging vegetation, docks/piers/boatslips, large woody debris, riprap, and bedrock/boulders (Table 1). Based on visually estimated proportional length, overhanging vegetation was the predominant source of fish cover, totaling 25 percent of the 53,500 ft of shoreline surveyed, followed by riprap (21 percent), large woody debris (7 percent), and docks/piers/boatslips (5 percent). Riprap was the predominant fish cover type by length available in the mainstem reservoir, Tussahaw Creek, and Alcovy River sections of Lake Jackson, where residential development is widespread and riprap is commonly used to stabilize shorelines. In contrast, overhanging vegetation was the predominant fish cover type in the less developed South River section, where it was estimated to cover 56 percent of the shoreline. Overhanging vegetation also provided a substantial amount of cover in the Tussahaw Creek and Alcovy River sections. Large woody debris and emergent vegetation were estimated to cover 12 percent and 10 percent, respectively, of the shoreline length in the South River section of the reservoir. Bedrock and boulders were the predominant source of fish cover in the tailrace area followed by overhanging vegetation. .

3.2 Habitat by Shoreline Vegetative Buffer Zone Condition

Of the 107 shoreline sites surveyed, 35 (33 percent) were characterized as having a “natural” shoreline vegetative buffer zone condition. Their buffer zones were heavily vegetated with less than about 20 percent of the natural vegetation removed. Forty-four sites (41 percent) had “landscaped” buffer zones. They were cleared of more than 50 percent of the natural vegetation or had the undergrowth completely removed. Twenty-eight sites (26 percent) had “landscaped-natural” buffer zones. They were disturbed and cleared up to 50 percent with some trees and understory remaining. Natural vegetative buffer zone conditions were most prevalent in the South River section of the reservoir and in the tailrace area. Sites with landscaped riparian zones were spread throughout the reservoir but most prevalent within the mainstem reservoir and Tussahaw Creek sections. The landscaped-natural sites were most prevalent in the Alcovy River section of the reservoir.

Table 2 summarizes the availability of littoral-zone fish cover types at the Lake Jackson and tailrace area survey sites by observed shoreline vegetation buffer zone condition. The most frequently observed sources of fish cover at natural sites were, in descending order, overhanging vegetation, large woody debris, bedrock and boulders, emergent vegetation, and standing timber. Overhanging vegetation occurred along 60 percent of the surveyed length of natural sites, while docks and piers totaled less than 1 percent. In contrast, the most frequently observed sources of fish cover at landscaped sites in descending order were docks and piers, riprap, overhanging vegetation, and large woody debris. Riprap occurred along 36 percent of the surveyed length of landscaped sites, docks and piers covered 7 percent, and overhanging vegetation covered 4 percent. Landscaped-natural sites also had a substantial length of riprap (21 percent) and docks and piers covered 8 percent, but these sites had more overhanging vegetation and bedrock and boulders than landscaped sites.

3.3 Shoreline Structural Stabilization Practices and Littoral Zone Habitat

The shoreline reconnaissance survey documented the use of structural practices in Lake Jackson for stabilizing shoreline modified by residential or other development or otherwise subject to erosion (see Geology and Soils Study Report). The most common types of structural stabilization practices in place were seawalls with riprap at the base, seawalls, and riprap. The Geology and Soils Study Report provides a literature review on the relationship between shoreline structural stabilization practices and littoral-zone fish habitat. The literature review included field studies at other southeastern hydropower reservoirs in North and South Carolina (Barwick 2004) and Alabama (Purcell et al. 2013) and other relevant literature. The literature review is not repeated in this report but a brief summary follows:

- The relevant scientific literature dealing with the effects of shoreline structural practices on littoral fish habitat indicates an overall positive relationship between greater habitat complexity of riprapped shoreline habitats and higher species richness, diversity, and abundance of littoral zone fish assemblages, including sport fishes.

- When erosion control is necessary at a developed shoreline site, available evidence supports the use of riprap, either alone or in front of seawalls, as providing more beneficial fish habitat than the use of seawalls alone without accompanying structural or non-structural practices.

4.0 FRESHWATER MOLLUSKS

The freshwater mussel surveys conducted in fall 2019 in Lake Jackson and in the Ocmulgee River downstream of Lloyd Shoals Dam to Juliette Dam documented the occurrence of seven native freshwater mussel species. An eighth native species was detected as a relict (dead) shell. Appendix A provides the WRD survey report (GDNR 2019) and Table 2 summarizes the results. None of the species detected are federally listed as threatened or endangered. Two of the species detected in Lake Jackson are listed as threatened in Georgia. The species include, in descending order of overall relative abundance:

- Altamaha Slabshell (*Elliptio hopetonensis*) – widespread and locally abundant in the Altamaha River basin, found in sand/mud and sand substrates (NatureServe 2020).
- Inflated Floater (*Pyganodon gibbosa*) – endemic to the Altamaha River basin, inhabits large rivers, oxbows, and reservoirs in sandy, silty, or muddy substrate (Rowe 2020).
- Paper Pondshell (*Utterbackia imbecillus*) – widely distributed from the Great Lakes and Mississippi River to Gulf Coast and Atlantic Coast; inhabits slow water of creeks, rivers, and reservoirs, usually in mud or sand (Williams et al. 2008).
- Eastern Floater (*Pyganodon cataracta*) – wide ranging in Atlantic Coast drainages from the St. Lawrence River to the Altamaha River; occurs in a wide variety of habitats, usually in sand or mud with little or no current (Williams et al. 2008).
- Variable Spike (*Elliptio icterina*) – ranges along Atlantic Coast from North Carolina to northeast Florida; occurs in lakes, ponds, reservoirs, and streams with slight to moderate current (NatureServe 2020).
- Savannah Lilliput (*Toxolasma pullus*) – Georgia threatened; occurs in Atlantic Coast drainages from Georgia to North Carolina; inhabits very shallow water, usually at the edges of streams, rivers, and lakes in mud or silty sand (NatureServe 2020).
- Rayed Pink Fatmucket (*Lampsilis splendida*) – ranges in Atlantic Coast rivers from the Altamaha River north to the Cape Fear River in North Carolina; considered stable in the Altamaha River basin but not very common in the Ocmulgee River (NatureServe 2020).
- Altamaha Arcmussel (*Alasmidonta arcula*) – Georgia threatened; range includes the Altamaha, Savannah, and Ogeechee River basins in Georgia; inhabits sloughs, oxbows, or depositional areas of large creeks, rivers, and reservoirs in silt, mud, or sand; primarily known from riverine habitats in the Coastal Plain physiographic province but recently collected in reservoir habitats of Lake Jackson and in the Ocmulgee River and Alcovy River in the Piedmont province (Wisniewski 2018a; Georgia Power 2017, 2018).

4.1 LAKE JACKSON

WRD surveyed 22 sites, primarily in northern reaches of Lake Jackson (GDNR 2019). Eighteen sites were in the Alcovy River, South River, and Yellow River embayments. One site was in a cove on the east side of the mainstem reservoir, one site was in the upper Tussahaw Creek embayment, and two sites were just above the dam near Lloyd Shoals Park and the auxiliary spillway. Bottom substrates varied from soft and silty to rocky, and included sand, sand with a top layer of soft silt, silt, silty mud with sticks and logs, and bedrock/boulders on sand and gravel or silty gravel. Cans, bottles, and other trash were present at some sites.

The Lake Jackson surveys in fall 2019 yielded 294 live specimens of five native mussel species and one relict shell of a sixth species (Table 2). The most common species encountered was Inflated Floater, comprising 49 percent of the native mussels found in Lake Jackson and occurring at 82 percent of the surveyed sites. Altamaha Slabshell was second in relative abundance at 35 percent and was found at 36 percent of the sites. Paper Pondshell comprised 15 percent of the mussels found and occurred at 73 percent of the sites. All three of these species inhabit silt, mud, and/or fine sand substrates in streams, rivers, and backwaters (NatureServe 2020).

The most significant finding was that of a single live specimen of Savannah Lilliput, a Georgia threatened species. This specimen represented the first record of the species from Lake Jackson and from the upper Ocmulgee River basin in the Piedmont physiographic province (GDNR 2019). Nearly all collection records in Georgia and all in the Altamaha River basin previously have been from the Coastal Plain province (GDNR 2020). The species typically inhabits very shallow water near the banks of streams, rivers, ponds, and lakes with little flow, in soft substrates including mud, silty sand, and sand (Wisniewski 2018b). The presence of Savannah Lilliput in Lake Jackson extends the species' known range about 235 miles upstream in the Ocmulgee River basin (GDNR 2019).

The collection of a single relict shell but no live individuals of the Altamaha Arcmussel, a Georgia threatened species, was noteworthy because the species was first reported from Lake Jackson in 2012 (GDNR 2019). The lack of detection of live individuals in the 2019 field season, even at some sites where the species was found in 2012, does not necessarily mean the species has disappeared from the reservoir but indicates the need for additional survey effort to detect this uncommon species (GDNR 2019). As part of the occupancy-based sampling design, WRD plans to conduct additional surveys in southern portions of Lake Jackson in 2020.

Length-frequency distributions for Altamaha Slabshell, Inflated Floater, Eastern Floater, and Paper Pondshell, combined for Lake Jackson and the Ocmulgee River downstream, indicate that their populations are successfully reproducing and recruiting young mussels (GDNR 2019). Similar inferences could not readily be drawn about the less common species because of their smaller sample sizes.

Notwithstanding WRD's plan to conduct additional surveys in Lake Jackson in 2020, the search effort completed in Lake Jackson in 2019 totaled 21.3 person-hours and met the target search effort of 20 person-hours or more established in the study plan.

4.2 LLOYD SHOALS TAILRACE AREA

WRD surveyed 20 sites in the Lloyd Shoals tailrace area (GDNR 2019). Fifteen sites were in the 1.1-mile reach of the Ocmulgee River between Lloyd Shoals Dam and the Hwy 16 bridge; five of these were within the project boundary. Five additional sites were surveyed just downstream of the Hwy 16 bridge to encompass a long island-and-shoal complex and nearby habitats. These sites extended downstream of the bridge to about 2 river miles. Bottom substrates in the tailrace area included bedrock outcrops, boulders, cobbles, gravel, sand, soft clay, and silt. Dead shells of the invasive Asian Clam (*Corbicula fluminea*) dominated the substrate at some sites.

The mussel survey in the tailrace area yielded 528 live specimens of native freshwater mussels representing six species (Table 2). None of the species are federally or state-listed as threatened or endangered species. The most abundant species was Altamaha Slabshell, comprising 63 percent of all live native mussels found and occurring at all but one of the survey sites (95 percent). It was followed in relative abundance by Eastern Floater (18 percent), Paper Pondshell (12 percent), and Inflated Floater (6 percent). These four species also occurred in Lake Jackson. Variable Spike and Rayed Pink Fatmucket were the least common species found in the tailrace area, comprising 1.1 percent and 0.2 percent, respectively, of the live native mussels found. The single individual of Rayed Pink Fatmucket, relatively uncommon in the Ocmulgee River, was found in the island-and-shoal complex downstream of Hwy 16.

4.3 OCMULGEE RIVER BETWEEN HWY 16 BRIDGE AND JULIETTE DAM

WRD surveyed for mussels at seven other sites in the Ocmulgee River downstream of the tailrace area reach between the Hwy 16 bridge and Juliette Dam (GDNR 2019). The survey sites began over 3 river miles downstream of Hwy 16 at a public boat launch and also included the Hwy 83 bridge and five sites between the Towaliga River confluence and Juliette Dam. Surveyed habitats included bedrock shoals with sand and fine gravel, sandy areas near the bank, soft substrates sloping down into deeper water, and soft mud and silt substrates.

The mussel survey in the Ocmulgee River between the Hwy 16 bridge and Juliette Dam yielded 421 live specimens of four native species of freshwater mussels (Table 2). All four species were also collected in the tailrace area upstream. None of the species are federally or state-listed as threatened or endangered species. Similar to the tailrace area upstream, the numerically dominant species was Alabama Slabshell, which comprised 83 percent of all live native mussels found. It was followed in relative abundance by Paper Pondshell (11 percent), Variable Spike (3 percent) and Inflated Floater (3 percent).

5.0 PRIMARY SPORT FISH SPECIES HABITAT

5.1 LAKE JACKSON FISHERY

As described in the PAD, Lake Jackson supports a fishery for Largemouth Bass, Spotted Bass, Striped Bass and Hybrid Bass, catfish, crappie, and a variety of sunfish species. GDNR performs annual standardized fisheries surveys of Lake Jackson targeting sport fishes. The surveys consist of a sampling event each fall using boat electrofishing and gillnetting collection methodologies (Figure 1). GDNR maintains a comprehensive database of fishery population data, which includes fish length, weight, and relative condition by species. These data are used by GDNR to evaluate the overall health of the fishery and make management decisions. Georgia Power has obtained the GDNR fishery database for Lake Jackson for the years 2007-2019 for use in characterizing the sport fish populations of Lake Jackson and analyzing the effects of continued project operations on fishery resources (GDNR 2018d).

One of the ways GDNR supports the fishery in Lake Jackson is by stocking fish. GDNR began stocking Striped Bass into Lake Jackson in 2005 to provide an additional sport fish option (GDNR 2018d). GDNR currently stocks both Striped Bass and Hybrid Bass in the reservoir annually (K. Weaver, GDNR, personal communication with P. O'Rourke, Georgia Power, January 30, 2018). Table 4 summarizes stocking data from 2008 to 2019. More Hybrid Bass are stocked than Striped Bass at an average ratio of 2.2 to 1. The current preferred stocking rates are 9 fingerlings per acre for Hybrid Bass (~42,500 fish) and 5 fingerlings per acre for Striped Bass (~23,500 fish). Stocking rates have increased in the last two years. The annual stockings have produced the potential for a quality fishery, with the opportunity to catch trophy-size Striped Bass. Striped Bass in Lake Jackson typically average 4 to 5 lbs, with fish more than 18 lbs having been reported (GDNR 2018d). Largemouth Bass have been stocked recently at a rate of 83 fingerlings per acre (395,407 fish) in 2017, 8 fish per acre in 2018 (36,479 fish), and 16 fish per acre in 2019 (76,390 fish).

Tournament fishing for black bass is popular on Lake Jackson and primarily targets Largemouth Bass and Spotted Bass. The Georgia Bass Chapter Federation (GBCF) has compiled creel data from tournaments annually in many Georgia reservoirs and has created a dataset of catch statistics to monitor any changes that may occur to the fishery over time. Table 5 summarizes creel tournament data from 1996 to 2015. The average tournament bass weight ranged from 1.35

to 1.77 pounds (lbs) (GBCF 1996-2015). The average largest bass reported in Lake Jackson tournaments ranged in weight from 3.12 to 4.38 lbs. In 1996, 95.5 percent of bass recorded in these tournaments were Largemouth Bass. That number declined to 28.8 percent in 2015 as introduced Spotted Bass increased in abundance.

5.1.1 STANDARDIZED FISH SURVEYS

The Wildlife and Resources Division (WRD) conducts standardized fisheries surveys in Lake Jackson to assess the fishery and make management decisions. These data were obtained from WRD for the years 2007 to 2019 and used to evaluate the potential effects of Lloyd Shoals generation on sport fishes in Lake Jackson, including Largemouth Bass, Spotted Bass Striped Bass, Hybrid Bass, Channel Catfish, Blue Catfish, Black Crappie, and Bluegill. Sampling was performed by electrofishing at 10 sampling stations on Lake Jackson and gillnetting was performed at an additional 10 stations (Figure 3). Gillnetting did not occur in 2011 or 2018. The numbers of all fish species sampled by electrofishing and gillnetting are summarized in Table 3 and Table 4, respectively.

5.1.2 SPORTFISH ANALYSIS

Catch-per-unit-effort (CPUE) was calculated as the catch rate of one hour of electrofishing or 1 night of gillnetting. Relative condition factor is the ratio of the actual weight of a fish at a given length to the expected weight of the fish at that given length, which is calculated from the length weight regression (Le Cren 1951). A relative condition of 1.00 would represent an average-sized fish. Proportional Size Distribution (PSD) is a metric used by fisheries managers to determine if populations of sportfish are “in balance.” PSD values were calculated by dividing the number of quality-sized or larger fish sampled by the number of stock-sized or larger fish and multiplying by 100. Stock-sized and quality-sized fish lengths proposed in Gabelhouse (1984) were used for this analysis. PSD values range from 0 to 100, with lower values indicating low numbers of larger fish, and higher values indicating lower numbers of smaller fish.

Largemouth Bass

Figure 4 summarizes Largemouth Bass CPUE data for both electrofishing and gillnetting. Electrofishing catch-per-unit-effort (CPUE) ranged from 19.74 to 40.63 (mean = 30.84, SE = 2.08, n = 13) from 2007 to 2019. Largemouth Bass accounted for 15.87 to 36.51 percent (mean =

25.51 percent, SE = 1.66, n = 13) of individuals and 41.75 to 73.23 percent (mean = 54.29 percent, SE = 2.55, n = 13) biomass of fish sampled by electrofishing. Average gillnetting CPUE ranged from 0.00 to 1.10 (mean = 0.50, SE = 0.11, n = 11). Largemouth Bass accounted for 0.00 to 2.93 percent (mean = 1.52, SE = 0.29, n = 11) of individuals and 0.00 to 2.47 percent (mean = 0.85 percent, SE = 0.26, n = 11) biomass of fish sampled by gillnetting.

Figure 6 summarizes relative condition of Largemouth Bass for both electrofishing and gillnetting. Average relative condition of Largemouth Bass electrofished in Lake Jackson from 2007 to 2019 was slightly below the average, ranging from 0.86 to 0.99 (mean = 0.92, SE = 0.00, n = 1,406). Average relative condition for gillnetting from 2007 to 2019 ranged from 0.82 to 1.01 (mean = 0.91, SE = 0.02, n = 55).

Figures summarizing length-frequency of Largemouth Bass for both electrofishing and gillnetting are provided in Appendix B. Total length of Largemouth Bass electrofished from the years 2007 to 2019 ranged from 47 to 705 mm (mean = 289.88, SE = 3.12, n = 1,410; 1.85 to 27.76 inches). Total length of gillnetted Largemouth Bass ranged from 155 to 421 mm (mean = 268.73, SE = 11.45, n = 55; 6.10 to 16.57 inches). The largest fish sampled by electrofishing was in 2007 and weighed 5,442 grams, or 12.0 pounds, and the largest fish sampled by gillnetting was in 2007 and weighed 1,100 grams, or 2.4 pounds.

Figure 8 summarizes PSD data of Largemouth Bass for electrofishing and gillnetting combined. PSD was calculated by dividing the number of quality-sized or larger Largemouth Bass (≥12 inches) by the number of stock-sized or larger (≥8 inches) and multiplying by 100. PSD by electrofishing from 2007 to 2019 ranged from 44.19 to 85.44 (mean = 62.00, SE = 3.17, n = 13). The range for more recent years (2015 to 2019) was 53.47 to 85.44 (mean = 68.55, SE = 5.46, n = 5). Gillnetting PSD ranged from 0.00 to 100.00 (mean = 57.78, SE = 11.23, n = 10). Due to low sample sizes for some years of gillnetting, PSD of gillnetted fish may not be a reliable metric for assessing health of the Largemouth Bass population.

Spotted Bass

Figure 4 summarizes Spotted Bass CPUE data for both electrofishing and gillnetting. Electrofishing CPUE from 2007 to 2019 ranged from 0.36 to 29.85 (mean = 17.55, SE = 2.42, n = 13). Spotted Bass accounted for 0.96 to 29.04 percent (mean = 14.92 percent, SE = 2.17, n =

13) of individuals and 0.85 to 25.46 percent (mean = 18.81 percent, SE = 2.01, n = 13) biomass sampled by electrofishing from 2007 to 2019. Gillnetting CPUE ranged from 0.00 to 1.30 (mean = 0.47, SE = 0.14, n = 11). Bluegill accounted for 0.00 to 3.47 percent (mean = 1.31 percent, SE = 0.37, n = 11) of individuals and 0.00 to 1.81 percent (mean = 0.66, SE = 0.20, n = 11) biomass of fish sampled by gillnets.

Figure 6 summarizes relative condition of Spotted Bass for both electrofishing and gillnetting. Average relative condition of Spotted Bass electrofished in Lake Jackson from 2007 to 2019 ranged from 0.93 to 1.10 (mean = 0.97, SE = 0.01, n = 854). Average relative condition for gillnetting from 2007 to 2019 ranged from 0.88 to 1.25 (mean = 0.98, SE = 0.02, n = 52).

Figures summarizing length-frequency of Spotted Bass for both electrofishing and gillnetting are provided in Appendix B. Total length of Spotted Bass electrofished from the years 2007 to 2019 ranged from 61 to 543 mm (mean = 241.47 mm, SE = 4.06, n = 855; 2.40 to 21.38 inches). Total length of gillnetted Spotted Bass ranged from 160 to 478 mm (mean = 253.81, SE = 9.43, n = 11; 6.30 to 18.82 inches). The largest Spotted Bass sampled by electrofishing was in 2009 and weighed 936 grams, or 2.06 pounds and the largest sampled by gillnetting was in 2008 and weighed 1,490 grams, or 3.28 pounds.

Figure 8 summarizes PSD data of Spotted Bass for electrofishing and gillnetting, combined. PSD was calculated by dividing the number of quality-sized or larger Spotted Bass (≥11 inches) by the number of stock-sized or larger (≥7 inches) and multiplying by 100. Electrofishing PSD from 2007 to 2019 ranged from 0.00 to 84.09 (mean = 57.73, SE = 5.72, n = 13). Gillnetting PSD from 2007 to 2019 ranged from 0.00 to 10.00 (mean = 43.46, SE = 12.55, n = 9). Gillnetting did not occur in 2011 or 2018 and gillnetting in 2009 and 2010 did not yield any Spotted Bass. The range for more recent years (2015 to 2019) is 47.46 to 84.09 (mean = 64.31, SE = 6.10, n = 5) for electrofishing and 0.00 to 66.67 (mean = 40.83, SE = 16.12, n = 4) for gillnetting. Due to low sample sizes for some years of gillnetting, PSD of gillnetted fish may not be a reliable metric for assessing health of the Spotted Bass population.

Bluegill

Electrofishing CPUE from 2007 to 2019 ranged from 2.12 to 70.52 (mean = 30.49, SE = 5.60, n = 13) (Figure 4). Bluegill accounted for 2.31 to 42.17 percent (mean = 21.65 percent, SE = 2.96, n = 13) of individuals and 0.34 to 7.58 percent (mean = 3.91 percent, SE = 0.56, n = 13) biomass sampled by electrofishing from 2007 to 2019. Gillnetting CPUE ranged from 0.00 to 1.50 (mean = 0.55, SE = 0.17, n = 11). Bluegill accounted for 17.60 to 57.27 percent (mean = 41.33 percent, SE = 4.45, n = 11) of individuals and 0.00 to 2.47 percent (mean = 1.06, SE = 0.26, n = 11) biomass of fish sampled by gillnets.

Average relative condition of Bluegill electrofished in Lake Jackson from 2007 to 2019 ranged from 0.88 to 1.19 (mean = 1.04, SE = 0.01, n = 1,255) (Figure 6). Average relative condition for gillnetting from 2007 to 2019 ranged from 0.77 to 1.28 (mean = 0.91, SE = 0.03, n = 58).

Total length of Bluegill electrofished from the years 2007 to 2019 ranged from 21 to 362 mm (mean = 120.82 mm, SE = 0.93, n = 1,301; 0.83 to 14.25 inches) (Appendix B). Total length of gillnetted Bluegill ranged from 100 to 181 mm (mean = 121.08, SE = 2.61, n =61; 3.94 to 7.13 inches). The largest Bluegill sampled by electrofishing was in 2017 and weighed 648 grams, or 1.43 pounds and the largest fish sampled by gillnetting was in 2015 and weighed 95 grams, or 0.21 pounds.

PSD was calculated by dividing the number of quality-sized or larger Bluegill (≥3 inches) by the number of stock-sized or larger (≥6 inches) and multiplying by 100 (Figure 8). Electrofishing PSD from 2007 to 2019 ranged from 10.34 to 71.43 (mean = 23.05, SE = 4.55, n = 13). Gillnetting yielded much fewer Bluegills than electrofishing, and numbers were as low as two fish some years. Therefore, the PSD values for gillnetting may not accurately reflect actual sizes of fish. Gillnetting PSD from 2007 to 2019 ranged from 0.00 to 23.08 (mean = 7.74, SE = 3.89, n = 7). Gillnetting did not occur in 2011 or 2018 and gillnetting in 2009, 2010, and 2019 did not yield any Bluegill. The range for more recent years (2015 to 2019) is 10.34 to 71.43 (mean = 29.43, SE = 11.35, n = 5) for electrofishing and 0.00 to 23.08 (mean = 7.69, SE = 7.69, n = 3) for gillnetting. Due to low sample size some years by gillnetting, PSD of gillnetted Bluegill may not be a reliable metric for assessing Bluegill health.

Black Crappie

Electrofishing CPUE from 2007 to 2019 ranged from 1.09 to 15.43 (mean = 7.24, SE = 1.20, n = 13) (Figure 4). Black Crappie accounted for 0.66 to 8.74 percent (mean =5.19 percent, SE = 0.71, n = 13) of individuals and 0.97 to 7.59 percent (mean = 4.22 percent, SE = 0.57, n = 13) biomass sampled by electrofishing from 2007 to 2019. Gillnetting CPUE ranged from 3.10 to 25.20 (mean = 12.59, SE = 2.26, n = 11). Black Crappie accounted for 17.60 to 57.27 percent (mean = 41.33 percent, SE = 4.45, n = 11) of individuals and 0.00 to 2.47 percent (mean = 1.06, SE = 0.26, n = 11) biomass of fish sampled by gillnets. Gillnet sampling was not performed in 2011 or 2018.

Average relative condition of Black Crappie electrofished in Lake Jackson from 2007 to 2019 ranged from 0.83 to 1.04 (mean = 0.94, SE = 0.01, n = 294) (Figure 6). Average relative condition for gillnetting from 2007 to 2019 ranged from 0.86 to 1.01 (mean = 0.91, SE = 0.00, n = 1,382).

Total length of Black Crappie electrofished from the years 2007 to 2019 ranged from 105 to 372 mm (mean = 220.68, SE = 3.57, n = 294; 4.13 to 14.65 inches) (Appendix B). Total length of gillnetted Black Crappie ranged from 107 to 510 mm (mean = 204.95, SE = 1.45, n =1385; 4.21 to 20.08). The largest Black Crappie sampled by electrofishing was in 2019 and weighed 685 grams, or 1.51 pounds and the largest fish sampled by gillnetting was in 2016 and weighed 1,132 grams, or 2.50 pounds.

PSD was calculated by dividing the number of quality-sized or larger Black Crappie (≥8 inches) by the number of stock-sized or larger (≥5 inches) and multiplying by 100 (Figure 8). Electrofishing PSD from 2007 to 2019 ranged from 31.43 to 100.00 (mean = 65.96, SE = 5.40, n = 13). Gillnetting PSD from 2007 to 2019 ranged from 30.61 to 85.44 (mean = 54.57, SE = 4.97, n = 11). Gillnetting did not occur in 2011 or 2018. The range for more recent years (2015 to 2019) is 40.00 to 82.35 (mean = 61.75, SE = 4.37, n = 5) for electrofishing and 52.87 to 85.44 (mean = 63.03, SE = 7.59, n = 4) for gillnetting. Due to low sample size in 2008 by electrofishing, PSD of electrofished Black Crappie may not be a reliable metric for assessing Black Crappie health that year.

Striped Bass

Figure 5 summarizes Striped Bass CPUE data for both electrofishing and gillnetting. Electrofishing catch-per-unit-effort (CPUE) ranged from 0.00 to 0.73 (mean = 0.18, SE = 0.08, n = 13) from 2007 to 2019. Striped Bass accounted for 0.00 to 0.49 percent (mean = 0.12, SE = 0.05, n = 13) of individuals and 0.00 to 1.36 percent (mean = 0.20 percent, SE = 0.11, n = 13) of biomass sampled. Gillnetting CPUE ranged from 0.00 to 5.70 (mean = 1.06, SE = 0.50, n = 11). Striped Bass accounted for 0.00 to 22.80 percent of individuals (mean = 3.57 percent, SE = 1.86, n = 11) and 0.00 to 2.47 percent (mean = 1.06 percent, SE = 0.26, n = 11) biomass of fish sampled. Gillnet sampling was not performed in 2011 or 2018.

Figure 7 summarizes relative condition of Striped Bass for both electrofishing and gillnetting. A total of seven Striped Bass were captured by electrofishing from 2007-2019. The average relative condition during the years they were caught ranged from 0.58 to 0.85 (mean = 0.75, SE = 0.14, n = 7). Average relative condition for gillnetting from 2007 to 2019 ranged from 0.74 to 0.92 (mean = 0.88, SE = 0.001, n = 117).

Figures summarizing length-frequency of Striped Bass for both electrofishing and gillnetting are provided in Appendix B. Total length of Striped Bass electrofished from the years 2007 to 2019 ranged from 190 to 514 mm (mean = 323.71, SE = 46.33, n = 7; 7.48 to 20.24 inches). Total length of gillnetted Striped Bass ranged from 172 to 781 mm (mean = 363.50, SE = 11.92, n = 117; 6.77 to 30.75 inches). The largest fish sampled by electrofishing was in 2009 and weighed 936 grams, or 2.06 pounds and the largest fish sampled by gillnetting was in 2015 and weighed 5,380 grams, or 11.86 pounds.

Figure 9 summarizes PSD data of Striped Bass for both electrofishing and gillnetting combined. PSD was calculated by dividing the number of quality-sized or larger Striped Bass (≥20 inches) by the number of stock-sized or larger (≥12 inches) and multiplying by 100. Seven Striped Bass were sampled by electrofishing from 2007 to 2019, with one quality-sized fish in 2009. Due to low sample sizes, PSD of electrofished Striped Bass may not be a reliable metric for assessing health of the Striped Bass population. Gillnetting PSD from 2007 to 2019 ranged from 0.00 to 100.00 (mean = 32.40, SE = 11.62, n = 10). No Striped Bass were captured by gillnets in 2019. The range for more recent years (2015 to 2017) is 0.00 to 66.67 (mean = 23.61, SE = 21.56, n = 3). Due to low electrofishing sample sizes and low gillnetting sample sizes for certain years, PSD may not be a reliable metric for assessing Striped Bass health for certain years.

Hybrid Bass

No Hybrid Bass were sampled by electrofishing. Average gillnetting CPUE ranged from 0.00 to 5.10 (mean = 1.35, SE = 0.51, n = 11) and accounted for 0.00 to 13.82 percent (mean = 3.62

percent, SE = 1.36, n = 11) of individuals and 0.00 to 12.95 percent (mean = 3.36 percent, SE = 1.31, n = 11) biomass of fish sampled by electrofishing (Figure 5). Gillnet sampling was not performed in 2011 or 2018.

Average relative condition factor of Hybrid Bass gillnetted in Lake Jackson from 2007 to 2019 ranged from 0.93 to 1.06 (mean = 0.99, SE = 0.01, n = 148) (Figure 7).

Total length of Hybrid Bass gillnetted from 2007 to 2019 ranged from 151 to 591 mm (mean = 313.74, SE = 6.70, n = 148; 5.94 to 23.27 inches) (Appendix B). The largest fish sampled by gillnetting was in 2015 and weighed 1,880 grams, or 4.14 pounds.

PSD was calculated by dividing the number of quality-sized or larger hybrid bass (≥12 inches) by the number of stock-sized or larger (≥8 inches) and multiplying by 100 (Figure 9). PSD by gillnetting from 2007 to 2019 ranged from 15.00 to 82.61 (mean = 45.64, SE = 9.47, n = 6). PSD in more recent years (2015 to 2019) ranged from 27.27 to 82.61 (mean = 52.20, SE = 11.41, n = 4).

Channel Catfish

Average electrofishing CPUE ranged from 0.00 to 2.75 (mean = 0.64, SE = 0.26, n = 13) from 2007 to 2019 (Figure 5). Channel Catfish accounted for 0.00 to 2.41 percent (mean = 2.47 percent, SE = 0.20, n = 13) of individuals and 0.00 to 8.94 percent (mean = 1.95 percent, SE = 0.85, n = 13) biomass of fish sampled by electrofishing. Average gillnetting CPUE ranged from 0.50 to 6.40 (mean = 3.67, SE = 0.59, n = 11). Channel Catfish accounted for 3.14 to 17.61 percent (mean = 11.92, SE = 1.28, n = 11) of individuals and 7.28 to 33.94 percent (mean = 18.62 percent, SE = 2.16, n = 11) biomass of fish sampled by electrofishing.

Average relative condition of Channel Catfish electrofished in Lake Jackson from 2007 to 2019 ranged from 0.80 to 1.32 (mean = 1.04, SE = 0.05, n = 31) (Figure 7). Average relative condition for gillnetting from 2007 to 2019 ranged from 0.78 to 1.01 (mean = 0.87, SE = 0.01, n = 403).

Total length of Channel Catfish electrofished from the years 2007 to 2019 ranged from 210 to 603 mm (mean = 413.13, SE = 22.14, n = 31; 8.27 to 23.74 inches) (Appendix B). Total length of gillnetted Channel Catfish ranged from 121 to 915 mm (mean = 387.09, SE = 6.50, n = 404; 4.76 to 36.02 inches). The largest fish sampled by electrofishing was in 2007 and weighed 2,722 grams, or 6.00 pounds, and the largest fish sampled by gillnetting was in 2019 and weighed 9,415 grams, or 20.76 pounds.

PSD was calculated by dividing the number of quality-sized or larger Channel Catfish (≥16 inches) by the number of stock-sized or larger (≥11 inches) and multiplying by 100 (Figure 9). PSD by electrofishing from 2007 to 2019 ranged from 0.00 to 100.00 (mean = 57.74, SE = 16.38, n = 7). The range for more recent years (2015 to 2019) is 50.00 to 87.5 (mean = 68.75, SE = 18.75, n = 2). PSD by gillnetting from 2007 to 2019 ranged from 17.86 to 80.00 (mean = 49.32, SE = 5.75, n = 11). The range for more recent years (2015 to 2019) ranged from 17.86 to 48.89 (mean = 35.10, SE = 6.42, n = 4). Due to low sample sizes by electrofishing, PSD of electrofished Channel Catfish may not be a reliable metric for assessing health of the Channel Catfish population.

Blue Catfish

One Blue Catfish was sampled by electrofishing from 2007 to 2019. Average gillnetting CPUE ranged from 0.20 to 4.90 (mean = 1.80, SE = 0.51, n = 11) (Figure 5). Blue Catfish accounted for 0.57 to 13.69 percent (mean = 5.70 percent, SE = 1.25, n = 11) of individuals and 5.06 to 35.29 percent (mean = 19.18 percent, SE = 2.91, n = 11) biomass of fish sampled by gillnetting. Gillnet sampling was not performed in 2011 or 2018.

Average relative condition of Blue Catfish gillnetted in Lake Jackson from 2007 to 2019 ranged from 0.93 to 1.06 (mean = 0.98, SE = 0.01, n = 139) (Figure 7).

Total length of Blue Catfish gillnetted from the years 2007 to 2019 ranged from 130 to 905 mm (mean = 471.73, SE = 13.01, n = 198; 5.12 to 35.63 inches) (Appendix B). The largest fish sampled by gillnetting was in 2019 and weighed 9,670 grams, or 21.32 pounds.

PSD was calculated by dividing the number of quality-sized or larger Blue Catfish (≥20 inches) by the number of stock-sized or larger (≥12 inches) and multiplying by 100 (Figure 9). PSD by electrofishing was not calculated for Blue Catfish due to low sample size (n = 1). PSD by gillnetting from 2007 to 2019 ranged from 17.39 to 100.00 (mean = 71.31, SE = 10.09, n = 11). The range for more recent years (2015 to 2019) ranged from 17.39 to 62.79 (mean = 35.69, SE = 9.72, n = 4).

5.1.3 ANALYSIS OF LAKE JACKSON HABITAT

An important resource issue for the relicensing of Lloyd Shoals Dam is the effects of project operations on summer reservoir water quality and habitat for sport fish species, namely Largemouth Bass and Striped Bass. Georgia Power operates the Lloyd Shoals Project in a modified run-of-river mode for generation during peak power demand hours to meet electrical system demand. Lloyd Shoals Dam discharges directly into the Ocmulgee River. When the plant is not operating to generate peaking energy, the Project releases a continuous minimum flow of 400 cfs, or inflow, whichever is less, through the turbines into the Ocmulgee River downstream.

Water quality profiles were measured seasonally in Lake Jackson at six sampling stations (Stations JA1, JA2, JA3, JA4, JA5, and JA6). The locations of these sampling stations are detailed in the Pre-Application Document (Georgia Power 2018) and are shown in Figure 10. The reservoir stratifies in some areas during the summertime (June – August), with warmer surface temperatures, a pronounced thermocline, and cooler, low-DO water below 5 m. Figure 11 and Figure 12 depict average water temperature and DO profiles collected at the mainstem of the reservoir at the forebay (JA1; at Lloyd Shoals Dam), mid-lake (JA3; ~ 2.5 mi. upstream of the dam), and upper lake (JA5; ~4.25 mi. upstream of the dam). Figure 13, Figure 14, and Figure 15 depict average water temperature and DO profiles collected in the Tussahaw Creek (JA2), South/Yellow River (JA4), and Alcovy River (JA6) embayments of the reservoir. In the embayments, DO concentration in the summertime ranges from around 8-9 milligrams per liter (mg/L) near the surface and typically decreases to near 0 mg/L in depths greater than 6 m. Water temperature in the embayments during summertime exhibits less pronounced stratification, with surface temperatures ranging from 26 – 33 °C, and 21 – 26 °C near the bottom.

Largemouth Bass

Largemouth Bass typically reside in lakes, ponds, oxbows, reservoirs, and pools of still water in rivers and prefer cover such as fallen trees, roots, and vegetation (Boschung and Mayden 2004). They typically spawn from April to June when temperatures reach 17 to 20 °C (Boschung and Mayden 2004; Mettee et al. 1996). The critical thermal maxima of Largemouth Bass is around 38.5°C (Currie et al. 1998) and they avoid but can tolerate DO concentrations of 2.0 mg/L (Burleson et al. 2001). Water quality monitoring data collected by Georgia Power suggest that water quality conditions in Lake Jackson support the growth and survival of Largemouth Bass.

Metrics such as CPUE, relative condition, length-frequency distribution, and PSD suggest that the overall population of Largemouth Bass is healthy.

Striped Bass

Striped Bass are typically anadromous species that spend most of their life in the ocean and enter rivers to spawn (Boschung and Mayden 2004). Due to the construction of dams and impoundments, many Striped Bass are stocked for recreational use and inhabit rivers and reservoirs (Boschung and Mayden 2004; Mettee et al. 1996; GDNR 2018d). Adult Striped Bass favor temperatures of 25°C or less and begin to experience severe stress or mortality at temperatures around 28°C or greater (Crance 1984). Striped Bass have often been found to inhabit waters where DO is 4.0 mg/L or greater and cannot tolerate DO levels less than 2.0 mg/L (Coutant 1985).

Habitat is generally suitable for Striped Bass in Lake Jackson with regard to temperature and DO in the fall, winter, and spring. In the summer, temperature and DO constraints limit available habitat. The majority or entire water column is at a stressful or lethal temperature for Striped Bass (~28°C or greater; Crance 1984) at Stations JA2, JA3, JA4, and JA5. At stations JA1 and JA6, the temperature criterion of less than 28°C is met at depths of around 10.0 m and 7.5 m, respectively (Figures 11 and 15). The suitable DO criterion of 4.0 mg/L (Coutant 1985) was met at a depth of around 5.5 m at JA1, 4.0 m around JA2, around 5.0 to 7.0 at JA5, and 4.0 to 6.5 at JA6. At JA3, the suitable DO criterion of 4.0 mg/L was generally met at depths of around 6.0 to 7.5 m except for one sampling event in 2010, where it was met at 4.5 m. Station JA4 was relatively shallow (around 2.0 m) and DO was generally above 4.0 mg/L throughout the water column.

Striped Bass must inhabit a portion of the water column that is deep enough to meet temperature needs but shallow enough to meet DO needs. During summer, many areas of the reservoir may not be suitable for Striped Bass due to the inability to meet both temperature and DO criterion simultaneously. Striped Bass may be able inhabit areas higher in the water column, where DO is suitable and temperature is stressful, and mortalities begin to occur. Alternatively, they may inhabit cooler, deeper waters in some areas of the lake where temperature reaches suitable levels and where DO levels may be stressful but non-lethal.

5.1.4 FISH KILL INVESTIGATIONS

On December 20, 2018, Georgia Power filed additional information requested by FERC staff pertaining to, among several items, documentation of fish kills in the project waters. Georgia Power provided a detailed description of a fish kill event that occurred in Lake Jackson in summer 2012 and included the investigation report prepared by GDNR. According to the GDNR report, the fish-kill occurred on June 30 or July 1, 2012 in about 8 acres of shallow water in the cove on the west side of the South River arm of Lake Jackson immediately upstream of the Georgia Highway (Hwy) 36 bridge. GDNR biologists counted 2,471 dead juvenile and adult Gizzard Shad, crappie, catfish, Largemouth Bass, and sunfish. The cove had been cut off from the South River embayment flow due to low inflow from the South River and the low level in the reservoir, which was below normal pool level. Prior to and during the fish kill, the region was experiencing severe drought and the weather was hot, with air temperatures above 100°F. The fish apparently succumbed to low DO levels and high temperatures in shallow water. GDNR had stated that similar fish kills were happening all over the state at the time due to the combined effects of drought and record high temperatures.

In its December 2018 filing, Georgia Power also described and documented a Common Carp die-off on Lake Jackson that occurred over a few weeks in May-June 2018. The die-off appeared to be a natural occurrence resulting from aggressive spawning activities, which can weaken fish immune systems and allow bacterial or viral infections to spread.

Georgia Power has since obtained from GDNR one other fish kill investigation report for Lake Jackson from July 2012 (K. Weaver, GDNR, personal communication with P. O’Rouke, Georgia Power, March 17, 2020). The event was first observed July 27, 2012 in about 2 acres of the same cove on the west side of the South River upstream of Hwy 36 that had experienced a fish kill earlier in the month. GDNR biologists counted about 250 dead Gizzard Shad, catfish, Largemouth Bass, and sunfish. The cove had been cut off from water exchange with the reservoir due to extensive vegetation growth at the entrance of the cove. Fish were trapped in an area with thick cover and succumbed to a DO sag. There was no evidence fish had died from other than natural causes or that man-influenced pollution or pesticides contributed to the fish kill.

Georgia Power proactively monitors the occurrence of and has periodically treated invasive terrestrial and aquatic plants within the project boundary. Licensed herbicide specialists have chemically treated small areas within the project boundary to manage nuisance conditions or help prevent further infestation, as warranted. Several treatments in 2012-2016 targeted the invasive species alligatorweed and floating primrose-willow along shorelines and in shallow coves in the South River embayment, including one treatment in June 2014 at the mouth of the cove just upstream of Hwy 36 that experienced fish kills in July 2012.

6.0 DOWNSTREAM RIVERINE HABITAT

6.1 FISHERY

The Ocmulgee River downstream of Lloyd Shoals Dam flows freely for about 19 miles to the pool created by Juliette Dam. Popular sport fishes in this reach include Largemouth Bass, Shoal Bass, Spotted Bass, Striped Bass, hybrid bass, Channel Catfish, Redbreast Sunfish, Bluegill, And Redear Sunfish (GDNR 2018c). Shoal Bass from the upper Flint River (Apalachicola River basin) were introduced into the upper Ocmulgee River below Lake Jackson in 1975 and have since spread throughout the Piedmont portions of the watershed (Bart et al. 1994). Striped bass and hybrid bass stocked into Lake Jackson are known to occasionally pass through the Lloyd Shoals turbines and add to the tailrace fishery downstream (GDNR 2018c). Channel Catfish are relatively abundant in the Ocmulgee River downstream of Lloyd Shoals Dam. Introduced flathead catfish are also now present in the river above Juliette Dam. Flathead Catfish pose a risk of direct predation and potentially negative population effects on native species such as suckers, catfish, and sunfish (Bart et al. 1994).

Fisheries investigations for the previous Lloyd Shoals relicensing included one year of quarterly sampling of the Ocmulgee River at four stations in 1988 (EA 1990b). The sampling stations each consisted of river segments 0.5- to 1.0-mile in length beginning at distances of 0.6, 4.2, 14.0, and 27.6 river miles downstream of Lloyd Shoals Dam. Three stations were between Lloyd Shoals Dam and Juliette Dam, and one was downstream of Juliette Dam. Boat and backpack electrofishing gear were used exclusively. The Ocmulgee River fish community downstream of Lloyd Shoals Dam included 45 total species. The top ten numerically abundant species overall were (in descending order of abundance) Redbreast Sunfish, Threadfin Shad, Ocmulgee shiner, Altamaha shiner, Bluegill, Spottail Shiner, Snail Bullhead, American Eel, Largemouth Bass, and Blackbanded Darter. These species comprised 86 percent of the total catch. Sport fish made up 43 percent of the total catch by number and 33 percent by weight.

Electrofishing sampling at two sites downstream of Lloyd Shoals Dam in fall 1987, as part of the instream flow study (EA 1990c; see below), yielded fish species composition and relative abundance data very similar to the quarterly sampling in 1988. Of the 30 species collected, Redbreast Sunfish, Spottail Shiner, Snail Bullhead, Altamaha Shiner, Spotted Sucker, And American Eel comprised 75 percent of the total catch by number.

Through the Ocmulgee Candidate Conservation Agreement with Assurances for Robust Redhorse (Ocmulgee CCAA for Robust Redhorse), Georgia Power has participated in a multi-stakeholder partnership to advance conservation of the robust redhorse in the Ocmulgee River (Georgia Power 2016). Studies funded by Georgia Power have documented the movements and habitat use of hatchery-reared Robust Redhorse stocked downstream of Lloyd Shoals Dam to establish a refugial population. Jennings and Shepard (2003) released and monitored 30 fish via radio telemetry in 2002 and found that tagged fish moved gradually downstream. Sixty-six percent of the fish remained in the reach upstream of Juliette Dam, while 34 percent moved downstream beyond the dam. Grabowski and Jennings (2009) released 30 radio-tagged fish into the river below Lloyd Shoals Dam in 2006 and monitored their movements weekly over the course of a year. The radio-tagged fish exhibited an initial exploratory pattern of movement, mostly in the downstream direction, and consistently remained in the main channel associated with current, deep water, and woody debris. Two-thirds remained in the reach upstream of Juliette Dam; however, relatively few of the fish seemed to locate suitable spawning habitat and participate in spawning activities.

Surveys conducted in 2010-2011 showed that stocked redhorse had survived and were participating in spawning activities in the Lloyd Shoals tailrace, but evidence of successful recruitment was not confirmed (Georgia Power 2016). In 2014, GDNR survey efforts in downstream reaches in the Coastal Plain (near Hawkinsville) resulted in the capture of a juvenile Robust Redhorse, indicating successful natural recruitment in the river. GDNR collected, tagged, and released four adults from a shoal below Juliette Dam in May 2018 (GDNR 2018a).

Georgia Power is currently working on the Ocmulgee CCAA for Robust Redhorse with its partners, FWS Region 4 and GDNR's Wildlife Conservation Section, to renew the agreement beyond its current term, which expires at the end of the current FERC license term in December 2023.

6.2 Habitat

An instream flow study conducted for the previous FERC relicensing of Lloyd Shoals (EA 1990c) informed operational flow control decisions in the current license for the protection and enhancement of fish and wildlife resources in the Ocmulgee River. That study resulted in the continuous minimum flow requirement of 400 cfs, or inflow to the project reservoir, whichever is less. In practice, no flows less than 250 cfs have been released from the Project in recent years when inflow has been less than 250 cfs. Assurances in the Ocmulgee CCAA for Robust Redhorse include the minimum flow regime provided for in the current license. The Ocmulgee CCAA for robust redhorse expires with the current license term in December 2023.

The instream flow study for the Project (EA 1990c) applied the Instream Flow Incremental Methodology (IFIM) developed by FWS (Bovee 1982). This habitat-based approach estimates the relationship between stream flow and the area of suitable habitat for fish species life stages of interest. The study was conducted in consultation with GDNR and FWS. The study area extended from Lloyd Shoals Dam downstream approximately 16.8 river miles to the Georgia Hwy 83 bridge. Habitat suitability criteria were developed from site-specific studies of fish habitat use in the upper Ocmulgee River and the Chattooga River (Savannah River basin) for 12 species/life stages:

- Altamaha Shiner (juveniles and adults);
- Redeye Bass (young-of-year [YOY], juveniles, and adults);
- Shoal Bass (YOY and adults);
- Redbreast Sunfish (spawning and adults);
- Striped Jumprock (juveniles and adults); and
- Silver Redhorse4 (adults).

The Physical Habitat Simulation (PHABSIM) model integrated the results of hydraulic simulations over a range of flows and the habitat suitability criteria to produce discharge versus weighted usable area relationships for each species and life stage. Figure 16 plots discharge versus average percentage of maximum weighted usable area (PMWUA) for all species and life stages within the spawning and non-spawning seasons. A matrix analysis was used to identify a minimum flow that would optimize habitat across multiple species and life stages. The matrix showed available habitat (expressed as PMWUA) for each species/life stage at 20 different discharges ranging from 50 cfs to 3,500 cfs (Table 8). The IFIM study results showed that a minimum flow release of 400 cfs would provide for 91 percent and 92 percent of the maximum weighted usable area on average for the spawning and non-spawning seasons, respectively (EA 1990c).

The matrix of IFIM study results also shows that a flow of 250 cfs, which in recent years has been the lowest flow Georgia Power releases from the Project when inflows are 250 cfs or less, provides for 87 percent and 82 percent of the maximum weighted usable area on average for the spawning and non-spawning seasons, respectively (Table 9). Releases this low usually occur only during drought periods, which are most likely to occur in late summer or fall, after the peak spawning and rearing seasons of most fishes in the Ocmulgee River. Discharges less than 250 cfs produce lower average habitat values (Figure 16).

Habitat mapping performed during the IFIM study revealed the study reach was dominated by irregular bedrock and gravel substrate. Substrate composition at microhabitat study sites consisted of irregular bedrock (28.2 percent), smooth bedrock (21.1 percent), fines (14.5 percent), small boulder (10.8 percent), large boulder (7.7 percent), large gravel (7.1 percent), small gravel (5.1 percent), small cobble (2.8 percent), large cobble (2.3 percent). Cover composition at microhabitat study sites consisted of no cover (49.3 percent), boulder (17.9 percent), ledge (16.0 percent), rooted plants (7.7 percent), log (4.8 percent), overhang (1.7 percent), log complex/root wad (1.4 percent), undercut (1.1 percent).

Based on a review of aerial imagery spanning from 1988 to 2019, there has been little, if any change to this section of the Ocmulgee River and adjacent floodplains since the IFIM study was conducted. As such, the findings of that study and minimum flow releases in the current Project license should continue to provide suitable habitat for species inhabiting this reach.

6.3 WATER QUALITY

Based on the Georgia Environmental Protection Division’s (GEPD’s) latest 305(b)/303(d) list, the Ocmulgee River is supporting its designated uses from Lloyd Shoals Dam downstream 17 miles to is confluence with the Towaliga River (GEPD 2018b). GEPD collected monthly tailrace water quality data in 2009, approximately 30 ft downstream of the powerhouse, including measurements of water temperature, DO, pH, and specific conductance (Table 10). GEPD also collected monthly water quality data in 2016 and 2018 on the Ocmulgee River at Georgia Hwy 83, approximately 14.5 miles downstream of Lloyd Shoals Dam, including measurements of water temperature, DO, pH, and specific conductance. Those data indicated water temperature, pH, and DO meet applicable criteria in the Ocmulgee River at Hwy 83.

As presented in Water Resources Study Report, Georgia Power's continuous water quality monitoring in the Lloyd Shoals tailrace area from July 24, 2019 through April 30, 2020 shows that water quality in the tailrace meets applicable criteria for water temperature, DO, and pH. Throughout the first nine months of continuous monitoring, including the latter half of the 2019 summer critical period, tailrace DO concentrations met the state criterion of no less than 4.0 mg/L instantaneous 100 percent of the time (Figure 17). In addition, the daily average concentrations met the 5.0 mg/L daily average criterion on all but one day (4.95 mg/L; Table 9). The 2019 summer DO monitoring data demonstrate the effective performance of the passive draft tube aeration system installed in the Lloyd Shoals powerhouse in 2006. Monitoring data collected by Georgia Power in 2006 and 2007, as presented in the PAD (Georgia Power 2018), also showed that the aeration system maintained DO levels above applicable criteria.

7.0 FISH ENTRAINMENT

Fish entrainment refers to the incorporation of fish with intake water flow entering and passing through the hydroelectric turbines. Fish approaching the powerhouse intake in Lake Jackson during generation may become entrained and subjected to risks of turbine-induced injury or mortality. The following analysis characterizes the potential for fish entrainment and turbine-induced mortality at the Lloyd Shoals Project.

7.1 PROJECT FACILITIES

Lloyd Shoals Dam is 1,599.5 ft long and has a maximum height of about 105 ft. Its principal structures include a west concrete non-overflow section, a powerhouse intake section, a concrete spillway section with Obermeyer gates and one trash gate, and an east earth embankment. The intake section is 198 ft long and contains six, 12-ft by 12-ft octagonal, concrete water passages that supply water to the turbines. It has an open forebay to Lake Jackson and draws intake flow from the upper and middle depths of the reservoir. The invert elevation of the intake is 495 ft PD, which is 35 ft below the normal full pool elevation of Lake Jackson. Steel trash racks in front of the intake consist of vertical bars with clear spacing between bars of 1.3125 inches.

The powerhouse is integral with the dam on the west side of the river. It contains six turbine-generator units numbered 1 through 6 from west to east. Table 12 summarizes the turbine design characteristics. The turbines are horizontal, Francis-type, double-runner units each rated 5,650 horsepower at 96.8 ft of head and 550 cfs of discharge. The maximum hydraulic capacity of each turbine unit is 620 cfs, for a total powerhouse maximum hydraulic capacity of 3,720 cfs. The turbine runner diameter is 52 inches for Units 1-4 and 55 inches for Units 5 and 6. The rated normal turbine speed of all six units is 300 revolutions per minute (rpm). The turbines operate with peripheral runner velocities of 69 and 71 feet per second (fps).

7.2 FACTORS INFLUENCING FISH ENTRAINMENT AND MORTALITY

The number, species, and life stages of fish entrained at a hydroelectric development are related to a variety of physical factors near the dam and powerhouse. These may include plant flow, intake forebay configuration, intake depth, intake approach velocities, trash rack spacing, plant operating mode, and proximity to fish spawning, rearing, and feeding habitats (EPRI 1992; FERC 1995a). Biotic factors also affect entrainment, including diurnal and/or seasonal patterns of fish migration and dispersal, fish size and swimming speed, behavior, life history requirements, and density-dependent influences (e.g., resource availability) on fish populations in upstream habitats (EPRI 1992; FERC 1995a; Cada et al. 1997).

Injury and mortality of fish passing through hydroelectric turbines can occur via the following mechanisms (Cada 1990; Cada et al. 1997; Franke et al. 1997; Odeh 1999; and Cada 2001):

- Mechanical effects (strike and grinding) – Direct strikes or collisions with structures within the turbine system, such as moving runner blades or fixed guide and stay vanes, and grinding when fish are drawn through narrow openings or gaps between fixed and moving structures.
- Pressure changes – Rapid and extreme pressure decreases that occur momentarily on the downstream side of the runner and into the draft tube. In a matter of seconds, water pressures within the turbine may increase to several times atmospheric pressure and then drop to sub-atmospheric pressures. The main cause of pressure-related mortality is injury to the swim bladder from rapid decompression.
- Cavitation – The rapid formation of vapor bubbles caused by sub-atmospheric pressures within a turbine. Cavitation can occur downstream from the runner, in areas of increasing local velocities, in areas with abruptly changing flow direction, and along roughened or irregular surfaces (e.g., blade surface). As cavitation bubbles stream to areas of higher pressure, they collapse violently, creating localized shock waves. Rapid exposure to these high-pressure shock waves can injure entrained fish.
- Turbulence – Irregular motions of the water occurring throughout turbine passage. Intense, small-scale turbulence can distort and compress portions of the fish's body, while larger-scale turbulence, such as vortices in the draft tube, can spin and disorient fish, leaving them more susceptible to predators in the tailrace.
- Shear stress – Fluid-induced forces applied parallel to the fish's surface, experienced by a fish passing between two water masses of different velocities or sliding along a solid structure such as an intake wall or turbine blade (Nietzel et al. 2000). Fish encounter shear forces related to velocity gradients within the turbine system as they move from one velocity zone to the next.

Survival of turbine-passed fish depends on physical characteristics of the turbine system, such as head, turbine size and design, runner speed, number of runner blades, wicket gate openings and overhangs, runner blade angle, clearances between runner blades and housing, flow through the turbine, and water passage routes through the turbine (Cada 1990; Odeh 1999; Cada and Rinehart 2000; Cada 2001; EPRI and U.S. Department of Energy 2011). These factors can be sources of blade strikes and grinding and also produce pressure changes, shear stress, and turbulence that may injure fish (Cada 2001). Survival also depends on species, size, physiology, and behavior of entrained fish, and their distribution in the turbine intake, which influence the paths fish take in the turbine and the parts they encounter (Cada et al. 1997; Cada 2001).

Maximum survival of entrained fish tends to occur near peak turbine operating efficiency, and smaller fish tend to suffer the least mortality (EPRI 1992). Outside the peak range of operating efficiency, increased mortality appears to be related mainly to the effects of cavitation, pressure changes, shear stresses, turbulence, and narrow clearances between wicket gates at low gate settings (EPRI 1992; Cada 2001).

Pressure changes experienced by entrained fish depend on turbine design, flow rate, and head. High-head turbines, which tend to be smaller units, generally have a higher rate of pressure change per unit time than low-head turbines (Odeh 1999). Pressure increases are unlikely to directly injure or kill entrained fish. Rather, it is brief exposure to sub-atmospheric pressures downstream from the runner at high-head turbines that is more likely to injure fish having swim bladders (Cada et al. 1997). Bottom-dwelling fish may be more prone to pressure-related injury.

Design factors affecting cavitation include hydraulic head on the turbine runner, net head, surface irregularities on the turbine blades, and abrupt changes in flow direction (Cada 1990; Odeh 1999). Cavitation at hydroelectric facilities is difficult to predict but often occurs at high loads, when pressure drops within the turbine are greatest (Cada 1990).

Although turbine passage may not directly injure fish, pressure changes, shear stress, and turbulence may nonetheless physically stress or disorient entrained fish, increasing their susceptibility to predation or disease (indirect mortality) (Cada et al. 1997). Predation in the tailrace is one of the most immediate sources of indirect mortality to entrained fish (Cada 2001).

7.3 POTENTIAL ENTRAINMENT AT LLOYD SHOALS DAM

This section characterizes the potential size distribution, species composition, and seasonal distribution of fish entrainment occurring at the Lloyd Shoals Project based on common trends and data from entrainment field studies completed at 47 other hydroelectric sites east of the Mississippi River. Site characteristics and fish entrainment rates estimated from site-specific studies are presented in Table 13. Forty-three of the sites are from the EPRI (1997a) entrainment database; two are from the FERC (1995a) entrainment database (Abbeville and King Mill); one is evaluated in a FERC (1995b) environmental assessment (Stevens Creek); and one was recently relicensed (Jocassee). Forty-five of the sites are conventional hydroelectric projects and two of the sites are pumped storage projects (Jocassee and Richard B. Russell); only data for conventional generation are included for the pumped storage sites.

The 47 sites in the entrainment database generally bracket the physical characteristics of the Lloyd Shoals Project. Table 14 compares the sites in the database, including 11 southeastern sites as a subset, with the physical characteristics of the Lloyd Shoals Project. Similar to Lloyd Shoals, 11 of the sites are located on southeastern rivers; 10 are in the Piedmont province and 1 is on the edge of the Blue Ridge province. These sites include Abbeville, Jocassee, King Mill, Richard B. Russell, and Stevens Creek in the Savannah River basin, South Carolina and Georgia; Gaston Shoals, Ninety-Nine Islands, Saluda, Hollidays Bridge, and Buzzard's Roost in the Santee-Cooper River basin, South Carolina; and Luray in the Potomac River basin, Virginia.

All 47 sites in the entrainment database are on warm- or cool-water river systems, and their impoundments share many of the same dominant resident fish species or genera. Dominant sport fishes typically include Largemouth or Smallmouth Bass, sunfishes, catfishes, Walleye, and/or Yellow Perch. Although entrainment sampling methods and analytical approaches varied considerably among sites, the study plans were developed in consultation with, and in most cases were approved by, state and/or federal resource agencies.

7.3.1 SIZE DISTRIBUTION

Entrainment Samples from Other Projects

Small and/or young-of-year (YOY) fish less than 6 inches long likely comprise the majority of fish entrained by the Lloyd Shoals Project. In numerous field studies at other hydroelectric sites in the eastern U.S., fish less than 4 inches long represented over 75 percent of estimated annual entrainment (EPRI 1992, 1997a; FERC 1995a, 1996). Table 15 shows the size-class composition of entrainment samples from 43 hydroelectric developments (EPRI 1997a; Degan and Mueller 2013). Overall, the proportion of fish less than 4 inches long averaged 67.9 percent. Fish less than 4 inches long comprised over 75 percent of entrainment samples at 24 sites, and over 90percent at 9 sites. Fish less than 6 inches long exceeded 75 percent of the entrainment catch at 33 sites.

Among southeastern hydroelectric projects, fish under 4 inches long comprised 98 and 71 percent of entrainment samples at Buzzard's Roost and Richard B. Russell, respectively (Table 15). Entrainment samples collected at Gaston Shoals, Hollidays Bridge, Ninety-Nine Islands, and Saluda, consisted of more variably sized fish. The average proportion of fish less than 6 inches long was 59 percent at these 4 sites, while the average proportion of fish between 6 and 8 inches was 24 percent. However, the studies at all four sites concluded that some resident fish in the tailrace likely intruded into the tailrace sampling net (FERC 1995a). Tailrace intrusion can result in overestimates of entrainment and produce a bias toward larger fish, because fish that intrude into a tailrace sampling net are typically species that prefer turbulent conditions and/or prey on fish exiting the turbines (EPRI 1992, 1997b). Based on hydroacoustic monitoring, 71 percent of fish entrained by generation at Jocassee were under 6 inches long (Degan and Mueller 2013).

Size-class information summarized by FERC (1995a) showed that small to moderate-sized fish dominated entrainment samples at the Abbeville and King Mill projects adjacent to the Savannah River. Fish under 6 inches long comprised over 75 percent and 95 percent of entrainment samples at Abbeville and King Mill, respectively. Small fish also dominated entrainment samples at Stevens Creek on the Savannah River, where fish less than 3 inches long comprised 77 percent of the entrainment sample (FERC 1995b).

Production of YOY fish in healthy reservoir systems with abundant littoral areas providing nursery habitat is often high. Many of these small fish disperse from upstream habitats in response to changing habitat needs and density-dependent influences on resource availability. Moreover, YOY fish generally are more susceptible than larger fish to being transported downstream during higher flow conditions and are less capable of escaping intake velocities as they approach dams.

Trash Rack Spacing

FERC's (1995a) entrainment assessment found no consistent associations between trash rack bar spacing and the size of entrained fish. Winchell et al. (2000) summarized trends in the EPRI (1997a) entrainment database and also found little difference in the size distributions of entrained fish from sites with very different trash rack spacing.

The trash racks in front of the intake in the Lloyd Shoals forebay consist of vertical bars with 1.3125 inches clear spacing. Table 16 provides estimates of the length of the smallest fish that would be physically excluded by trash racks with this spacing based on average proportional relationships between body width and total length measured by Smith (1985) for several representative resident or stocked species. The trash rack spacing at Lloyd Shoals, which is relatively narrow compared to other sites (Table 13), physically excludes fish longer than about 8 to 15 inches depending on the species/body proportions. Nevertheless, fish of many species and life stages smaller than these lengths are able to pass through the trash racks.

Despite the apparent ability of many fish to pass through the racks, field studies across a wide range of trash rack spacing indicate that the majority of entrained fish are small, the vast majority are much smaller than the length of fish that would be physically excluded by the trash rack spacing, and the size of entrained fish tends to be similar among sites in spite of differing trash rack spacing (FERC 1995a; EPRI 1997a). For example, the Richard B. Russell site has trash rack spacing of 8 inches, yet fish smaller than 6 inches comprised 89 percent of entrainment (conventional generation; Table 15), or roughly equivalent to the average proportion of entrained fish less than 6 inches long for all 43 sites in Table 15 (84.3 percent).

Winchell et al. (2000) recompiled fish size data from the EPRI (1997a) entrainment database to exclude clupeids (shads and herrings), whose high abundance at some sites might skew the entrainment size distribution toward smaller size classes, and American Eels, which are capable of passing through narrowly spaced trash racks at relatively long fish lengths. Even after excluding these taxa, Winchell et al. (2000) found no apparent relationship between trash rack spacing and the size distribution of entrained fish.

The relatively low vulnerability of larger resident fish to turbine entrainment likely relates in part to the stronger swimming performance of larger fish (Wolter and Arlinghaus 2003). Larger fish are usually much more capable than small fish of escaping the hydraulic forces of intake flow as they approach dams.

Intake Velocity

FERC (1995a) assessed fish entrainment test data from 45 sites using exploratory regression analysis and found no significant trends between entrainment rate and average intake velocity.

Average intake velocities reported at 12 sites in the EPRI (1997a) entrainment database ranged from 0.7 to 2.4 fps (Table 13). FERC (1995a) reported average intake velocities at maximum flow for additional sites in South Carolina that were higher than those in the EPRI database, including average velocities of 5.8 fps at Ninety-Nine Islands and 7.2 fps at Saluda and Hollidays Bridge. Average intake velocities at the open forebay of the Jocassee site for conventional generation were less than 1.5 fps (Duke Energy Carolinas, LLC 2014).

7.3.2 SPECIES COMPOSITION AND RELATIVE ABUNDANCE

The predominant species reported from entrainment sampling at other sites in the eastern U.S. include sunfishes (Centrarchidae), perches (Percidae), catfishes (Ictaluridae), minnows (Cyprinidae), and herrings and shads (Clupeidae). Table 17 summarizes percent composition of entrainment by family at 43 sites (EPRI 1997a). Each of these five predominant families comprised on average over 10 percent of the entrainment samples. Sunfishes numerically dominated entrainment at 20 sites, followed by perches at nine sites, catfishes and herrings at five sites each, and minnows at two sites.

Sunfish relative abundance exceeded 29 percent at over half of the sites (Table 17). Perch abundance (mainly Yellow Perch, some Walleye, and to a lesser extent, darters) was highest at sites in the Northeast and upper Midwest. Catfish relative abundance exceeded 26 percent at 9 sites, including Gaston Shoals (41 percent) in South Carolina. Minnows were reported in samples from all but one site and averaged 13 percent of the entrainment composition. Clupeids were more variable in their occurrence, appearing in entrainment samples at 25 percent of the sites, but when present, their relative abundance tended to be high. Clupeid relative abundance exceeded 81 percent at 5 sites, including 2 in the Southeast (82 percent at Richard B. Russell [conventional generation], and 97 percent at Buzzard’s Roost).

Southeastern Sites

Species composition of entrainment at the Lloyd Shoals Project is likely to be similar to that of other southeastern hydroelectric projects. Table 18 shows the relative abundance of the top five entrained species at each of nine hydroelectric sites in South Carolina and Georgia. All of these sites are located in Atlantic Coast drainages sharing many of the same numerically dominant families of fish, and many of the same species and popular sport-fishes (Swift et al. 1986; Hocutt et al. 1986; Rohde et al. 2009). The top five species at each site comprised 65.4 to 95.3 percent of the total entrainment, with the exception of Buzzard's Roost where Threadfin Shad alone comprised 96.8 percent of entrainment. Thirteen of the 17 species (76 percent) are known to occur in Lake Jackson or the upper Ocmulgee River basin, as indicated in Table 18. Although hydroacoustic monitoring at the Jocassee site could not verify species composition, Threadfin Shad and Blueback Herring were believed to dominate entrainment based on the size distribution of entrainment compared to the size distributions and numerical dominance of these two species in purse seine collections from the reservoir (Degan and Mueller 2013).

Shad, sunfishes, and/or catfishes typically dominated entrainment at the southeastern hydroelectric sites (Table 18). At sites with higher densities of shad as forage fish, shad may strongly dominate entrainment composition, especially where over-winter survival of Threadfin Shad populations is variable due to cold-weather conditions. Cold-stress of Threadfin Shad begins at water temperatures of 9°C (Griffith 1978) and can lead to winter kills that result in episodic entrainment events (FERC 1995a). As cold-stressed fish become naturally moribund, they are unlikely to exhibit avoidance or controlled body orientation to enable them to escape intake approach velocities (Cada et al. 1997). The highest Threadfin Shad entrainment observed at Buzzard's Roost occurred in January and February and likely included moribund fish from winter kills (FERC 1995a). At sites where shad densities are lower, or in years following severe winter kill of Threadfin Shad when standing stocks of shad are low, sunfishes, catfishes, and perches may be more likely to dominate entrainment composition. Minnows and suckers also may be commonly entrained. Species of all of these families are well represented in Lake Jackson and the upper Ocmulgee River basin (see fish species occurrence table in PAD).

Potentially Entrained Fish Community

Table 19 compares entrainment sample composition at six studied sites in South Carolina and Georgia (EPRI 1997a) with fish community sample composition for Lake Jackson based on the results of standardized fishery surveys conducted by GDNR from 2007 to 2019. Although differing sampling methods and objectives complicate comparison of the data sets, comparison of relative abundance between the two provide some insight into the potential species composition of entrainment at the Lloyd Shoals Project.

Sunfishes numerically dominated littoral habitats in Lake Jackson, a pattern consistent with the generally high relative abundance of sunfishes in entrainment samples at southeastern sites

(Table 17). Sunfish relative abundance was also high in Lake Jackson because the GDNR fishery surveys specifically target sport fishes to evaluate the health of the overall fishery and make management decisions.

The rank order of clupeids in Lake Jackson fishery surveys (second) was the same as in the entrainment composition but relative abundance was lower in the fishery surveys (Table 19). FERC (1995a) examined a limited number of studies comparing fish community sampling data and entrainment sampling data from the same site and found that the relative abundance of clupeids was consistently greater in entrainment samples than in their respective reservoirs. Thus, the clupeids Gizzard Shad and Threadfin Shad may be commonly entrained at Lloyd Shoals. American Shad may also be susceptible to occasional entrainment since GDNR began stocking juveniles in the reservoir in 2016 to help conserve the Altamaha River stock.

Catfish relative abundance in samples from Lake Jackson was similar to the median catfish relative abundance for entrainment samples in being ranked third (Table 19). FERC's (1995a) comparison of studies observed that channel catfish relative abundance tended to be greater in entrainment samples that in reservoir samples at the same site.

The relative abundance of species of Moronidae (temperate basses), which include Striped Bass, White Bass, and Hybrid Bass, was higher in fishery surveys at Lake Jackson than the median relative abundance in entrainment samples at other southeastern sites. However, the highest relative abundance of temperate basses in entrainment at a southeastern site was 3.9 percent at Saluda (Table 17) compared to 1.7 percent in fishery surveys at Lake Jackson. The Richard B. Russell site on the Savannah River is managed for a Striped Bass fishery but temperate basses comprised only 0.9 percent of generation entrainment. GDNR's annual stocking of juvenile Hybrid Bass and/or Striped Bass in Lake Jackson indicates the likelihood that some of these fish occasionally become entrained at the Project.

The relative abundances of perches and suckers in fishery survey samples from Lake Jackson ranked similarly low as the median relative abundances of these families in entrainment samples at southeastern sites (Table 19). Minnow relative abundance was lower in the fishery survey samples than in the entrainment samples at other sites, likely due in part to the selectivity of the surveys for sport fishes over smaller non-game species.

Most fish species residing in Lake Jackson are probably subject to occasional entrainment at the powerhouse. Other species attempting to migrate downstream, or that are transported downstream out of upstream reaches and tributaries in flood-flows, also may pass through the turbines.

Sport Fishes

A substantial proportion of entrained fish at the Lloyd Shoals Project likely consists of small or YOY sport-fish species, including Bluegill, Black Crappie, other sunfishes, and catfishes. The sunfish, catfish, and perch families, each of which contains several common species classified as sport fish or pan fish, together comprised over 50 percent of entrainment at 34 of the 43 sites (79 percent) listed in Table 17. These three families totaled over 50 percent of entrainment at 4 of 6 southeastern sites (Gaston Shoals, Ninety-Nine Islands, Hollidays Bridge, and Saluda). Shad strongly dominated entrainment at the other two southeastern sites (Richard B. Russell [conventional generation] and Buzzard's Roost). Otherwise, entrainment at Richard B. Russell consisted mostly of perches, sunfishes, and catfishes, and entrainment at Buzzard's Roost consisted mostly of perches, sunfishes, and temperate basses, the latter composed mainly of white perch (Table 17 and Table 18).

Notably, Largemouth Bass, one of the region's premier sport-fishes, was absent from the top five entrained species at any of the southeastern projects (Table 18). Similarly, Striped Bass, White Bass, and Hybrid Bass were absent from the top entrained species. While these popular sport fishes are likely to occasionally be entrained at Lloyd Shoals, they may not be especially susceptible to entrainment.

The potential for stocked Striped Bass and Hybrid Bass in Lake Jackson to become entrained by Lloyd Shoals generation flows may be highest in the early summer, as the water column warms and fish actively seek cooler water deeper in the forebay. However, these fish may also be larger and thus more capable of escaping intake velocities.

7.3.3 Seasonal Distribution

Peak entrainment rates at the Lloyd Shoals Project most likely occur in spring and summer, following the spawning and rearing seasons of sunfishes, clupeids, yellow perch, catfishes, and other species with high reproductive potential, when young fish are abundant and tend to be dispersing from spawning and rearing areas into preferred habitats. The lowest entrainment rates for most species other than shad generally would be expected to occur from late fall through winter, when colder water temperatures tend to suppress fish movements.

Monthly variation in entrainment documented at South Carolina and Georgia sites in the entrainment database (FERC 1995a, EPRI 1997a) indicates the following trends in seasonal abundance:

- Sunfish and bass entrainment likely peaks between April and June. Multiple-spawning species such as Bluegill and other sunfish may show secondary peaks through summer and early fall.
- Clupeids exhibit more variable patterns of peak entrainment depending on the species, with trends toward peak entrainment rates occurring between late fall and spring. Threadfin Shad entrainment rates documented at the Buzzard's Roost and Richard B. Russell sites were quite high. Over 8,000 Threadfin Shad per hour were sampled at Buzzard's Roost in February, an extremely high rate apparently related to low water temperature stress (FERC 1995a). Nearly all of these fish were juveniles less than 4 inches in length (EPRI 1997a). The peak entrainment rate of 212 Threadfin Shad per hour at Richard B. Russell in November (conventional generation), while substantially lower than that at Buzzard's Roost, was 10 times higher than peak clupeid entrainment rates observed at other sites. Thus, where large clupeid populations and/or the potential for cold-stress exists, the potential for fall-winter clupeid entrainment may be relatively high.
- Patterns of Yellow Perch entrainment observed at the Buzzard's Roost and Abbeville sites suggest that any Yellow Perch entrainment at Lloyd Shoals may reach its highest levels in late winter or early spring.
- Monthly variation in the entrainment of suckers (catostomids) at sites in South Carolina suggests that sucker entrainment at Lloyd Shoals may be highest in the spring. Entrainment of minnows (cyprinids) likely occurs throughout the spring and summer, and catfish entrainment may be most prevalent between spring and early fall.

Hydroacoustic monitoring of generation entrainment at the Jocassee site in South Carolina showed peak entrainment rates in November, January, and February (Degan and Mueller 2013). This fall-winter peak was consistent with the presumed dominance of entrainment by Threadfin Shad and Blueback Herring. A secondary entrainment peak occurred in April-May. Night entrainment rates were generally higher than day rates. The total entrainment was similar for day and night but 70 percent of the generation hours occurred during the day.

7.3.4 LLOYD SHOALS ENTRAINMENT EXTRAPOLATION

To estimate the potential magnitude of annual entrainment at the Lloyd Shoals Project, monthly entrainment rates from a representative site in the EPRI database were applied to Lloyd Shoals monthly generation data for the years 2012 through 2016 (Georgia Power 2018). The site used for extrapolation, Ninety-Nine Islands in South Carolina, was selected by inspecting the average annual entrainment rates for 43 sites in Table 13. The median entrainment rate was 8.1 fish per hour per 1,000 cfs of unit capacity. The median entrainment rate also was inspected for a subset of five South Carolina and Georgia sites in the EPRI database, excluding Buzzard's Roost as an outlier because of episodic entrainment of cold-stressed Threadfin Shad. The median entrainment rate for these five sites was 9.8 fish per hour per 1,000 cfs, which corresponded to Ninety-Nine Islands. Ninety-Nine Islands was selected for extrapolation because its entrainment rate was conservatively higher than the median rate for all sites, and like Lloyd Shoals, it is on an Atlantic Coast river in the Piedmont physiographic province. The top five entrained species at Ninety-Nine Islands occur in Lake Jackson or the upper Ocmulgee River basin (Table 18), and the plant hydraulic capacity, hydraulic capacity of the sampled unit, and trash rack spacing are similar to Lloyd Shoals (Table 12 and Table 13).

The entrainment extrapolation assumes that the fish communities are similar between Ninety-Nine Islands and Lloyd Shoals and that seasonal variation in entrainment is similar despite Lloyd Shoals having a larger reservoir. Table 20 presents the extrapolation of monthly entrainment rates for all species combined to the average monthly generation flows for the Lloyd Shoals powerhouse. First, the entrainment rates were converted to the number of fish per million cubic feet (mcf) of water, and the average generation flow was converted to total monthly generation flow in mcf. The converted values were then multiplied to yield the total number of fish entrained by month. Based on this extrapolation, total annual entrainment at the Lloyd Shoals Project is estimated to be on the order of 130,377 fish. As discussed in Section 7.3.2, the species composition of entrainment at Lloyd Shoals is likely similar to the relative abundance rankings of dominant families indicated by the entrainment composition at South Carolina and Georgia sites (Table 19). The numerically dominant families in approximate descending order of relative abundance are likely to be sunfish, shad, and catfish, followed in lower relative abundance by minnows, perch, suckers, and temperate bass.

7.4 POTENTIAL MORTALITY AT LLOYD SHOALS

The results of turbine passage mortality (or survival) studies conducted at other hydroelectric sites indicate that the mostly small fish entrained by the Lloyd Shoals Project are likely to incur relatively low rates of injury and mortality.

Important considerations in reviewing turbine passage mortality (or survival) tests are the size distribution of entrained fish and the controls used to distinguish mortality related to turbine passage from mortality related to handling and recapture stress of test fish (EPRI 1992, 1997b). Small or YOY fish generally comprise a large proportion of naturally entrained fish. The probability of an entrained fish being struck by a turbine blade is a function of the length of the fish, as well as the number of runner buckets/blades, turbine speed, cross-sectional area of water passage, blade angle, and discharge (Von Raben 1957, as given by Cada 1990), and turbine geometry and the zones of the turbine traversed by the fish (Franke et al. 1997). Thus, smaller fish generally suffer lower levels of mortality from blade strikes and also are less prone to injury resulting from shear stresses and rapid pressure changes (Cada 1990). However, many mortality studies have necessarily used larger, introduced test fish than the average size fish naturally entrained because larger fish better tolerate cumulative stress of transport, handling, and recapture, which may confound estimated mortality resulting from turbine passage (EPRI 1992). Therefore, some consideration of these factors is important in applying common trends from the mortality studies reviewed below.

Indirect mortality of fish resulting from sublethal injuries or disorientation incurred during turbine passage also was considered in the following analysis and is described in further detail in Section 7.4.3.

7.4.1 FRANCIS TURBINES

Survival of fish passing through turbine types with larger water passages, such as Kaplan, Francis, and bulb turbines, commonly exceeds 70 percent (Cada and Rinehart 2000). Mortality studies conducted with resident fishes using adequate methods to control for handling stress and recapture injury typically have shown low fish mortality rates for low-head Francis turbines, as low as 1 to 2 percent and averaging about 6 percent (EPRI 1992). For instance, at the Stevens Creek site on the Savannah River, which has vertical Francis turbines operating at 28 ft of head, RMC Environmental Services, Inc. (RMC 1994) estimated latent turbine mortality (48 hours after passage) of 4.6 percent for resident sunfish (Bluegill, Redear Sunfish, Warmouth, and Redbreast Sunfish), 4.2 percent for resident Spotted Sucker and Yellow Perch, and 5.7 percent for Blueback Herring, used as a surrogate for American Shad. Other studies using adequate scientific control methods have documented similarly low mortality rates at a number of other sites using Francis turbines (e.g., RMC 1992, 1993; Normandeau Associates, Inc. 1994).

Eicher Associates, Inc. (1987; as summarized by EPRI 1992) examined data from 22 studies of salmonid (trout and salmon) mortality at Francis turbines operating at heads ranging from 40 ft to over 400 ft and found mortality to be positively correlated with both head and peripheral runner velocity. Salmonid species do not occur in the Ocmulgee River basin, and they tend to be more sensitive than many warm-water fish species to injury and stress from turbine passage. For this reason, they may be a conservatively high predictor of potential mortality at Lloyd Shoals. The correlation between head and mortality of salmonids for Francis turbines, as plotted by EPRI (1992), predicts turbine-induced mortalities on the order of 17 percent at a rated head of 97 ft (rated head at Lloyd Shoals Dam). The relationship between peripheral runner velocity and mortality of salmonids predicts mortalities on the order of 18 percent at a peripheral runner velocity of about 70 fps (Table 12).

Table 21 summarizes turbine passage survival estimates compiled by EPRI (1997a) for 14 hydroelectric sites in the eastern U.S. and from a recent study of the Conowingo site (Normandeau Associates, Inc. and Gomez and Sullivan Engineers, P.C. 2012). These 15 sites represent a range of head and Francis turbine characteristics that bracket the turbine characteristics at Lloyd Shoals (Table 12). The studies at these sites used paired releases of treatment and control fish, and tag and recapture methods. Treatment fish were marked and introduced into the turbine penstock or intake and recaptured in the tailrace. Control fish were marked and released either into the draft tube or tailrace discharge and recaptured in the tailrace. Fish were recaptured using full-flow tailrace netting or dipnetting if fish were marked with self-inflating balloon tags. Fish were held for up to 48 hours after recapture to estimate latent survival; however, because of highly variable survival of control fish for many tests, only estimates of immediate turbine passage survival are presented in Table 21. High rates of control fish mortality diminish the reliability of test results for distinguishing fish mortality caused by turbine passage from that caused by the cumulative effects of stress from handling and recapture techniques (EPRI 1992, 1997b). Therefore, following the guidance of EPRI (1997a), test results for which control fish mortality exceeded 10 percent were excluded.

Turbine passage survival estimates at the 15 studied sites with Francis turbines were highest for smaller size classes of fish (Table 21). Immediate survival rates across all of the sites averaged 82 percent for small fish (< 6 inches), 73 percent for moderate-sized fish (maximum size of test group > 6 inches and < 10 inches), and 63 percent for large fish (maximum size of test group > 10 inches). Survival rates were highest for the smallest size class tested at 11 of the 15 sites. Survival rates of the smallest size class averaged over 90 percent at 7 sites. Turbine speed at these 7 sites ranged from 90 to 257 rpm (Lloyd Shoals turbine speed is 300 rpm), and rated head varied from 42 to 100 ft (Lloyd Shoals rated head is 97 ft). Turbine passage survival of Bluegill and catfish species at Ninety-Nine Islands, with a turbine speed of 225 rpm and rated head of 74 ft, averaged 97 percent and higher for all sizes of fish tested. Four other sites showed average survival rates of over 80 percent for all size classes tested.

The lowest average survival rates of small fish were observed at Schaghticoke (58 percent) and Hoist (46 percent), which operated at rated head of 142 and 153 ft, respectively (Table 21). Rated head at these sites was substantially higher than at Lloyd Shoals. The Hardy site operated at about the same head as Lloyd Shoals (100 ft) and with a similar number of runner blades, and showed average small fish survival of 91 percent. However, the higher turbine speed, smaller runner diameter, and smaller rated flow at Lloyd Shoals suggest a higher probability of blade strikes and collisions, and therefore a likelihood of lower fish survival rates than Hardy for the same size fish. In contrast, the High Falls site, with slightly lower rated head than Lloyd Shoals but with higher turbine speed and smaller passageways as indicated by smaller runner diameter and smaller rated flow, showed average small fish survival of 79 percent. The Caldron Falls site, with 80 ft of head, rated flow similar to Lloyd Shoals, but with slower turbine speed, showed average small fish survival of 89 percent. These comparisons suggest that small fish survival rates at Lloyd Shoals may be within the range of those observed at the Hardy, Caldron Falls, and High Falls sites. Immediate survival of small fish at these three sites averaged 86 percent.

Turbine passage survival estimates were more variable for larger fish tested (Table 21). Immediate survival of large fish exceeded 80 percent at 7 of the 15 sites (Alcona, Finch Pruyn, E.J. West, Ninety-Nine Islands, Conowingo, Hardy, and Bond Falls). Turbine speed at these sites varied from 90 to 300 rpm and head ranged from 43 to 210 ft. Survival of large fish at the Hardy site, with its relatively high-flow, low-speed turbine, averaged 85 percent. Survival of large catfish at Ninety-Nine Islands, with 74 ft of head and turbine speed of 225 rpm, was about 99 percent. Survival of large rainbow trout at Bond Falls, with 210 ft of head and turbine speed of 300 rpm, was 83 percent. Survival was considerably lower for large fish tested at the highest turbine speed of 360 rpm at both High Falls and Hoist. Large fish survival averaged only 13 and 23 percent at the High Falls and Hoist sites, respectively.

Fish less than 6 inches long likely comprise the majority of entrained fish at Lloyd Shoals (see Section 7.3.1), and the survival of these small fish is likely to be quite high. The probability that juveniles entrained by Francis turbines will be struck by a blade or collide with other parts in the system is much lower than for larger fish. Based on the survival estimates for sites with similar turbine characteristics discussed above, average immediate survival of small fish at Lloyd Shoals is likely to be about 86 percent. Further, the median average survival rate of small fish at the sites in Table 21 was also about 86 percent (i.e., median average mortality rate of about 14 percent).

Survival of moderate-sized and large fish at Lloyd Shoals likely depends more upon turbine characteristics affecting the size of clearances and passageways through the turbine system, such as rated flow, runner diameter, peripheral runner velocity, and number of blades. In turn, these factors influence the probability of injury due to blade strikes and collisions, rapid pressure changes, and hydraulic shear forces as larger entrained fish pass through the system. The survival estimates in Table 21 indicate that average immediate survival may range between 31 and 100 percent for moderate-sized fish, and between 23 and 98 percent for large fish. These ranges exclude High Falls and Hoist because of their very high turbine speeds. Median average survival rates, excluding High Falls and Hoist, were about 81 and 83 percent for moderated-sized and large fish, respectively, or about 82 percent for larger size classes combined. This rate corresponds to a median average mortality rate of about 18 percent for larger fish.

Assuming that total annual entrainment at the Lloyd Shoals Project is about 130,377 fish (Section 7.3.4, Table 20), that 75 percent of all entrained fish are small fish less than or equal to 6 inches (Section 7.3.1), and that immediate turbine-passage survival rates are 86 percent for small fish and 82 percent for larger fish, then total annual entrainment mortality could be about 19,577 fish.

7.4.2 Latent Mortality

Latent survival estimates from the EPRI (1997a) turbine passage survival database are not presented herein because of the highly variable survival of control fish for many of the tests. High rates of control mortality not only reduce the reliability of test results but indicate the effects of cumulative stress (of transport, marking, introduction, turbine passage, recapture, and holding) that could exaggerate the mortality of test fish even after adjustment for control mortality (EPRI 1992). Small fish and species sensitive to handling, such as clupeids, tend to be most susceptible to mortality from cumulative stress effects.

Rates of control survival less than 90 percent generally indicate levels of experimental stress that can lead to unreliable survival estimates (EPRI 1997b). Winchell et al. (2000) summarized latent survival observed 48 hours after turbine passage from the EPRI (1997a) database, after excluding tests in which control fish survival was less than 90 percent (i.e., control mortality greater than 10 percent). They observed that 48-hour latent survival generally was about 3 to 4 percent lower than immediate survival for the combinations of fish size and turbine type where immediate survival was relatively high. Greater reductions tended to occur for turbines and fish sizes showing lower rates of immediate survival.

Of the turbine passage studies examined herein from the EPRI database, eight of the sites included 48-hour latent survival tests with control survival exceeding 90 percent (EPRI 1997a). Survival over the 48-hour holding period averaged 4.4 percent lower than the immediate survival (N=104) across all size classes of fish tested.

7.4.3 Indirect Mortality

Little is known about the indirect mortality of entrained fish that may ultimately result from sublethal levels of injury, loss of equilibrium, or disorientation incurred during turbine passage (Cada and Rinehart 2000). These stresses, although not immediately lethal, may make entrained fish more susceptible to predators in the tailwaters below the dam, at least temporarily, or disable them such that they are later more susceptible to disease (Cada 2001). Indirect mortality may be increased by sub-optimal water temperatures, low DO concentrations, or other water quality factors (Cada et al. 1997).

Bickford and Skalski (2000) suggested that the 6 percent difference they observed between independent estimates of immediate turbine passage survival (average of 93.3 percent) and longer-term turbine passage survival (average of 87.3 percent) for salmonid smolts in the Snake-Columbia River may have been due to subacute or chronic (i.e., indirect) mortality associated with turbine passage.

The short-term survival rates estimated by turbine passage studies are likely to overestimate longer-term survival to some degree, but the amount and significance of additional indirect mortality are poorly known (Cada 2001). At the Lloyd Shoals Project, one of the most immediate sources of indirect mortality to fish surviving turbine passage is likely to be predation by larger sport-fishes, such as Striped Bass, Hybrid Bass, and Largemouth Bass, in the tailrace.

7.5 Potential Implications to Fisheries Management

7.5.1 Striped Bass and Hybrid Bass

Lake Jackson is managed as a Striped Bass and Hybrid Bass fishery, with stocking in recent years shifting to a greater proportion of Hybrid Bass. The populations of Striped Bass and Hybrid Bass in Lake Jackson are sustained through stocking; there is no evidence of successful Striped Bass reproduction in the area. Since 2013, annual stocking rates have averaged 36,301 fingerlings of Hybrid Bass and 16,976 fingerlings of Striped Bass, an approximately 2 to 1 ratio. GDNR has expressed interest in Striped Bass and Hybrid Bass regarding turbine passage because of their migratory behavior.

Three species of temperate basses, including Striped Bass, were represented in entrainment samples at five of the eastern U.S. sites in the EPRI (1997a) database (Table 22). White Bass (*Morone chrysops*) and White Perch (*Morone americana*) were considered surrogates for Striped Bass because they share behaviors of schooling in open waters and migrating upstream to spawn (Etnier and Starnes 1993). Schools of Striped Bass and White Bass often follow and attack schools of forage fish, such as Threadfin Shad, and may be similarly vulnerable to entrainment when their pursuit of forage fishes takes them near the dam. All three species are classified in the same genus and thus are considered to be closely related.

The wide size range of entrained Striped Bass and closely related surrogate species indicates potential vulnerability of all life stages of Striped Bass to some entrainment, but the numbers of entrained fish were quite small (Table 17). FERC (1995a) surmised that the prevalence of larger Striped Bass in entrainment samples at Buzzard's Roost may have resulted from their limnetic schooling behavior and foraging among large schools of cold-stressed Threadfin Shad drifting toward the intakes.

The high proportion of small temperate basses (<6 inches) entrained at several sites (Table 22) suggests potential vulnerability of stocked striped bass fingerlings to entrainment at Lloyd Shoals. However, turbine passage survival estimates of 92.3 percent for small (<6 inches) white perch at Buzzard's Roost (EPRI 1997a) suggest that immediate survival of small juvenile Striped Bass and Hybrid Bass entrained at Lloyd Shoals may be on the order of 90 percent.

In summary, stocked fingerlings and small juveniles may be the size classes of Striped Bass and Hybrid Bass most susceptible to entrainment at Lloyd Shoals because fingerlings are stocked annually at a rate of about 11 total fish per acre in Lake Jackson. These young fish are likely to school in open waters and may exhibit downstream migratory behavior as juveniles. They become vulnerable to entrainment as they approach the dam; however, because of their small body size, the vast majority would be expected to survive turbine passage into the downstream river. Adult Striped Bass and Hybrid Bass, while large and potentially subject to higher turbine mortality rates if entrained, are facultative in their downstream migratory behavior and may be less inclined to migrate downstream, as evidenced by low numbers of Striped Bass in entrainment samples at other sites. Moreover, adult Striped Bass have strong swimming capabilities and would be much more capable of escaping intake velocities.

7.5.2 AMERICAN SHAD

GDNR began experimental stocking of American Shad in Lake Jackson in 2016 as part of basin-wide efforts to help conserve the Altamaha River stock. Historical evidence suggests the species formerly occurred upstream of the present-day Project (GDNR 2014). Although successful natural reproduction of American Shad may not be expected to occur upstream of the reservoir, turbine-passage survival of stocked fish could contribute to the downstream population in the Ocmulgee River. Naturally reproducing American Shad in the Ocmulgee River currently migrate upstream as far as Juliette Dam and likely spawn downstream of that dam.

Survival tests with American Shad at sites with Francis turbines are limited and include the Holtwood and Conowingo sites on the Susquehanna River (Table 21). Average immediate survival of juvenile American Shad less than 6 inches long was 86 percent at Holtwood (EPRI 1997a). The turbine-passage survival of adult American Shad averaging 18 inches long at Conowingo was estimated at 93.0 percent (Normandeau Associates, Inc. and Gomez and Sullivan Engineers, P.C. 2012). Estimated 48-hour (latent) survival of these adult fish was 88.3 percent; control fish survival was relatively high at 87.6 percent at 48 hours.

The available testing suggests that a majority of American Shad entrained at Lloyd Shoals would survive turbine passage into the downstream river. However, the size of clearances and passageways through the Francis units at Holtwood and Conowingo were larger than those in the Lloyd Shoals units, as indicated by higher rated flows, larger runner diameters, and lower turbine speeds. Thus, immediate survival rates of American Shad at Lloyd Shoals may be lower than those observed at Holtwood and Conowingo, particularly for larger fish.

7.6 DISCUSSION

Common trends and data from other studied hydroelectric sites, including several in Atlantic Coast drainages of South Carolina and Georgia, indicate that small and/or YOY fish likely comprise the majority of fish entrained by the Lloyd Shoals Project. Entrainment is likely to be numerically dominated by species of sunfishes, shads, catfishes, minnows, perch, suckers, and a few other species. Peak entrainment rates likely occur in spring and summer for most species, when young fish are most abundant and tend to be dispersing between habitats. Entrainment rates for Threadfin Shad and Gizzard Shad may increase into fall and winter. A substantial portion of entrainment likely consists of juvenile sport-fishes, including Bluegill, Black Crappie, Redbreast Sunfish, other sunfishes, catfishes, and Yellow Perch, but Largemouth Bass, Striped Bass, and Hybrid Bass probably represent relatively small proportions of sport-fish entrainment.

The vast majority of entrained fish, because of their small size, are likely to survive turbine passage. The mortality of these smaller fish is expected to be relatively low because they are less prone to mechanical injury from turbine passage than larger fish and less prone to injury resulting from shear stresses and rapid pressure changes (Cada 1990). Trends in turbine passage survival at numerous studied hydroelectric sites with Francis turbines predict average immediate survival on the order of 86 percent for small fish and 82 percent for moderate-sized and large fish at the Lloyd Shoals Project.

Based on extrapolating monthly entrainment rates from Ninety-Nine Islands, a representative southeastern site in the EPRI database, to Lloyd Shoals average monthly generation data, total annual entrainment at Lloyd Shoals is estimated to be on the order of 130,377 fish. Assuming 75 percent of the entrained fish are less than 6 inches long and immediate survival is 86 percent for small fish and 82 percent for larger fish, then total annual entrainment mortality at Lloyd Shoals may be on the order of 19,577 fish.

Entrainment losses of young fish, which typically exhibit high rates of natural mortality due to density-dependent factors (e.g., limited habitat space or food), may tend to be offset by increased survival of the young fish remaining in the reservoir due to reduced competition for limiting resources. Density-dependence is a fundamental concept in the study of fish population dynamics (Rose and Cowan 2001). Compensatory density-dependence operates to offset the loss of individuals in populations, allowing populations to persist under conditions of increased mortality. Increased mortality in fish populations may occur from natural causes (food availability, predation, disease, etc.) or from anthropogenic activities, such as fishing, introductions of non-native species (e.g., Flathead Catfish), or power plant operations. Compensatory density-dependence, which is a major underlying assumption in the management of fish populations, may be an important factor in offsetting losses of young fish to entrainment mortality, especially since most entrained fish are young, survive turbine passage, and otherwise experience high natural mortality rates.

The fact that entrainment occurs does not necessarily equate with high potential for adverse impacts of entrainment to resident fish populations. Entrainment may be higher at some sites simply because the resident fish populations are healthy and produce high relative abundance of juvenile fish that may become vulnerable to entrainment as they disperse between habitats or approach the dam. Lake Jackson supports a relatively diverse mix of naturally reproducing sport fishes, including Largemouth Bass, Spotted Bass, Black Crappie, Bluegill, Redear Sunfish, Redbreast Sunfish, Channel Catfish, and Yellow Perch. Overall, the reservoir supports a healthy fishery and exhibits an ecologically balanced community structure. Existing fisheries information does not provide any evidence suggesting that current levels of fish entrainment and turbine mortality may be resulting in significant adverse impacts to the fish community of the Ocmulgee River, to the extent such effects may be reflected in the species richness of the fish community or in the condition, balance, or stability of populations. Thus, continued operation of the Lloyd Shoals Project is likely to result in only minor effects to fish populations and recreational fishing opportunities as a result of fish entrainment and turbine-induced mortality.

8.0 SUMMARY

8.1 SHORELINE HABITAT

As part of a shoreline reconnaissance survey in August 2019, Georgia Power qualitatively characterized shoreline aquatic habitat and available sources of littoral-zone cover at 101 representative sites on Lake Jackson and 6 sites in the tailrace area. The most frequently observed sources of littoral zone fish cover overall were overhanging vegetation, docks/piers/boatslips, large woody debris, riprap, and bedrock/boulders. Based on proportional length, overhanging vegetation was the predominant source of fish cover, followed by riprap, large woody debris, and docks/piers/boatslips. Riprap was the predominant fish cover type by length in the mainstem reservoir, Tussahaw Creek, and Alcovy River sections of Lake Jackson. Overhanging vegetation was the predominant fish cover type by length in the South River section, followed by large woody debris and emergent vegetation.

The most frequently observed sources of fish cover at sites with natural shoreline vegetative buffer zone conditions were overhanging vegetation, large woody debris, bedrock and boulders, emergent vegetation, and standing timber. Sites with landscaped and landscaped-natural buffer zone conditions had substantial proportional coverage by riprap and docks and piers.

8.2 FRESHWATER MOLLUSKS

Freshwater mussel surveys were conducted within Lake Jackson and in the Ocmulgee River downstream of the Project in fall 2019 to characterize the occurrence, distribution, relative abundance, and species richness of the native freshwater mussel community. The survey effort was conducted by WRD under the Altamaha Mollusk CCA. The surveys used an occupancy-based survey design. Methods included visual observations while wading, hand grubbing while on hands and knees, snorkeling, SCUBA, and surface-supplied air in deeper water.

The surveys documented the occurrence of seven native freshwater mussel species and an eight species detected as a relict (dead) shell, including, in descending order of overall relative abundance: Altamaha Slabshell, Inflated Floater, Paper Pondshell, Eastern Floater, Variable Spike, Savannah Lilliput, Rayed Pink Fatmucket; and Altamaha Arcmussel. None of the species detected are federally listed as threatened or endangered. Two of the species detected in Lake Jackson, Savannah Lilliput and Altamaha Arcmussel, are listed as threatened in Georgia.

8.3 PRIMARY SPORT FISH SPECIES HABITAT

The availability of suitable summer habitat for sport fish species in Lake Jackson was assessed using reservoir water quality data collected by Georgia Power, standardized fisheries survey data collected by GDNR, and temperature and DO preference criteria reported in the scientific literature. Most sport fish species residing in Lake Jackson are capable of tolerating seasonally high water temperatures and occasionally lower DO levels in summer. GDNR standardized fishery survey data for Lake Jackson indicate an overall healthy and balanced fish community typical of southeastern Piedmont reservoirs. Recent and historic water quality monitoring data show that water temperature and DO conditions remain within acceptable ranges for most of the resident sport fish species.

Habitat is generally suitable for Striped Bass in Lake Jackson with regard to temperature and DO in the fall, winter, and spring. In the summer, temperature and DO constraints limit available habitat. The upper portion of the water column (0 to 5 m) is at a stressful or lethal temperature for Striped Bass (~28°C or greater). The lower portion of the water column (> 5 m) has DO levels less than 4 mg/L. Summer temperature and DO profiles for Lake Jackson sufficiently explain the limiting nature of habitat suitability for Striped Bass, as reflected in low catch rates and low relative condition of the population.

8.4 DOWNSTREAM RIVERINE HABITAT

A variety of fish species utilize the Ocmulgee River downstream of Lloyd Shoals Dam, including the state-endangered Robust Redhorse. Continuous tailrace monitoring data and data collected by GDNR further downstream indicate sufficient DO levels for all species. Water temperatures were also sufficient for all species, with the exception of Striped Bass. During the warmest months (July – September), maximum and average temperatures exceeded 28°C.

The IFIM study conducted during the previous relicensing, in consultation with GDNR and FWS, spanned 16.8 river miles below Lloyd Shoals Dam. The study integrated the results of hydraulic simulations over a range of flows and habitat suitability criteria to produce discharge versus weighted usable area relationships for target species and life stages. The IFIM study results showed that a minimum flow release of 400 cfs would provide for 91 percent and 92 percent of the maximum weighted usable area on average for the spawning and non-spawning seasons, respectively.

Based on a review of aerial imagery spanning from 1988 to 2019, there has been little, if any change to this section of the Ocmulgee River and adjacent floodplains since the IFIM study was conducted. A geomorphic analysis of stream-gage data for streams within the Georgia Piedmont conducted by USGS found that the Ocmulgee River near Jackson exhibited long-term channel stability. As such, the findings of the IFIM study are sufficient to conclude that the 400 cfs, or inflow, whichever is less, minimum flow releases in the current Project license should continue to provide suitable habitat for species inhabiting this reach.

8.5 FISH ENTRAINMENT

Common trends and data from other studied hydroelectric sites, including several in Atlantic Coast drainages of South Carolina and Georgia, indicate that small and/or young fish likely comprise the majority of fish entrained by the Lloyd Shoals Project. Entrainment is likely to be numerically dominated by species of sunfishes, shads, catfishes, minnows, perch, and suckers. Peak entrainment rates likely occur in spring and summer for most species, when young fish are most abundant and tend to be dispersing between habitats. A substantial portion of entrainment likely consists of juvenile sport-fishes, but Largemouth Bass, Striped Bass, and Hybrid Bass probably represent relatively small proportions of entrainment.

The vast majority of entrained fish are small and likely to survive turbine passage. Trends in turbine passage survival at numerous studied hydroelectric sites predict average immediate survival rates at Lloyd Shoals on the order of 86 percent for small fish and 82 percent for moderate-sized and large fish. Based on extrapolating monthly entrainment rates from a representative southeastern site to Lloyd Shoals monthly generation data, total annual entrainment at Lloyd Shoals is estimated to be about 130,377 fish, and total annual entrainment mortality is estimated to be about 19,577 fish.

Overall, Lake Jackson supports a healthy fishery and evidence is lacking to suggest that current levels of fish entrainment and turbine-induced mortality may be adversely affecting the fish community of the Ocmulgee River. Continued operation of the Lloyd Shoals Project is likely to result in only minor impacts to fish populations and recreational fishing opportunities as a result of entrainment and turbine-induced mortality.

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TABLE 1 LITTORAL-ZONE FISH COVER BY LAKE JACKSON SECTION AND TAILRACE AREA

Study Area Section	Docks and Piers	Riprap	Bedrock and Boulders	Emergent Vegetation	Submersed Vegetation	Overhanging Vegetation	Large Woody Debris	Standing Timber
Frequency of Occurrence (Percent): [a]								
South River (SR)	44	24	8	24	4	96	80	0
Alcovy River (AR)	84	52	28	16	0	84	36	24
Tussahaw Creek (TC)	69	62	12	8	0	73	62	8
Mainstem reservoir (MR)	84	56	32	4	4	72	60	0
Tailrace Area (TR)	17	17	83	0	0	67	50	17
Total (N=107)	**67**	**47**	**23**	**12**	**2**	**80**	**59**	**8**
Proportion of Surveyed Shoreline Length (Percent): [b]								
South River (SR)	3	9	<1	10	1	56	12	0
Alcovy River (AR)	7	15	2	6	0	13	3	2
Tussahaw Creek (TC)	6	31	<1	2	0	22	6	<1
Mainstem reservoir (MR)	5	35	2	<1	<1	5	6	0
Tailrace Area (TR)	5	2	54	0	0	33	5	8
Total (53,500 ft)	**5**	**21**	**4**	**4**	**<1**	**25**	**7**	**1**

[a] The SR, AR, and MR sections had 25 shoreline survey sites, the TC section had 26 sites, and the TR section had 6 sites, for a total of 107 sites.

[b] The survey length in the SR, AR, and MR sections was 12,500 ft, the survey length in the TC section was 13,000 ft, and the survey length in the TR section was 3,000 ft, for a total survey length of 53,500 ft.

TABLE 2 LITTORAL-ZONE FISH COVER BY SHORELINE VEGETATIVE BUFFER ZONE CONDITION

Shoreline Vegetative Buffer Zone Condition[a]	Docks and Piers	Riprap	Bedrock and Boulders	Emergent Vegetation	Submersed Vegetation	Overhanging Vegetation	Large Woody Debris	Standing Timber
Frequency of Occurrence (Percent):								
Natural (N=35)	6	9	20	17	0	100	97	11
Landscaped-Natural (N=28)	89	71	46	11	7	86	43	11
Landscaped (N=44)	100	64	11	1	0	61	39	<1
Total (N= 107)	**66**	**48**	**23**	**12**	**2**	**80**	**59**	**8**
Proportion of Surveyed Shoreline Length (Percent):								
Natural (17,500 ft)	<1	3	2	11	0	60	16	1
Landscaped-Natural (14,000 ft)	8	21	13	2	1	13	2	2
Landscaped (22,000 ft)	7	36	1	<1	0	4	3	<1
Total (53,500 ft)	**5**	**21**	**4**	**4**	**<1**	**25**	**7**	**1**

[a] Shoreline vegetative buffer zone condition definitions were as follows:

- Natural: heavily vegetated, less than 20 percent of natural vegetation removed.
- Landscaped-Natural: disturbed and cleared up to 50 percent; some trees and understory remaining.
- Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed.

TABLE 3 SUMMARY OF 2019 FRESHWATER MUSSEL SURVEY RESULTS FOR LAKE JACKSON AND THE OCMULGEE RIVER DOWNSTREAM

Scientific Name	Common Name	Number of Mussels	Relative Abundance (Percent)	Frequency of Occurrence (Percent)[a]
Lake Jackson:		**(N = 22 sites)**		
Pyganodon gibbosa	Inflated Floater	145	49.2	81.8
Elliptio hopetonensis	Altamaha Slabshell	103	34.9	36.4
Utterbackia imbecillus	Paper Pondshell	43	14.6	72.7
Pyganodon cataracta	Eastern Floater	2	0.7	9.1
Toxolasma pullus	Savannah Lilliput[b]	1	0.3	4.5
Alasmidonta arcula	Altamaha Arcmussel[b]	1[c]	0.3	4.5
		295		
Ocmulgee River, Lloyd Shoals Tailrace Area:		**(N = 20 sites)**		
Elliptio hopetonensis	Altamaha Slabshell	335	63.4	95.0
Pyganodon cataracta	Eastern Floater	96	18.2	75.0
Utterbackia imbecillus	Paper Pondshell	61	11.6	65.0
Pyganodon gibbosa	Inflated Floater	29	5.5	25.0
Elliptio icterina	Variable Spike	6	1.1	20.0
Lampsilis splendida	Rayed Pink Fatmucket	1	0.2	5.0
		528		
Ocmulgee River, Hwy 16 Bridge to Juliette Dam:		**(N = 7 sites)**		
Elliptio hopetonensis	Altamaha Slabshell	351	83.4	100.0
Utterbackia imbecillus	Paper Pondshell	47	11.2	28.6
Elliptio icterina	Variable Spike	12	2.9	42.9
Pyganodon gibbosa	Inflated Floater	11	2.6	28.6
		421		

Source: GDNR (2019)

[a] Frequency of occurrence is the proportion of surveyed sites (N) where the species was found.

[b] Georgia threatened species.

[c] Relict (dead) shell only.

TABLE 4 LAKE JACKSON FISH STOCKING DATA

	Striped Bass		Hybrid Bass		Largemouth Bass	
Year	Number Stocked	Fish per Acre	Number Stocked	Fish per Acre	Number Stocked	Fish per Acre
2008	88,263	19	--	--	--	--
2009	34,800	7	--	--	--	--
2010	38,167	8	--	--	--	--
2011	47,600	10	--	--	--	--
2012	20,154	4	--	--	--	--
2013	14,312	3	31,573	7	--	--
2014	14,561	3	37,460	8	--	--
2015	14,414	3	33,250	7	--	--
2016	14,498	3	33,200	7	--	--
2017	14,288	3	33,525	7	395,407	83
2018	21,503	5	42,850	9	36,479	8
2019	25,254	5	42,250	9	76,390	16
Total	**347,814**		**254,108**		**508,276**	
Average	**28,985**		**36,301**		**169,425**	

Source: GDNR

TABLE 5 LAKE JACKSON BASS TOURNAMENT STATISTICS

Year	Number of tournaments analyzed	Number of angler hours	Bass weighed-in per angler hour	Lbs. weighed-in per angler hour	Avg bass weight (lbs)	Avg largest bass (lbs)	Percent bass as Largemouth
1996	55	n/a	0.142	0.203	1.56	3.79	95.5
1997	55	7,456	0.208	0.304	1.47	3.99	95.2
1998	53	6,708	0.178	0.244	1.43	3.6	89.9
1999	43	5,778	0.215	3.07	1.42	3.68	81.6
2000	53	6,393	0.191	0.268	1.45	3.54	75.0
2001	50	6,428	0.164	0.226	1.37	3.51	74.9
2002	48	5,556	0.209	0.296	1.5	3.71	62.8
2003	32	3,339	0.233	0.353	1.62	3.76	56.3
2004	41	4,695	0.21	0.331	1.69	3.91	55.4
2005	38	4,201	0.223	0.371	1.69	4.38	57.3
2006	26	3,019	0.229	0.364	1.6	4.2	52.4
2007	44	4,696	0.27	0.418	1.57	3.49	43.2
2008	36	3,851	0.263	0.391	1.52	4.16	37.9
2009	28	2,854	0.251	0.384	1.56	3.68	41.9
2010	58	6,604	0.198	0.294	1.65	3.12	52.1
2011	23	2,283	0.236	0.418	1.77	4.09	50.4
2012	13	1,571	0.239	0.375	1.65	4.09	37.3
2013	14	1,986	0.283	0.374	1.35	3.15	41.9
2014	12	1,338	0.29	0.432	1.52	3.96	42.3
2015	15	1,553	0.275	0.387	1.44	3.65	28.8

Source: GBCF (1996-2015)

TABLE 6 NUMBER OF EACH FISH SPECIES SAMPLED BY ELECTROFISHING

	Number Sampled by Electrofishing												
Species	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Blue Catfish	--	--	--	--	--	--	--	--	--	--	--	1	--
Black Crappie	20	3	28	13	7	36	28	28	26	40	37	17	11
Bluegill	175	157	122	100	47	85	127	57	90	194	105	7	35
Brown Bullhead	3	--	--	--	--	--	--	--	--	--	--	--	--
Channel Catfish	10	1	6	2	--	2	--	--	2	8	--	--	--
Chain Pickerel	1	--	1	--	--	--	4	2	1	--	--	2	--
Dollar Sunfish	--	--	--	3	--	--	--	--	--	--	--	--	--
Gizzard Shad	1	--	29	30	10	5	--	--	--	--	--	--	--
Golden Shiner	--	--	4	--	1	--	--	--	--	--	--	--	--
Green Sunfish	--	--	3	2	--	2	--	--	--	--	--	--	--
Longear Sunfish	10	13	1	--	16	1	3	7	3	28	1	--	--
Largemouth Bass	110	93	99	109	111	122	120	112	99	126	129	111	69
Redbreast Sunfish	1	45	53	50	45	18	34	15	40	71	59	--	18
Redear Sunfish	76	75	65	107	91	78	48	77	97	109	96	76	87
Spotted Bass	4	69	94	143	97	57	27	42	91	69	31	88	43
Spotted Sucker	--	--	1	--	--	--	--	--	--	--	--	--	--
Striped Bass	--	2	2	--	--	2	--	--	--	--	--	1	--
Threadfin Shad	--	--	110	11	8	--	--	--	--	--	--	--	--
Warmouth	2	--	3	--	2	--	4	1	6	2	--	--	--
White Bass	--	--	1	--	--	1	--	3	--	--	--	--	--
Yellow Perch	2	--	2	1	2	3	4	--	1	--	1	--	--
Grand Total	**415**	**458**	**624**	**571**	**437**	**412**	**399**	**344**	**456**	**647**	**459**	**303**	**263**

TABLE 7 NUMBER OF EACH FISH SPECIES SAMPLED BY GILL NETTING

	Number Sampled by Gillnetting												
Species	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Blue Catfish	8	13	3	4	--	2	6	24	47	19	23	--	49
Black Crappie	49	44	41	31	--	192	153	175	111	252	178	--	159
Bluegill	--	2	--	--	--	9	15	9	13	5	8	--	--
Brown Bullhead	--	1	--	3	--	1	1	--	--	--	--	--	--
Common Carp	1	--	--	2	--	2	--	--	--	--	--	--	--
Channel Catfish	31	24	6	5	--	33	35	49	64	57	52	--	48
Chain Pickerel	--	--	--	--	--	--	--	--	--	1	--	--	--
Flat Bullhead	--	--	1	--	--	--	--	--	--	--	--	--	--
Flathead Catfish	--	3	--	1	--	1	--	1	1	--	--	--	8
Gizzard Shad	59	70	12	91	--	43	34	33	53	46	25	--	37
Golden Shiner	1	--	--	--	--	--	1	--	--	--	--	--	--
Longear Sunfish	--	--	--	--	--	--	--	2	--	--	--	--	--
Largemouth Bass	2	3	--	1	--	7	8	6	10	4	11	--	3
Longnose Gar	3	4	2	7	--	13	32	--	3	--	6	--	1
Rebreast Sunfish	--	--	--	1	--	4	1	2	1	--	--	--	--
Redear Sunfish	2	--	--	--	--	1	4	5	5	8	6	--	9
Snail Bullhead	4	5	--	--	--	--	--	--	--	--	--	--	--
Spotted Bass	1	1	--	--	--	10	1	7	4	11	13	--	4
Spotted Sucker	2	5	2	2	--	3	3	--	1	--	5	--	10
Striped Bass	4	57	1	7	--	10	2	4	3	5	24	--	--
Threadfin Shad	--	1	--	--	--	1	--	2	--	3	1	--	1
Warmouth	2	1	--	1	--	1	--	2	--	--	--	--	--
White Catfish	5	7	8	3	--	8	4	--	--	--	--	--	--
White Bass	--	9	--	--	--	5	1	--	2	5	--	--	3
Hybrid Bass	--	--	--	--	--	--	4	20	51	24	23	--	26
Yellow Bullhead	2	--	--	--	--	3	--	--	--	--	--	--	--
Grand Total	**176**	**250**	**76**	**159**	**--**	**349**	**305**	**341**	**369**	**440**	**375**	**--**	**358**

TABLE 8 PERCENT MAXIMUM WEIGHTED USEABLE AREA BY SPECIES\LIFE-STAGE

Discharge (cfs)	Percent Maximum Weighted Useable Area by Species/Life-Stage												
	Altamaha Shiner – YOY	Altamaha Shiner – adult	Redeye Bass – YOY	Redeye Bass – juvenile	Redeye Bass – adult	Redbreast Sunfish – spawn	Redbreast Sunfish – adult	Shoal bass – YOY	Shoal Bass – adult	Striped Jumprock – YOY	Striped Jumprock – adult	Silver Redhorse – adult	Overall Average
50	52	48	90	65	39	84	67	93	41	98	45	39	**63.4**
75	65	57	94	70	46	90	74	98	47	99	53	47	**70.0**
100	71	64	97	73	53	93	77	98	54	99	61	52	**74.3**
125	77	70	98	77	58	96	82	100	58	100	66	57	**78.3**
150	81	76	99	80	63	98	84	99	62	99	71	60	**81.0**
175	84	80	100	83	67	99	87	98	67	98	75	64	**83.5**
200	86	83	100	84	71	100	89	96	70	96	79	67	**85.1**
250	91	88	99	87	75	100	92	92	76	90	85	72	**87.3**
300	95	92	98	90	77	100	93	88	82	84	90	77	**88.8**
350	97	96	96	94	82	98	95	86	87	81	92	80	**90.3**
400	99	98	94	95	86	97	97	82	91	75	95	83	**91.0**
450	100	97	91	96	89	96	98	77	93	69	97	85	**90.7**
600	97	100	83	100	94	87	100	65	97	54	99	91	**88.9**
800	93	97	74	100	98	78	100	52	100	39	100	99	**85.8**
1,000	83	92	66	98	100	69	98	42	97	27	97	99	**80.7**
1,300	72	82	56	93	96	59	90	31	90	20	91	100	**73.3**
1,500	64	75	51	87	93	54	85	26	86	17	87	99	**68.7**
2,000	43	60	40	71	83	45	68	19	74	14	74	89	**56.7**
2,500	31	49	32	57	74	40	49	15	59	11	62	74	**46.1**
3,500	20	33	21	34	55	31	29	11	41	8	39	50	**31.0**

Source: EA 1990c

Note: Highlighting indicates the current Lloyd Shoals minimum flow target of 400 cfs (or inflow whichever is less).

YOY = young-of-year.

TABLE 9 MONTHLY SUMMARY OF CONTINUOUS WATER QUALITY DATA FROM TAILRACE MONITOR

PARAMETER		2019						2020		
		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR
Water Temperature (degrees C)	min	28.15	27.89	26.97	20.24	13.28	9.68	9.53	9.27	10.53
	avg	28.56	28.45	28.05	24.30	16.07	11.32	11.70	11.21	14.04
	max	29.3	29.33	29.24	28.34	20.61	13.88	15.00	13.08	19.18
Dissolved Oxygen (mg/L)	min	5.42	4.71	5.28	4.65	5.21	6.89	8.54	9.45	7.67
	avg	6.72	6.65	6.52	6.07	6.71	8.88	9.46	10.5	9.66
	max	7.36	7.64	7.71	8.37	8.18	10.48	11.05	11.57	11.53
pH	min	6.26	6.26	6.36	6.46	7.14	7.06	6.71	6.79	6.87
	avg	6.34	6.38	6.49	6.7	7.25	7.27	6.98	6.97	7.00
	max	6.49	6.57	6.71	7.19	7.37	7.49	7.25	7.28	7.29
Specific Conductance (µs/cm)	min	109.8	112.6	124.1	138.6	146.2	95.1	54.8	46.9	44.4
	avg	113.9	119.2	132.5	147.9	148.7	130.5	75.9	60.4	60.1
	max	116.1	131.8	150.2	154.8	152.7	152.3	103.3	93	80.1

TABLE 10 GEPD WATER QUALITY MEASUREMENTS IN THE LLOYD SHOALS TAILRACE

DATE	WATER TEMPERATURE (DEGREES C)	DO (MG/L)	PH	SPECIFIC CONDUCTANCE (µS/CM)
1/27/2009	7.7	9.9	7.4	119
2/24/2009	9.8	11.2	7.4	136
3/31/2009	14.42	9.72	7.19	60
4/28/2009	18.7	7.8	6.8	83
5/26/2009	22	6.1	6.8	101
6/30/2009	25.3	5.7	6.5	101
7/28/2009	27.1	4.8	6.4	118
8/25/2009	28.2	6	6.6	138
9/29/2009	23.5	7	6.2	62
10/28/2009	16.4	8.2	7	60
11/30/2009	13.1	7.8	7	79
12/7/2009	10.4	11.3	6.7	61

TABLE 11 GEPD WATER QUALITY MEASUREMENTS IN THE OCMULGEE RIVER AT HWY 83

DATE	WATER TEMPERATURE (DEGREES C)	DO (MG/L)	PH	SPECIFIC CONDUCTANCE (µS/CM)
01/11/2016	10.05	9.14	7.58	58.0
02/04/2016	9.96	10.02	6.46	69.0
03/03/2016	11.85	9.83	5.88	65.0
04/07/2016	17.31	7.25	7.27	81.0
05/10/2016	21.32	7.22	6.25	96.0
06/23/2016	26.96	6.70	6.80	119.1
07/13/2016	27.95	6.50	7.12	130.1
08/02/2016	29.44	6.47	7.08	147.0
09/06/2016	27.36	7.17	7.01	143.1
10/06/2016	24.07	7.70	7.42	155.0
11/01/2016	19.84	8.40	7.12	159.2
12/01/2016	15.49	8.83	6.92	170.6
01/23/2018	8.03	11.14	6.02	112.0
02/21/2018	14.11	9.80	7.12	70.2
03/14/2018	12.29	9.72	6.47	96.6
04/18/2018	17.12	8.95	6.92	99.1
05/10/2018	15.71	8.84	5.97	83.3
06/07/2018	25.47	7.29	6.30	79.5
07/26/2018	28.79	7.05	7.12	99.6
08/21/2018	27.47	7.12	6.98	87.1
10/04/2018	26.69	7.39	7.11	135.4
11/07/2018	17.61	8.66	7.07	117.8
12/12/2018	8.17	9.86	6.32	57.5

TABLE 12 TURBINE CHARACTERISTICS OF THE LLOYD SHOALS POWERHOUSE

Unit	Turbine Type	Turbine Arrangement	Unit Hydraulic Capacity (cfs)	Net Head (ft)	Number of Runners	Turbine Operating Speed (rpm)	Runner Diameter (inches)	Number of Blades per Runner	Runner Diameter at Inlet (inches)	Blade Spacing at Inlet (inches)	Runner Diameter at Discharge (inches)	Peripheral Runner Velocity (fps)
1	Francis	Horizontal double runner	620	96.8	2	300	52.38	17	44.82	8.28	50.28	68.62
2	Francis	Horizontal double runner	620	96.8	2	300	52.38	17	44.82	8.28	50.28	68.62
3	Francis	Horizontal double runner	620	96.8	2	300	52.38	17	44.82	8.28	50.28	68.62
4	Francis	Horizontal double runner	620	96.8	2	300	52.38	17	44.82	8.28	50.28	68.62
5	Francis	Horizontal double runner	620	96.8	2	300	54.5	17	49.16	9.09	52.28	71.40
6	Francis	Horizontal double runner	620	96.8	2	300	54.5	17	49.12	9.08	52.28	71.40

Source: Southern Company Generation Hydro Services

TABLE 13 SITE CHARACTERISTICS AND FISH ENTRAINMENT RATES AT 47 HYDROELECTRIC DEVELOPMENTS EAST OF THE MISSISSIPPI RIVER

										Entrainment Rate	
Site Name	State	River	Reservoir Area (acres)	Reservoir Volume (acre-ft)	Total Plant Hydraulic Capacity (cfs)	Hydraulic Capacity of Sampled Units (cfs)	Operating Mode[a]	Average Velocity at Trash Rack (fps)	Trash Rack Clear Spacing (inches)	Time (fish/hr)	Time & Flow (fish/hr/1,000 cfs of unit capacity)
Abbevile	SC	Savannah	1,425	25,650	390	--	PK	--	2.6	12.4	--
Belding	MI	Flat	--	--	416	416	--	--	2	4.4	10.7
Bond Falls	MI	W.B. Ontonagon	--	--	900	450	PK	--	3	26.9	59.7
Brule	WI	Brule	545	8,880	1,377	916	PK-partial	1	1.62	5.4	5.9
Buzzard's Roost	SC	Saluda	11,404	270,000	3,930	1,310	--	--	3.625	1043.1	796.3
Caldron Falls	WI	Peshtigo	1,180	--	1,300	650	PK	--	2	5.7	8.8
Centralia	WI	Wisconsin	250	--	3,640	550	ROR	2.3	3.5	16.2	29.4
Colton	NY	Raquette	195	620	1,503	450	PK	--	2	0.6	1.2
Crowley	WI	N.F. Flambeau	422	3,539	2,400	1,200	ROR	1.4	2.375	6.9	5.7
E. J. West	NY	Sacandaga	25,940	792,000	5,400	5,400	--	--	4.5	7.4	1.4
Feeder Dam	NY	Hudson	--	--	5,000	2,000	PK	--	2.75	1.6	0.8
Four Mile Dam	MI	Thunder Bay	1,112	2,500	1,500	500	ROR	--	2	3.4	6.9
Gaston Shoals	SC	Broad	300	2,500	2,211	837	--	--	1.5	5.8	7.0
Grand Rapids	MI/WI	Menominee	250	--	3,870	2,216	ROR	--	1.75	3.9	1.7
Herrings	NY	Black	140	--	3,610	1,203	ROR	--	4.125	1.0	0.8
High Falls - Beaver River	NY	Beaver	145	1,058	900	300	--	0.7	1.81	1.0	3.3
Higley	NY	Raquette	742	4,446	2,045	2,045	PK	--	3.63	5.7	2.8
Hillman Dam	MI	Thunder Bay	988	1,600	270	270	ROR	--	3.25	10.9	40.4
Hollidays Bridge	SC	Saluda	466	6,000	4,396	370	--	--	--	2.8	7.5
Jocassee	SC	Keowee	7,980	1,206,798	36,200	36,200	PS[b]	--	--	120.3	3.3
Johnsonville	NY	Hoosic	450	6,430	1,288	1,288	PK	--	2	10.4	8.1
King Mill	GA	Savannah	--	--	--	--	ROR	1.48	2	15.8	--
Kleber	MI	Black	270	3,000	400	400	ROR	1.41	3	38.2	95.4
Lake Algonquin	NY	Sacandaga	--	--	750	750	--	--	1	0.7	1.0
Luray	VA	S.F. Shenandoah	--	--	1,477	369	ROR	--	2.75	0.5	1.5

Site Name	State	River	Reservoir Area (acres)	Reservoir Volume (acre-ft)	Total Plant Hydraulic Capacity (cfs)	Hydraulic Capacity of Sampled Units (cfs)	Operating Mode[a]	Average Velocity at Trash Rack (fps)	Trash Rack Clear Spacing (inches)	Entrainment Rate: Time (fish/hr)	Entrainment Rate: Time & Flow (fish/hr/1,000 cfs of unit capacity)
Minetto	NY	Oswego	350	4,730	7,500	4,500	PULSE	2.4	2.5	85.8	19.1
Moshier	NY	Beaver	365	7,339	660	660	PK	--	1.5	26.4	40.0
Ninety-Nine Islands	SC	Broad	433	2,300	4,800	584	--	--	1.5	5.7	9.8
Ninth Street Dam	MI	Thunder Bay	9,884	2,600	1,650	550	ROR	--	1	56.4	102.6
Norway Point Dam	MI	Thunder Bay	10,502	3,800	1,775	575	ROR	--	1.69	20.2	35.2
Potato Rapids	WI	Peshtigo	288	--	1,380	500	ROR	--	1.75	5.9	11.9
Raymondville	NY	Raquette	50	264	1,640	1,640	PK	--	2.25	13.3	8.1
Richard B. Russell	GA/SC	Savannah	31,770	1,297,513	60,000	7,200	PS[b]	--	8	134.3	18.7
Saluda	SC	Saluda	556	7,228	812	227	--	--	--	4.8	21.1
Sandstone Rapids	WI	Peshtigo	150	--	1,300	650	PK	--	1.75	7.7	11.8
Schaghticoke	NY	Hoosic	164	1,150	1,640	1,640	ROR	--	2.125	1.7	1.1
Shawano	WI	Wolf	155	1,090	850	850	ROR	--	5	5.5	6.5
Sherman Island	NY	Hudson	305	6,960	6,600	4,950	PK	--	3.125	0.9	0.2
Stevens Creek	GA/SC	Savannah	2,400	23,700	8,000	--	PULSE	--	3.00-3.50	4.6	--
Thornapple	WI	Flambeau	295	1,000	1,400	700	ROR-mod	1.22	1.69	5.8	8.3
Tower	MI	Black	102	620	404	404	ROR	0.82	1	5.1	12.7
Townsend Dam	PA	Beaver	--	--	4,400	4,400	ROR	--	5.5	527.2	119.8
Twin Branch	IN	St. Joseph	1,065	--	3,200	1,200	ROR	--	3	2.1	1.8
Warrensburg	NY	Schroon	--	--	1,350	1,350	--	--	--	1.0	0.8
White Rapids	MI/WI	Menominee	435	5,155	3,994	2,450	PK-partial	1.9	2.5	8.2	3.3
Wisconsin River Division	WI	Wisconsin	240	1,120	5,150	431	ROR	1.4	2.19	10.7	24.7
Youghiogheny	PA	Youghiogheny	2,840	149,300	1,600	1,600	ROR	0.7	10	208.3	130.2

Sources: EPRI (1997a); FERC (1995a) for Abbeville and King Mill; FERC (1995b) for Stevens Creek; Degan and Mueller (2013) for Jocassee generation.

[a] PK = peaking; PS = pumped storage; PULSE = pulsed (intermittent operation for re-regulation and/or to maximize turbine efficiency); ROR = run-of-river.

[b] For the pumped storage (PS) sites, only data for conventional generation are provided; pumpback data are not included.

TABLE 14 COMPARISON OF SITES IN ENTRAINMENT DATABASE AND THE LLOYD SHOALS PROJECT

Physical Characteristics	All Sites (N = 47)	Southeastern Sites (N = 11) [a]	Lloyd Shoals Project
Reservoir Area (acres)	50 – 31,770	300 – 31,770	4,750
Reservoir Volume (acre-ft)	264 – 1,297,513	2,300 – 1,297,513	107,000
Plant Hydraulic Capacity (cfs)	270 – 60,000	390 – 60,000	3,720
Unit Hydraulic Capacity (cfs)	227 – 7,200	227 – 9,050	620 cfs
Operating Modes	PK, PULSE, ROR, PS	PK, PULSE, ROR, PS	PK
Trash Rack Clear Spacing (inches)	1 – 10	1.5 - 8	1.3125

Sources: EPRI (1997a); FERC (1995a, 1995b); Southern Company Generation Hydro Services

[a] The 11 southeastern sites are Abbeville, Buzzard's Roost, Gaston Shoals, Hollidays Bridge, Jocassee, King Mill, Luray, Ninety-Nine Islands, Richard B. Russell, Saluda, and Stevens Creek.

[b] PK = peaking; PS = pumped storage; PULSE = pulsed; ROR = run-of-river.

TABLE 15 PERCENT FISH ENTRAINMENT COMPOSITION BY SIZE CLASS AT 43 HYDROELECTRIC DEVELOPMENTS (MODAL SIZE CLASS AT EACH SITE IN BOLD UNDERLINE)

Site Name	State	River	Trash Rack Clear Spacing (inches)	Percent Composition by Size Class (inches)						
				<4	4-6	6-8	8-10	10-15	15-30	>30
Belding	MI	Flat	2	**87.3**	6.5	3.8	1.1	1.0	0.2	0.03
Bond Falls	MI	W.B. Ontonagon	3	**98.1**	1.2	0.4	0.1	0.1	0.0	0.0
Brule	WI	Brule	1.62	**76.1**	17.1	4.4	1.1	1.0	0.3	0.0
Buzzard's Roost	SC	Saluda	3.625	**97.9**	1.5	0.4	0.1	0.1	0.01	0.0
Caldron Falls	WI	Peshtigo	2	**64.9**	26.8	7.2	0.5	0.5	0.05	0.0
Centralia	WI	Wisconsin	3.5	**97.2**	1.3	0.3	0.9	0.3	0.1	0.0
Colton	NY	Raquette	2	**79.4**	13.8	5.3	0.4	0.1	1.0	0.0
Crowley	WI	N.F. Flambeau	2.375	**81.2**	7.5	7.2	3.5	0.5	0.04	0.01
E. J. West	NY	Sacandaga	4.5	**94.2**	1.0	0.6	0.3	3.2	0.7	0.0
Feeder Dam	NY	Hudson	2.75	**45.1**	10.0	32.4	8.3	2.8	1.3	0.1
Four Mile Dam	MI	Thunder Bay	2	**32.0**	24.4	18.1	12.8	12.7	0.0	0.0
Gaston Shoals	SC	Broad	1.5	**31.6**	28.4	22.0	12.3	4.6	1.1	0.0
Grand Rapids	MI/WI	Menominee	1.75	**82.3**	9.3	4.5	1.5	2.0	0.4	0.0
Herrings	NY	Black	4.125	**63.2**	12.9	10.6	6.9	5.0	1.3	0.1
High Falls - Beaver River	NY	Beaver	1.81	19.6	**37.2**	36.9	4.5	1.5	0.3	0.0
Higley	NY	Raquette	3.63	**97.3**	1.6	0.8	0.2	0.1	0.03	0.0
Hillman Dam	MI	Thunder Bay	3.25	**81.3**	8.8	5.5	2.3	2.1	0.0	0.0
Hollidays Bridge	SC	Saluda	--	**44.1**	35.1	13.5	4.5	2.7	0.0	0.0
Jocassee[a]	SC	Keowee	--	**45**	26	11	5	4	9	0
Johnsonville	NY	Hoosic	2	**75.9**	15.3	7.1	1.4	0.4	0.01	0.0
Kleber	MI	Black	3	35.6	**53.7**	7.4	2.5	0.6	0.2	0.0
Lake Algonquin	NY	Sacandaga	1	**80.4**	12.5	4.4	1.2	1.3	0.2	0.0
Minetto	NY	Oswego	2.5	21.1	**66.8**	11.1	0.7	0.2	0.03	0.01
Moshier	NY	Beaver	1.5	**84.8**	10.2	4.9	0.1	0.003	0.0	0.0
Ninety-Nine Islands	SC	Broad	1.5	10.9	**34.5**	26.9	16.7	8.7	2.2	0.0
Ninth Street Dam	MI	Thunder Bay	1	**52.0**	39.6	4.0	4.0	0.3	0.0	0.0

Site Name	State	River	Trash Rack Clear Spacing (inches)	Percent Composition by Size Class (inches)						
				<4	4-6	6-8	8-10	10-15	15-30	>30
Norway Point Dam	MI	Thunder Bay	1.69	**89.0**	5.8	1.2	2.3	1.7	0.0	0.0
Potato Rapids	WI	Peshtigo	1.75	**89.4**	4.5	3.1	1.0	1.7	0.4	0.0
Raymondville	NY	Raquette	2.25	**87.0**	3.1	3.4	0.5	2.1	3.8	0.02
Richard B. Russell	GA/SC	Savannah	8	**70.9**	18.0	8.6	1.8	0.3	0.3	0.0
Saluda	SC	Saluda	--	22.6	28.7	**35.2**	7.0	4.8	1.7	0.0
Sandstone Rapids	WI	Peshtigo	1.75	**91.7**	3.5	3.5	0.9	0.3	0.02	0.0
Schaghticoke	NY	Hoosic	2.125	**80.0**	8.1	6.5	3.0	1.3	1.1	0.0
Shawano	WI	Wolf	5	**38.8**	28.6	19.7	8.1	3.8	1.0	0.02
Sherman Island	NY	Hudson	3.125	**73.1**	6.9	13.7	3.9	2.2	0.3	0.0
Thornapple	WI	Flambeau	1.69	**77.7**	8.8	4.1	3.4	5.4	0.7	0.04
Tower	MI	Black	1	**55.3**	18.5	14.5	5.4	3.9	2.4	0.0
Townsend Dam	PA	Beaver	5.5	**93.3**	4.4	1.0	1.2	0.1	0.0	0.0
Twin Branch	IN	St. Joseph	3	**64.9**	14.8	8.1	5.0	6.4	0.9	0.0
Warrensburg	NY	Schroon	--	34.6	**35.7**	20.3	5.6	2.6	1.2	0.0
White Rapids	MI/WI	Menominee	2.5	**75.5**	11.5	6.1	4.0	2.6	0.3	0.0
Wisconsin River Division	WI	Wisconsin	2.19	**94.4**	0.8	0.2	0.2	3.8	0.7	0.0
Youghiogheny	PA	Youghiogheny	10	**99.2**	0.3	0.3	0.2	0.02	0.01	0.0
			Average	**67.9**	**16.4**	**9.3**	**3.4**	**2.3**	**0.8**	**0.01**

Source: EPRI (1997a) for all sites except Jocassee; Degan and Mueller (2013) for Jocassee.

[a] Jocassee size class distribution estimated from graph and description provided by Degan and Mueller (2013).

TABLE 16 ESTIMATED TOTAL LENGTH OF SMALLEST FISH EXCLUDED BY LLOYD SHOALS TRASH RACKS

Species	Scaling Factor for Body Width[a]	Length of Smallest Fish Excluded by 1.3125 Inches Clear Spacing
American Shad	0.134	9.8
Gizzard Shad	0.105	12.5
Channel Catfish	0.157	8.4
Chain Pickerel	0.088	14.9
Striped Bass	0.113	11.6
Bluegill	0.132	9.9
Redbreast Sunfish	0.150	8.8
Largemouth Bass	0.134	9.8
Black Crappie	0.099	13.3

[a] Scaling factor expresses body width as a proportion of total length, based on average proportional measurements for the species provided by Smith (1985).

TABLE 17 PERCENT ENTRAINMENT COMPOSITION BY FAMILY AT 43 HYDROELECTRIC DEVELOPMENTS (TOP FAMILY AT EACH SITE IN BOLD UNDERLINE)

Site Name	State	River	Centrarchidae (Sunfishes)	Percidae (Perches)	Ictaluridae (Catfishes)	Cyprinidae (Minnows)	Clupeidae (Herrings)	Catostomidae (Suckers)	Esocidae (Pikes)	Salmonidae (Trouts)	Moronidae (Temperate Basses)	Anguillidae (Freshwater Eels)
Richard B. Russell	GA/SC	Savannah	5.0	8.2	3.9	0.35	**81.6**	0	0	0.009	0.89	0
Gaston Shoals	SC	Broad	35.7	0.80	**41.0**	7.8	2.9	11.8	0	0	0	0
Ninety-Nine Islands	SC	Broad	**29.1**	0.49	28.4	5.1	27.9	9.0	0	0	0	0
Buzzard's Roost	SC	Saluda	0.67	1.7	0.27	0.01	**97.0**	0.001	0	0	0.33	0.003
Hollidays Bridge	SC	Saluda	**33.3**	3.6	19.8	12.6	29.7	0.90	0	0	0	0
Saluda	SC	Saluda	**56.1**	2.2	5.7	13.5	18.3	0.43	0	0	3.9	0
Luray[a]	VA	S.F. Shenandoah	0	0	0	0	0	0	0	0	0	100.0
High Falls - Beaver River	NY	Beaver	9.8	**35.6**	26.2	23.5	0	0.19	2.0	1.6	0	0
Moshier	NY	Beaver	0.37	8.5	0.58	0.03	0	0.004	0.01	0.02	0	0
Herrings	NY	Black	**34.6**	14.0	1.3	17.4	0	1.9	14.4	0	0	0.13
Johnsonville	NY	Hoosic	**67.8**	2.8	5.2	21.9	0	1.9	0	0.31	0	0
Schaghticoke	NY	Hoosic	**48.6**	9.7	5.4	31.7	0.13	3.0	0	0.21	0	1.2
Feeder Dam	NY	Hudson	**60.3**	9.0	16.9	10.0	0	0.21	0.55	0.74	0	0.12
Sherman Island	NY	Hudson	**43.2**	9.1	3.9	36.4	0	0.14	0.25	0.17	0	0
Minetto	NY	Oswego	3.0	0.10	0.07	0.33	**95.5**	0.003	0	0.01	0.74	0.02
Colton	NY	Raquette	**47.7**	16.1	13.9	11.3	0	0.50	3.7	0.20	0	0.79
Higley	NY	Raquette	7.5	**91.2**	0.62	0.38	0	0.01	0.005	0.01	0	0
Raymondville	NY	Raquette	12.0	3.9	0.73	**37.0**	0	1.4	0.08	0	0	5.0
E. J. West	NY	Sacandaga	16.8	**81.3**	0.19	1.4	0	0.05	0	0.11	0	0
Lake Algonquin	NY	Sacandaga	**56.1**	19.8	5.6	13.9	0	2.7	0.38	1.7	0	0
Warrensburg	NY	Schroon	**39.8**	14.7	27.9	8.6	0	3.0	2.3	1.5	0	0
Townsend Dam	PA	Beaver	0.09	0.17	0.07	0.05	**99.4**	0.04	0.0003	0.001	0.04	0
Youghiogheny	PA	Youghiogheny	0.52	0.11	0.001	0	**99.4**	0.01	0	0.002	0	0
Twin Branch	IN	St. Joseph	17.8	4.8	**56.0**	8.6	0	7.0	0.53	0.04	1.8	0
Kleber	MI	Black	**64.0**	24.8	2.1	1.8	0	6.5	0.05	0.20	0	0

Site Name	State	River	Centrarchidae (Sunfishes)	Percidae (Perches)	Ictaluridae (Catfishes)	Cyprinidae (Minnows)	Clupeidae (Herrings)	Catostomidae (Suckers)	Esocidae (Pikes)	Salmonidae (Trouts)	Moronidae (Temperate Basses)	Anguillidae (Freshwater Eels)
Tower	MI	Black	**31.9**	24.0	17.2	14.3	0	7.2	1.6	1.5	0	0
Belding	MI	Flat	**48.6**	7.1	2.1	12.1	0	25.2	0.42	0.01	0	0
Four Mile Dam	MI	Thunder Bay	**42.8**	16.4	31.7	5.4	0	1.1	0.73	0.44	0	0
Hillman Dam	MI	Thunder Bay	13.5	23.4	1.4	**45.5**	0	6.5	0.51	0.55	0	0
Ninth Street Dam	MI	Thunder Bay	4.5	**46.9**	6.9	6.9	0.01	34.6	0.01	0.02	0	0.002
Norway Point Dam	MI	Thunder Bay	4.0	5.0	**84.3**	5.2	0	0.65	0.49	0.04	0	0
Bond Falls	MI	W.B. Ontonagon	12.1	**43.0**	1.3	35.7	0	2.1	0.15	0.08	0	0
Grand Rapids	MI/WI	Menominee	10.9	**38.3**	6.6	20.5	0	6.2	4.2	0.31	0	0
White Rapids	MI/WI	Menominee	**38.9**	19.8	6.2	29.9	0	4.4	0.04	0.03	0	0
Brule	WI	Brule	13.1	**60.0**	0.70	21.5	0	2.3	0.09	0.22	0	0
Thornapple	WI	Flambeau	**44.0**	15.5	6.7	22.0	0	4.5	0.70	0	0	0
Crowley	WI	N.F. Flambeau	11.2	**74.3**	6.6	3.4	0	2.4	0.01	0.41	0	0
Caldron Falls	WI	Peshtigo	41.7	**48.1**	0.63	4.9	0	2.8	0	0.73	0	0
Potato Rapids	WI	Peshtigo	**41.0**	10.1	0.26	16.0	0	30.3	1.4	0.19	0	0
Sandstone Rapids	WI	Peshtigo	**51.3**	9.1	2.1	3.4	0	31.1	1.0	0.41	0	0
Centralia	WI	Wisconsin	7.6	0.62	**80.9**	10.3	0	0.27	0	0	0	0
Wisconsin River Division	WI	Wisconsin	31.6	1.6	**50.7**	11.1	0	0.63	0.63	0	0	0
Shawano	WI	Wolf	**58.1**	5.1	6.5	18.4	0	8.0	0.98	1.4	0	0
		Average	**28.5**	**19.3**	**13.8**	**13.1**	**13.1**	**5.3**	**0.9**	**0.3**	**0.2**	**0.2**[b]

Source: EPRI (1997a).

[a] Only entrainment data for American Eels were reported for the Luray site.

[b] Luray site not included in average, because detailed data were not provided for other species and families.

TABLE 18 PERCENT RELATIVE ABUNDANCE OF THE TOP FIVE ENTRAINED SPECIES AT HYDROELECTRIC SITES IN ATLANTIC COAST RIVERS IN SOUTH CAROLINA AND GEORGIA

	Savannah River Basin				Santee-Cooper River Basin				
FAMILY and Species Common Name	**Abbeville**	**King Mill**	**Richard B. Russell**	**Stevens Creek**	**Buzzard's Roost**	**Gaston Shoals**	**Hollidays Bridge**	**Ninety-Nine Islands**	**Saluda**
CLUPEIDAE (HERRINGS):									
Threadfin shad◄	11.3	35.4	62.0	48.9	96.8	--	--	15.0	--
Gizzard shad◄	--	5.4	--	--	--	--	29.7	11.9	18.3
Blueback herring	--	9.1	19.4	--	--	--	--	--	--
CENTRARCHIDAE (SUNFISHES):									
Bluegill◄	29.2	7.9	2.6	18.0	0.6	15.5	24.3	22.6	49.6
Redbreast sunfish◄	--	--	--	--	--	11.0	--	--	--
ICTALURIDAE (CATFISHES):									
Channel catfish◄	--	--	--	--	--	13.1	11.7	18.0	--
White catfish◄	2.0	--	3.1	--	0.3	8.6	6.3	--	2.6
Snail bullhead◄	--	--	--	--	--	17.2	--	--	--
Brown bullhead◄	7.8	--	--	--	--	--	--	--	--
PERCIDAE (PERCHES):									
Yellow perch◄	44.4	--	8.2	7.1	1.5	--	--	--	--
Blackbanded darter◄	--	--	--	4.3	--	--	--	--	--
CYPRINIDAE (MINNOWS):									
Spottail shiner◄	--	12.8	--	--	--	--	--	--	6.1
Whitefin shiner	--	--	--	--	--	--	5.4	--	--
Sandbar shiner	--	--	--	--	--	--	--	--	6.5
CATOSTOMIDAE (SUCKERS):									
Striped jumprock◄	--	--	--	--	--	--	--	5.3	--
MORONIDAE (TEMPERATE BASSES):									
White perch	--	--	--		0.3	--	--	--	--
ANGUILLIDAE (FRESHWATER EELS):									
American eel◄	--	--	--	4.6	--	--	--	--	--
Total	**94.7**	**70.6**	**95.3**	**82.9**	**99.5**	**65.4**	**77.4**	**72.8**	**83.1**

Sources: EPRI (1997a); FERC (1995a) for Abbeville and King Mill; FERC (1995b) for Stevens Creek.

[a] Black triangles indicate species known to occur in Lake Jackson or the upper Ocmulgee River basin.

TABLE 19 COMPARISON OF PERCENT RELATIVE ABUNDANCE BY FAMILY OF ENTRAINMENT COMPOSITION AT SOUTHEASTERN SITES AND FISH COMMUNITY COMPOSITION IN LAKE JACKSON

Family	Median Percent Entrainment Composition at Six Sites in South Carolina and Georgia[a]	Percent Composition of Total Catch in Lake Jackson[b]
Centrarchidae (sunfishes)	31.2	87.8
Clupeidae (herrings and shads)	28.8	5.3
Ictaluridae (catfishes)	12.8	4.0
Cyprinidae (minnows)	6.4	0.1
Percidae (perches)	2.0	0.2
Catostomidae (suckers)	0.7	0.2
Moronidae (temperate basses)	0.2	1.7

[a] Summarized from EPRI (1997a) data for the Richard B. Russell, Gaston Shoals, Ninety-Nine Islands, Buzzard's Roost, Holliday's Bridge, and Saluda sites.

[b] Summarized from GDNR standardized electrofishing data (2007-2019) and gill netting data (2007-2010; 2012-2017; 2019) from Lake Jackson.

TABLE 20 EXTRAPOLATED LLOYD SHOALS ENTRAINMENT ESTIMATES USING NINETY-NINE ISLANDS MONTHLY ENTRAINMENT RATES AND LLOYD SHOALS AVERAGE MONTHLY GENERATION FLOWS

Month	Ninety-Nine Islands Entrainment Rate[a]		Lloyd Shoals Average Generation Flow, 2012-2016[c]		Lloyd Shoals Entrainment Extrapolation (Number of fish)
	Fish per hour per 1,000 cfs unit capacity	Fish per million cubic feet (mcf)	Average Generation Flow (cfs)	Total Monthly Generation Flow (mcf)	
January	8.89[b]	2.47	1,572	4,210	10,397
February	17.77	4.94	3,461	8,373	41,329
March	2.57	0.71	1,886	5,051	3,606
April	5.99	1.66	2,210	5,728	9,531
May	17.12	4.76	1,299	3,479	16,546
June	13.48	3.74	1,114	2,887	10,812
July	12.20[b]	3.39	1,150	3,080	10,438
August	12.20[b]	3.39	881	2,360	7,997
September	10.92	3.03	604	1,566	4,794
October	10.70	2.97	739	1,979	5,883
November	9.20	2.56	1,372	3,556	9,088
December	0.0	0.0	3,063	8,204	0.0
Total					**130,377**

[a] Source: EPRI (1997a)

[b] Month without sampling; rate was extrapolated by averaging preceding month and following month.

[C] Source: Southern Company Generation Hydro Services

TABLE 21 TURBINE PASSAGE SURVIVAL ESTIMATES AT SITES WITH FRANCIS TURBINE CHARACTERISTICS

	Turbine Characteristics						Estimated Percent Survival by Species and Size Class[a]				
									Size Class (Maximum Size in Inches)		
Site, State	**Rated Head (ft)**	**Rated Flow (cfs)**	**Speed (rpm)**	**Runner Diameter (inches)**	**Peripheral Runner Velocity (fps)**	**No. of Runner Blades**	**Family**	**Species Tested**	**≤6**	**≤10**	**>10**
Sandstone Rapids, MI	42	650	150	87	57	NG	Centrarchidae	Bluegill and hybrid sunfish	88.6		
								Bluegill and hybrid sunfish	96.2		
								Bluegill and hybrid sunfish	100.0		
								Bluegill and hybrid sunfish	92.0		
								Bluegill and hybrid sunfish	87.8		
							Cyprinidae & Catostomidae	Minnows and suckers	81.8	83.3	27.3
								Minnows and suckers	77.7	81.4	79.4
								Minnows and suckers	99.4	74.5	58.3
								Minnows and suckers	95.9	83.9	54.5
								Minnows and suckers	90.1	61.9	42.4
								Minnows and suckers		90.5	53.7
								Minnows and suckers		71.7	
								Sandstone Rapids Average	**90.9**	**78.2**	**52.6**
Alcona, MI	43	1600	90	100	39	16	Catostomidae	White sucker			96.3
								White sucker			88.3
							Centrarchidae	Bluegill	100.0	100.0	
								Bluegill	78.0	86.3	
							Cyprinidae	Golden shiner	93.9	90.9	
								Spottail shiner	94.3		
							Esocidae	Grass pickerel			96.7
								Northern pike			55.8
							Percidae	Walleye			95.6
								Yellow perch		100.0	
								Yellow perch		62.5	
								Yellow perch		45.2	
							Salmonidae	Rainbow trout	100.0		92.9
								Alcona Average	**93.2**	**80.8**	**87.6**

	Turbine Characteristics						Estimated Percent Survival by Species and Size Class[a]				
									Size Class (Maximum Size in Inches)		
Site, State	Rated Head (ft)	Rated Flow (cfs)	Speed (rpm)	Runner Diameter (inches)	Peripheral Runner Velocity (fps)	No. of Runner Blades	Family	Species Tested	≤6	≤10	>10
Higley, NY	45	695	257	48	53	13	Catostomidae	White sucker	90.7	69.0	42.9
								White sucker	71.4	54.3	
							Centrarchidae	Bluegill	85.1		
								Largemouth bass		39.2	37.5
							Percidae	Yellow perch	91.9		
								Yellow perch	96.6		
							Salmonidae	Brook trout	91.5		
								Brook trout	76.5		
								Rainbow trout		74.6	35.4
								Rainbow trout		51.1	38.6
								Higley Average	**86.2**	**57.7**	**38.6**
Finch Pruyn, NY	49	4600	225	41	40.2	NG	Centrarchidae	Smallmouth bass		94.1	92.6
								Smallmouth bass		81.5	70.7
								Smallmouth bass		94.9	
								Smallmouth bass		90.9	
								Finch Pruyn Average		**90.4**	**81.7**
Prickett, MI	54	326	257	53	60		Catostomidae	White sucker		69.9	
								White sucker		35.7	
							Centrarchidae	Bluegill	97.6		
								Bluegill	92.5		
								Bluegill	85.7		
								Prickett Average	**91.9**	**52.8**	
Holtwood, PA (Unit #3)	61.5	3500	103	112	50	17	Clupeidae	American shad	83.5		
Holtwood, PA (Unit #10)	62	NG	94.7	NG	NG	16		American shad	89.4		
								Holtwood Average	**86.4**		
E. J. West, NY	63	2450	113	131	64	15	Catostomidae	White sucker		77.3	72.2
								White sucker			76.7
							Centrarchidae	Bluegill	69.6		
								Bluegill	59.2		
								Largemouth bass		95.5	100.0

Site, State	Rated Head (ft)	Rated Flow (cfs)	Speed (rpm)	Runner Diameter (inches)	Peripheral Runner Velocity (fps)	No. of Runner Blades	Family	Species Tested	Size Class (Maximum Size in Inches) ≤6	≤10	>10
	Turbine Characteristics						Estimated Percent Survival by Species and Size Class[a]				
								Largemouth bass		81.6	87.0
							Cyprinidae	Golden shiner	85.0	92.5	
							Salmonidae	Rainbow trout	87.0	94.5	93.5
								Rainbow trout	97.1	90.9	93.2
								Rainbow trout	87.4		
								E. J. West Average	**80.9**	**88.7**	**87.1**
Ninety-Nine Islands, SC	74	584	225	NG	NG	NG	Centrarchidae	Bluegill	100.0		
								Bluegill	100.0		
								Bluegill	100.0		
								Bluegill	89.3		
							Ictaluridae	Catfish spp		100.0	100.0
								Catfish spp		100.0	96.2
								Ninety-Nine Islands Average	**97.3**	**100.0**	**98.1**
Caldron Falls, WI	80	650	226	72	71	NG	Centrarchidae	Bluegill and hybrid sunfish	98.1	86.7	
								Bluegill and hybrid sunfish	100.0	93.4	
								Bluegill and hybrid sunfish	99.9		
								Bluegill and hybrid sunfish	90.6		
								Bluegill and hybrid sunfish	94.1		
							Cyprinidae & Catostomidae	Minnows and suckers	88.3	88.4	81.1
								Minnows and suckers	61.3	33.3	45.0
								Minnows and suckers	99.1	72.3	59.7
								Minnows and suckers	57.2	80.0	46.9
								Minnows and suckers	97.4	46.5	25.9
								Minnows and suckers		78.4	46.5
								Caldron Falls Average	**88.6**	**72.4**	**50.9**
High Falls, WI	83	275	359	39	61	NG	Centrarchidae	Bluegill and hybrid sunfish	95.5	61.4	
								Bluegill and hybrid sunfish	72.1	62.2	
								Bluegill and hybrid sunfish	74.5	61.3	
								Bluegill and hybrid sunfish	82.4		
								Minnows and suckers	83.0	48.1	16.0

Site, State	Rated Head (ft)	Rated Flow (cfs)	Speed (rpm)	Runner Diameter (inches)	Peripheral Runner Velocity (fps)	No. of Runner Blades	Family	Species Tested	≤6	≤10	>10
	Turbine Characteristics						Estimated Percent Survival by Species and Size Class[a]		Size Class (Maximum Size in Inches)		
							Cyprinidae & Catostomidae	Minnows and suckers	86.1	52.8	25.5
								Minnows and suckers	89.1	51.1	23.5
								Minnows and suckers	66.5	58.5	2.6
								Minnows and suckers	57.1	37.8	1.8
								Minnows and suckers		44.4	6.3
								High Falls Average	**78.5**	**53.1**	**12.6**
Conowingo, MD (Unit #2)	87	6,320	82	203	73	13	Clupeidae	American shad			93.0
								Conowingo Average			**93.0**
Hardy, MI	100	1500	164	84	60	16	Catostomidae	White sucker		76.9	90.9
							Centrarchidae	Bluegill	97.1	95.8	
								Largemouth bass	94.9		
							Cyprinidae	Golden shiner	98.0	95.8	
							Esocidae	Northern pike			88.0
							Percidae	Walleye			80.0
								Yellow perch		94.7	98.0
							Salmonidae	Rainbow trout	73.1		66.7
								Hardy Average	**90.8**	**90.8**	**84.7**
Hoist, MI	142	NG	360	NG	NG	NG	Centrarchidae	Bluegill	16.8		
								Bluegill	76.5		
							Salmonidae	Brook trout	43.6		
								Brown trout	45.2		22.8
								Hoist Average	**45.6**		**22.8**
Schaghticoke, NY	153	410	300	51	66.1	17	Salmonidae	Brook trout	43.3		17.0
								Brook trout	73.7	0.0	
								Brook trout		42.7	
							Centrarchidae	Largemouth bass		31.4	25.4
								Bluegill	41.4		
								Bluegill	49.1		
							Cyprinidae	Golden shiner	61.7		
							Catostomidae	White sucker	61.5	51.6	34.9

	Turbine Characteristics						Estimated Percent Survival by Species and Size Class[a]				
									Size Class (Maximum Size in Inches)		
Site, State	Rated Head (ft)	Rated Flow (cfs)	Speed (rpm)	Runner Diameter (inches)	Peripheral Runner Velocity (fps)	No. of Runner Blades	Family	Species Tested	≤6	≤10	>10
								White sucker		29.5	13.7
							Percidae	Yellow perch	50.1		
								Yellow perch	79.1		
								Schaghticoke Average	**57.5**	**31.0**	**22.8**
Bond Falls, MI	210	450	300	NG	NG	NG	Centrarchidae	Bluegill		81.6	
							Cyprinidae	Golden shiner	74.4		
							Percidae	Yellow perch	79.8		
							Salmonidae	Rainbow trout			82.9
								Bond Falls Average	**77.1**	**81.6**	**82.9**
								Average for All Sites	**81.9**	**73.1**	**62.7**

Sources: EPRI (1997a) for all sites but Conowingo; also EPRI (1992) for Finch Pruyn; Normandeau Associates, Inc. and Gomez and Sullivan Engineers, P.C. (2012) for Conowingo.
NG = not given.
[a] Each estimate represents immediate survival based on the number of fish recovered in tests with control survival rates of 90 percent or higher.

TABLE 22 PERCENT COMPOSITION BY SIZE CLASS OF STRIPED BASS AND SURROGATE SPECIES ENTRAINED AT FIVE HYDROELECTRIC DEVELOPMENTS

				Percent Composition by Size Class (inches)[b]						
Species[a]	**Site Name**	**State**	**River**	**<4**	**4-6**	**6-8**	**8-10**	**10-15**	**15-30**	**>30**
Striped bass	Buzzard's Roost	SC	Saluda	0.0	0.0	5.7	39.9	**51.3**	3.0	0.0
	Richard B. Russell	GA/SC	Savannah	0.0	**56.6**	0.0	0.0	21.7	21.7	0.0
	Townsend Dam	PA	Beaver	0.0	0.0	**50.0**	**50.0**	0.0	0.0	0.0
White bass (S)	Buzzard's Roost	SC	Saluda	0.0	0.0	0.0	**84.2**	15.8	0.0	0.0
	Minetto	NY	Oswego	**57.8**	38.8	0.0	0.0	3.4	0.0	0.0
	Saluda	SC	Saluda	0.0	0.0	0.0	0.0	**100.0**	0.0	0.0
	Townsend Dam	PA	Beaver	4.4	4.3	11.9	**75.7**	3.7	0.0	0.0
White perch (S)	Buzzard's Roost	SC	Saluda	11.3	23.8	27.1	**28.4**	9.4	0.0	0.0
	Minetto	NY	Oswego	**72.2**	5.7	13.6	7.0	1.4	0.1	0.0
	Richard B. Russell	GA/SC	Savannah	15.8	**77.9**	3.9	2.0	0.4	0.0	0.0
	Saluda	SC	Saluda	0.0	0.0	40.0	**60.0**	0.0	0.0	0.0

Source: EPRI (1997a).

[a] S = surrogate species for striped bass in the genus *Morone*.

[b] Modal size classes are indicated by bold underline.

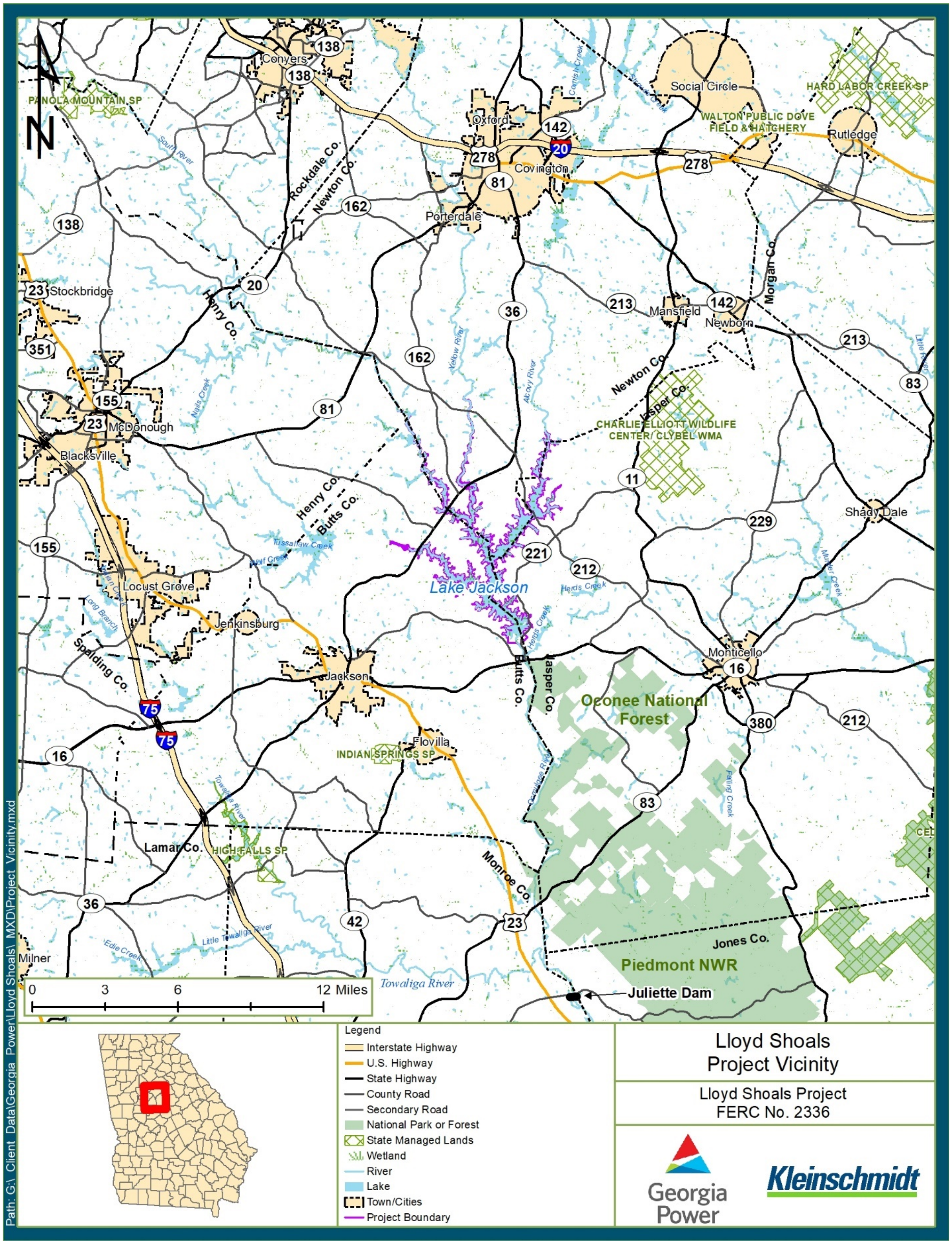

FIGURE 1 LLOYD SHOALS PROJECT VICINITY

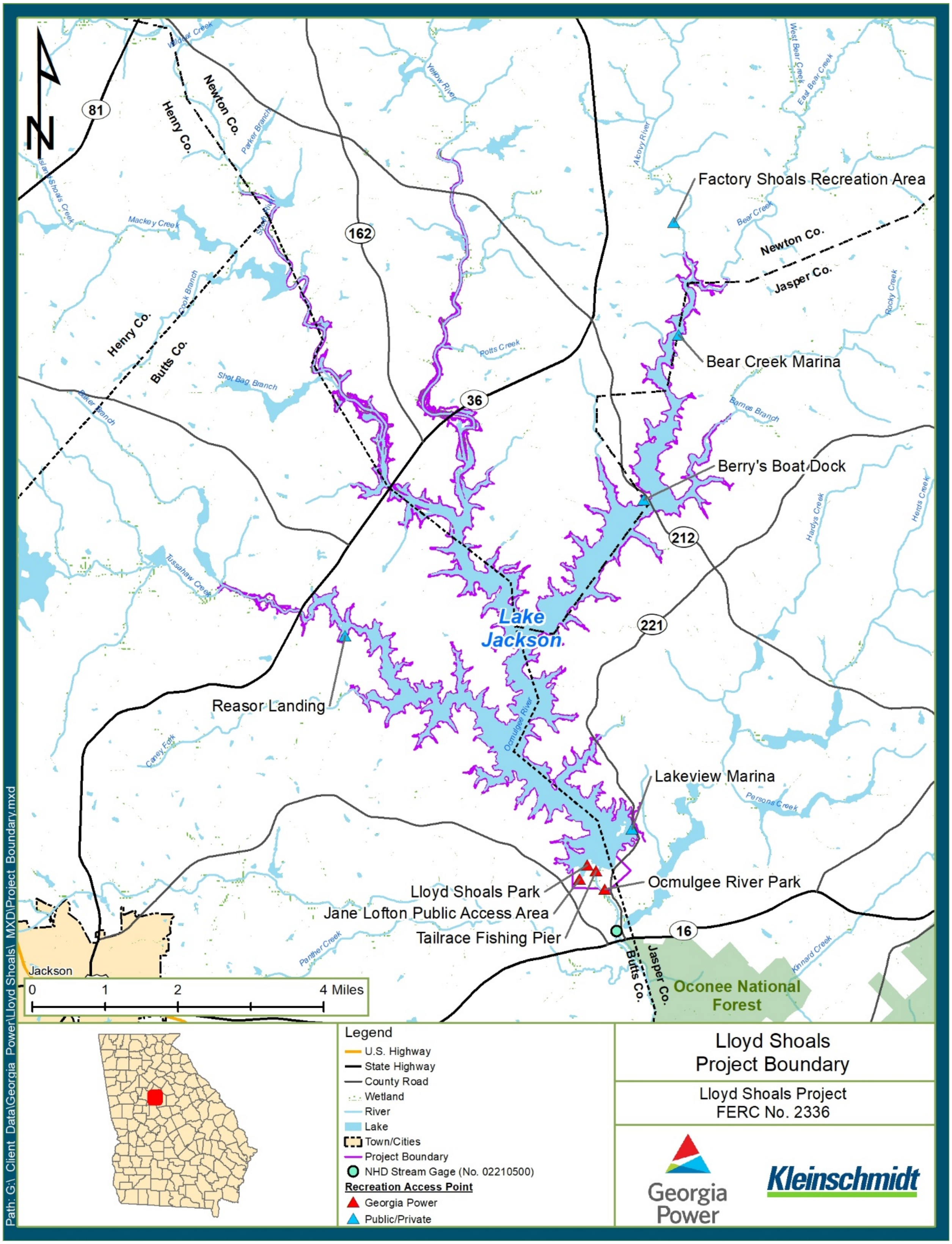

FIGURE 2 LLOYD SHOALS PROJECT BOUNDARY

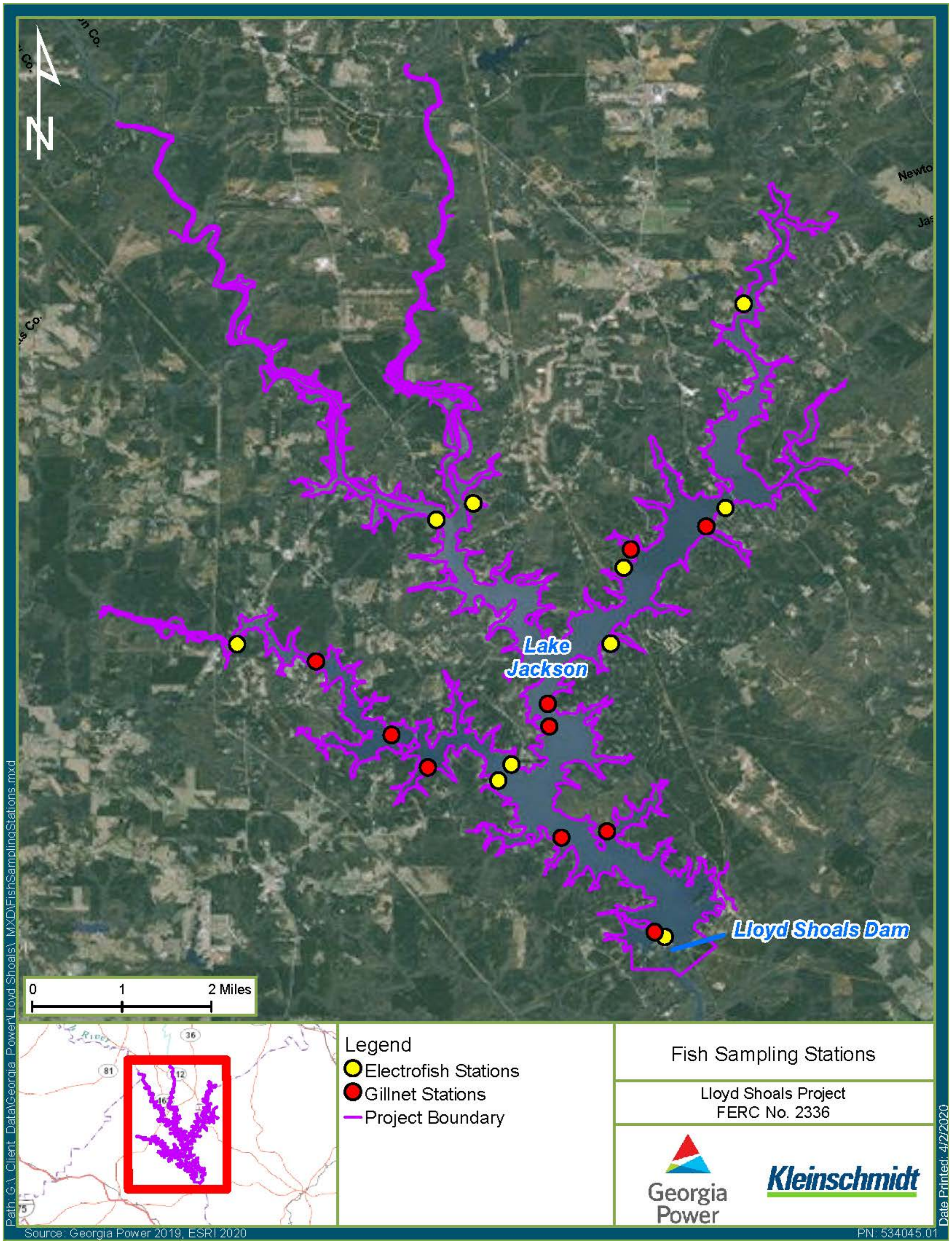

FIGURE 3 LAKE JACKSON FISH SAMPLING STATIONS

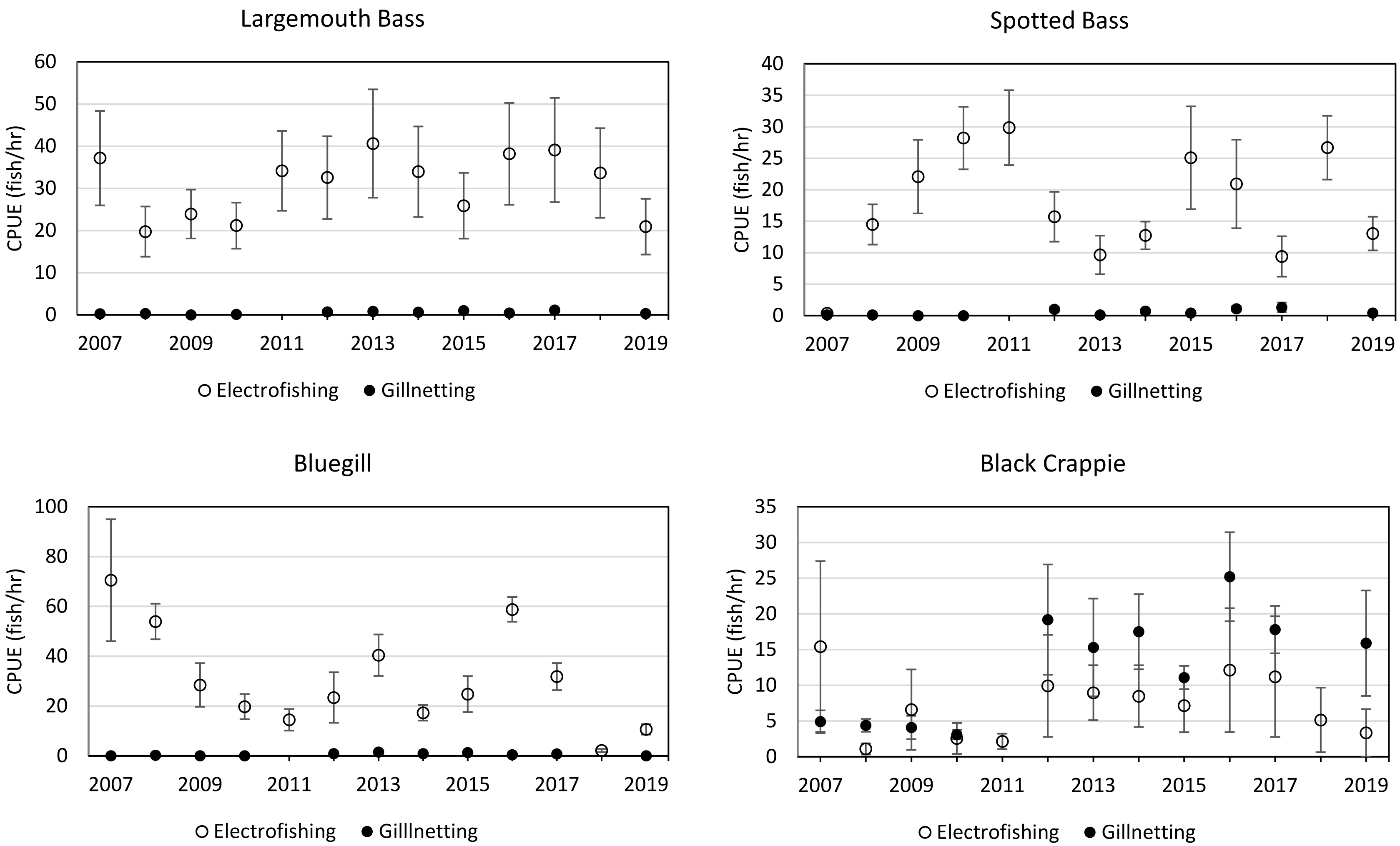

FIGURE 4 CATCH PER UNIT EFFORT (CPUE) FOR LARGEMOUTH BASS, SPOTTED BASS, BLUEGILL, AND BLACK CRAPPIE FROM GDNR STANDARDIZED SAMPLING ON LAKE JACKSON

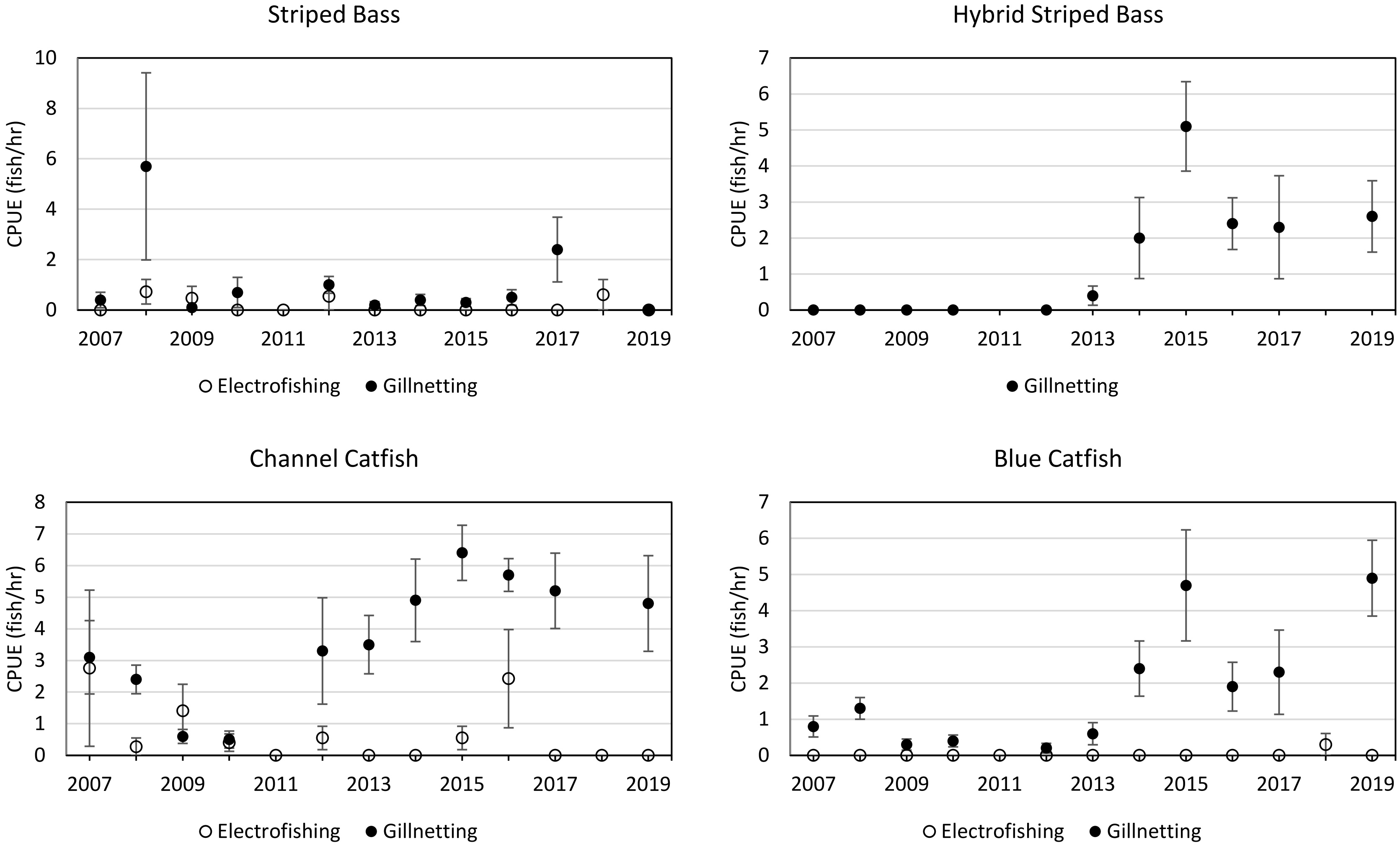

FIGURE 5 CATCH PER UNIT EFFORT (CPUE) FOR STRIPED BASS, HYBRID BASS, CHANNEL CATFISH, AND BLUE CATFISH FROM GDNR STANDARDIZED SAMPLING ON LAKE JACKSON

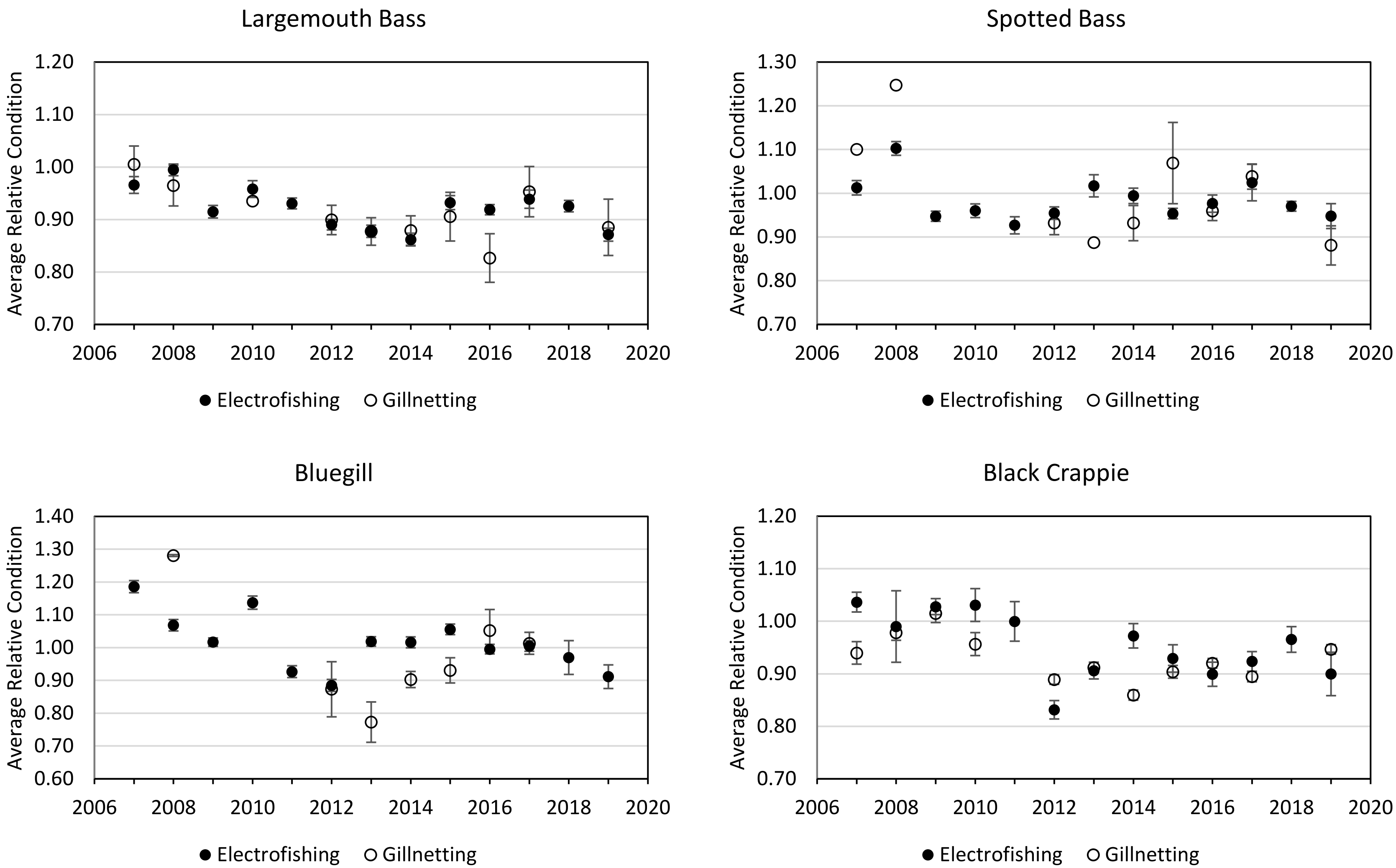

FIGURE 6 **AVERAGE RELATIVE CONDITION FOR LARGEMOUTH BASS, SPOTTED BASS, BLUEGILL, AND BLACK CRAPPIE FROM GDNR STANDARDIZED SAMPLING ON LAKE JACKSON**

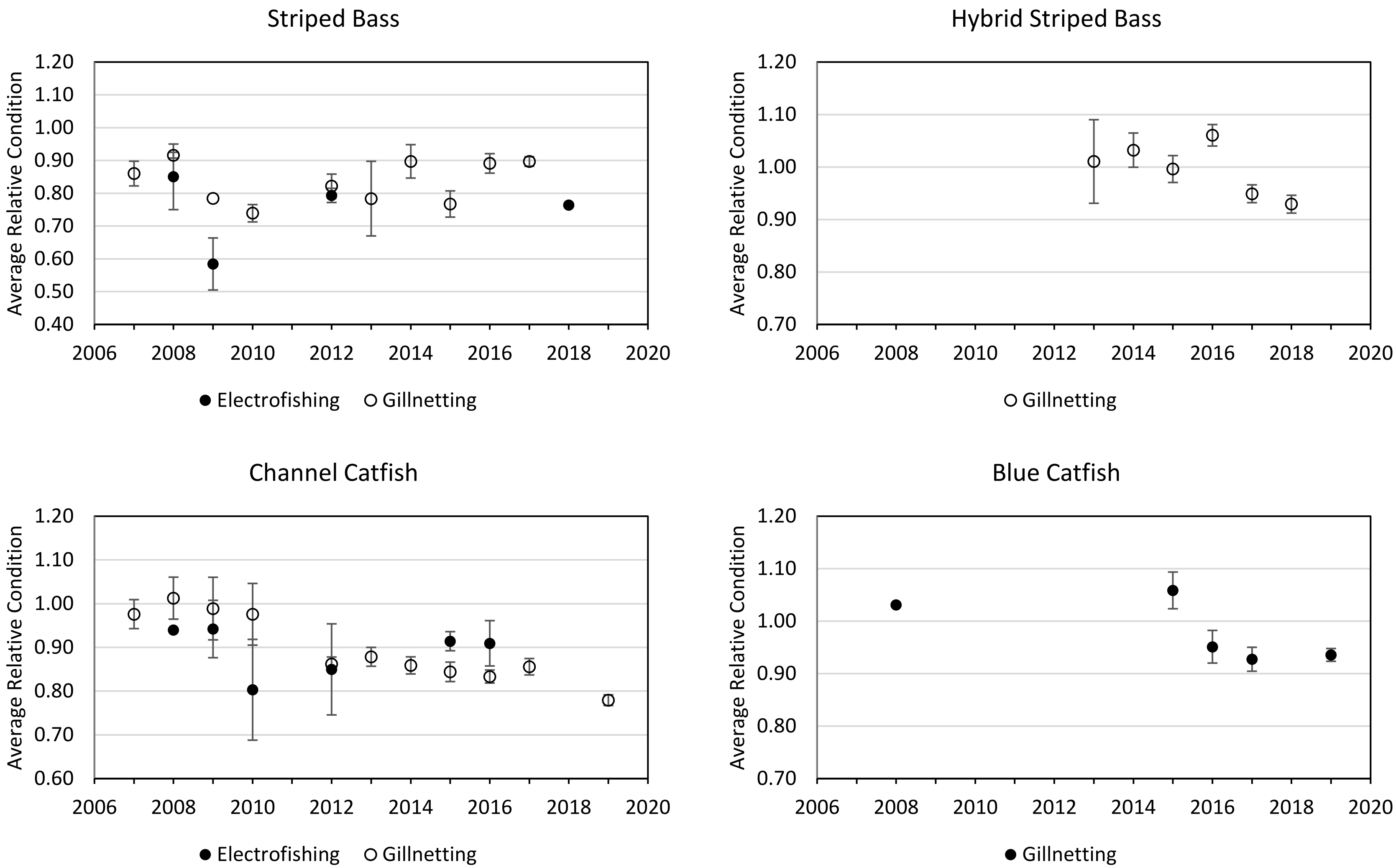

FIGURE 7 AVERAGE RELATIVE CONDITION FOR STRIPED BASS, HYBRID BASS, CHANNEL CATFISH, AND BLUE CATFISH FROM GDNR STANDARDIZED SAMPLING ON LAKE JACKSON

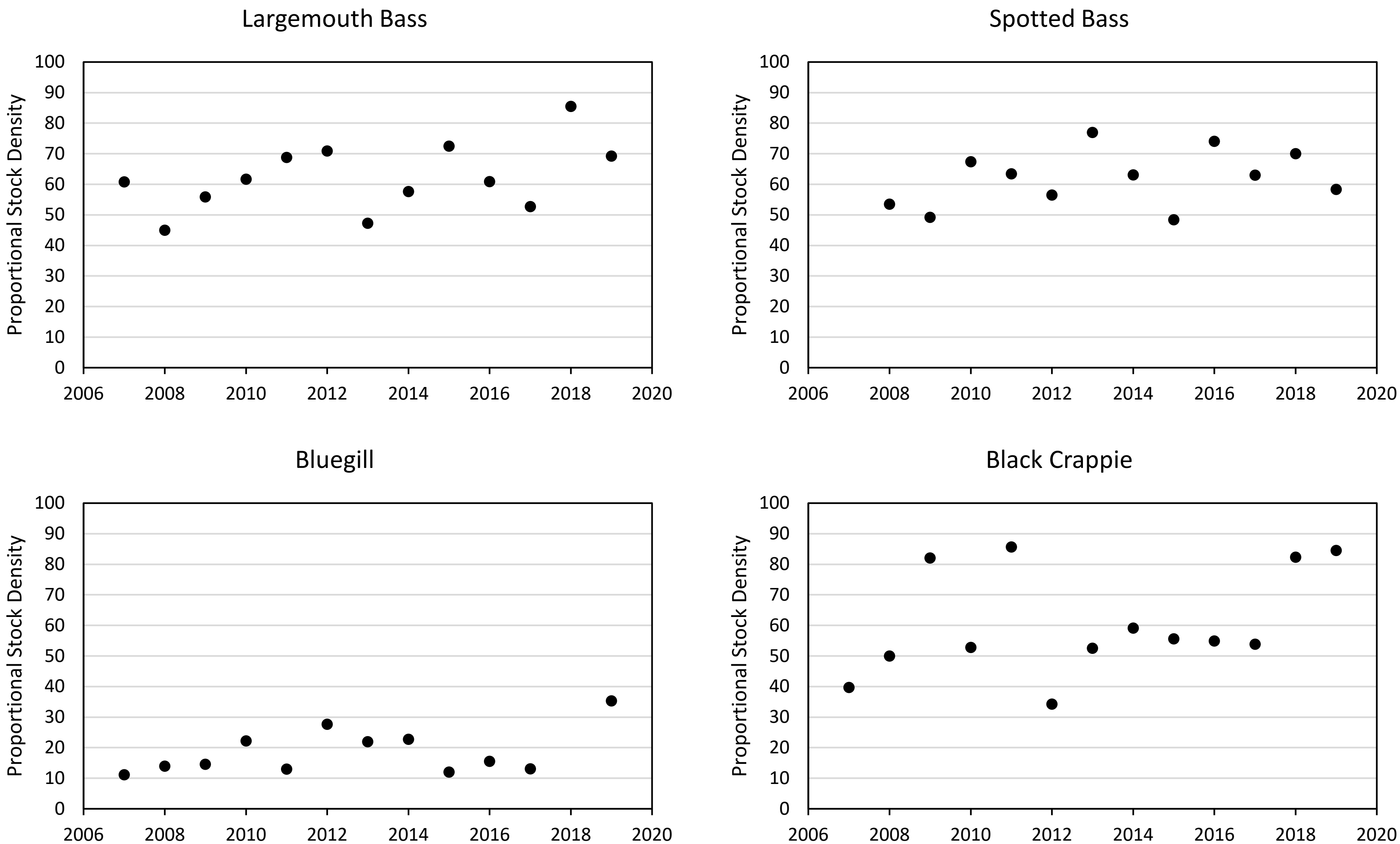

FIGURE 8 PROPORTIONAL STOCK DENSITY FOR LARGEMOUTH BASS, SPOTTED BASS, BLUEGILL, AND BLACK CRAPPIE FROM GDNR STANDARDIZED SAMPLING ON LAKE JACKSON

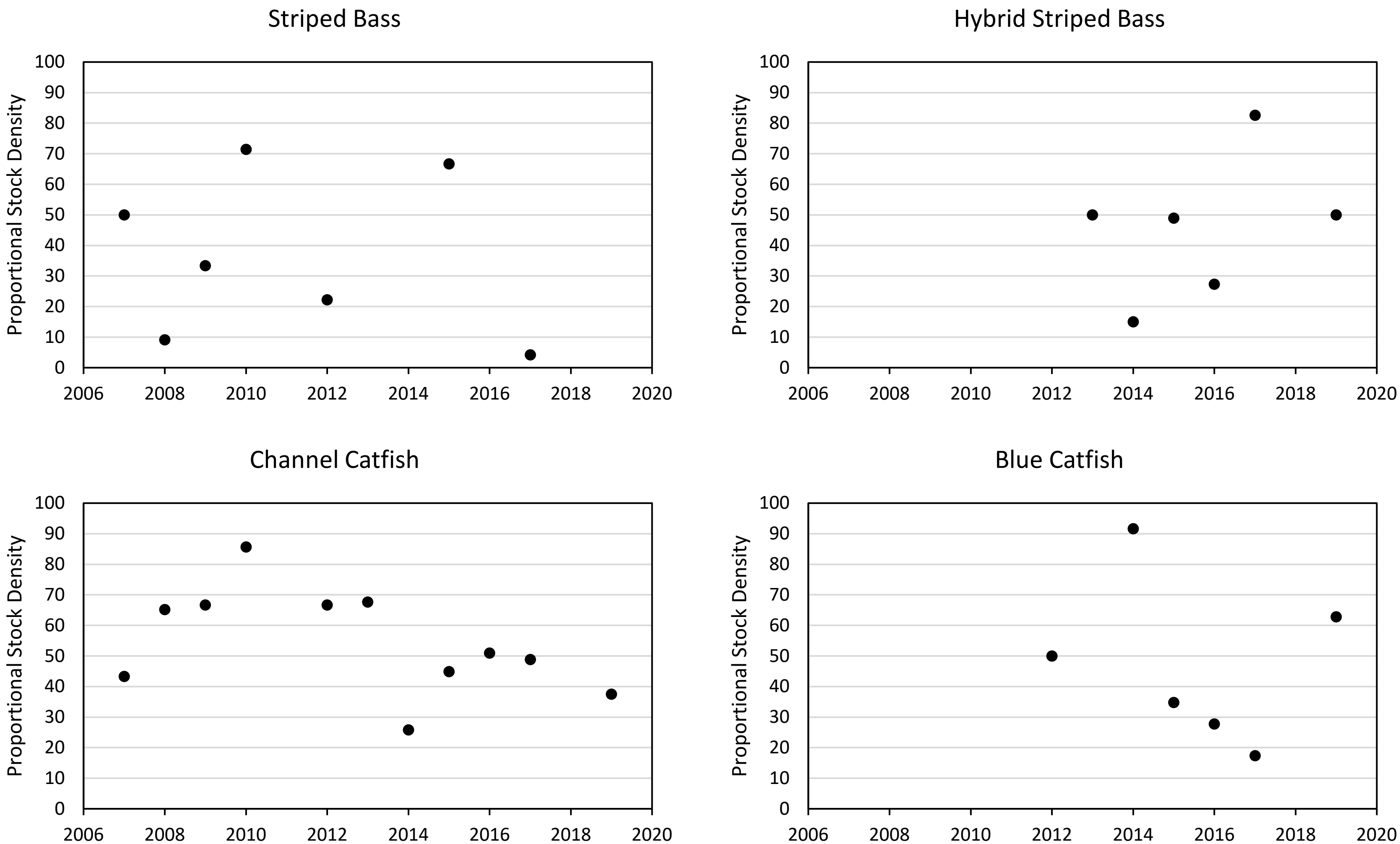

FIGURE 9 PROPORTIONAL STOCK DENSITY FOR STRIPED BASS, HYBRID BASS, CHANNEL CATFISH, AND BLUE CATFISH FROM GDNR STANDARDIZED SAMPLING ON LAKE JACKSON

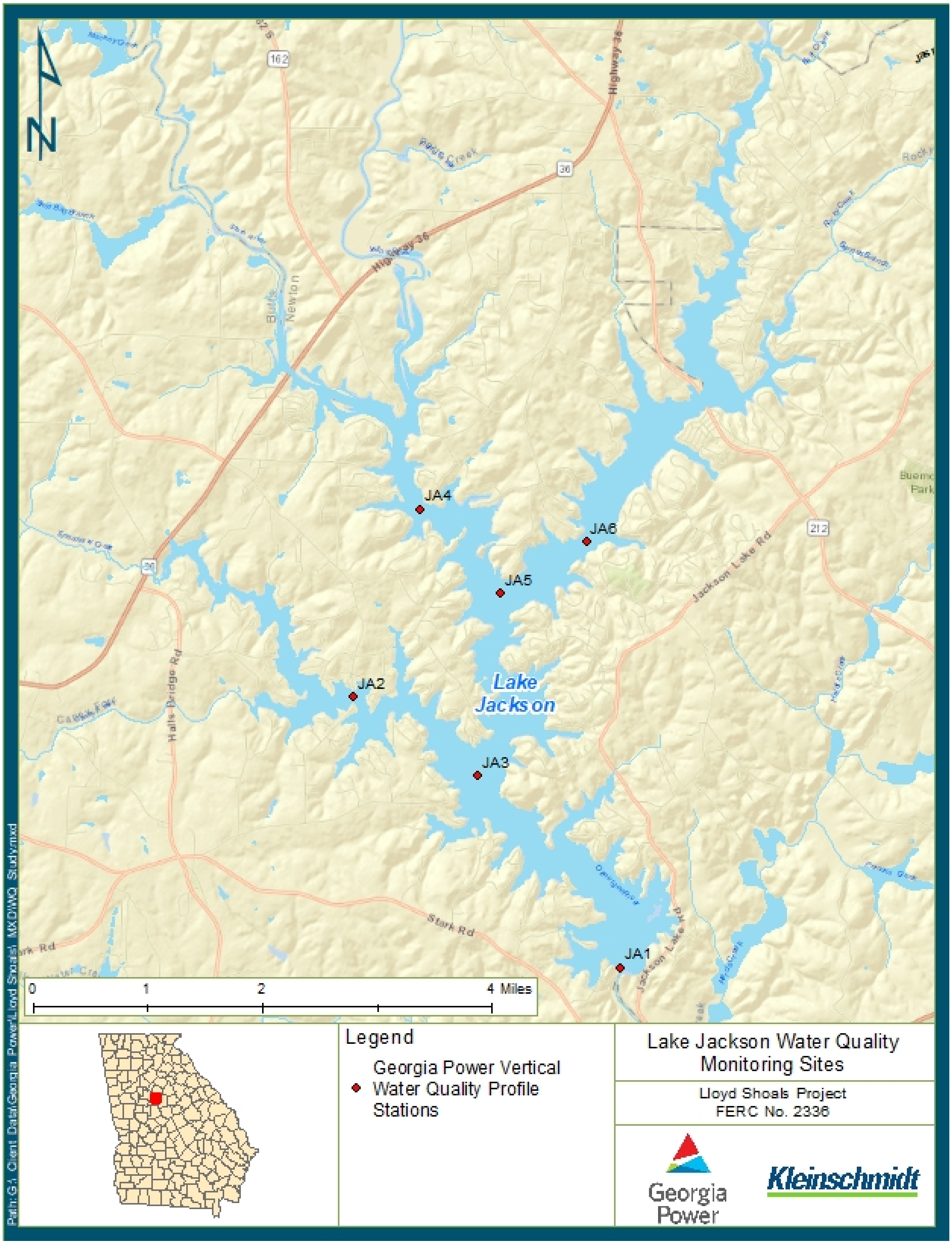

FIGURE 10 GEORGIA POWER VERTICAL WATER QUALITY PROFILE MONITORING LOCATIONS ON LAKE JACKSON

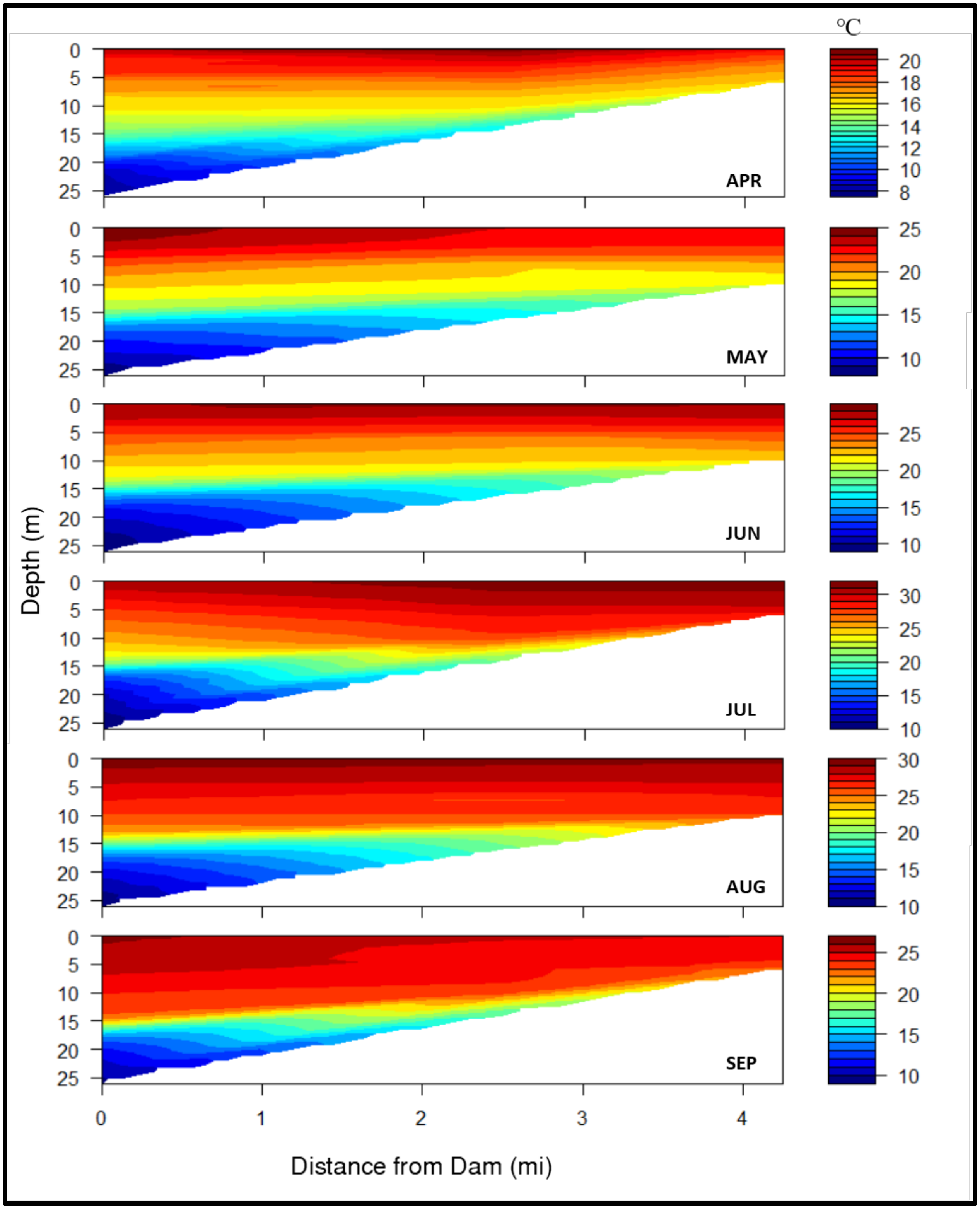

FIGURE 11 LONGITUDINAL VIEW OF LAKE JACKSON VERTICAL TEMPERATURE PROFILE DATA FROM THE FOREBAY (JA1), MID-LAKE (JA3), AND UPPER (JA5) STATIONS

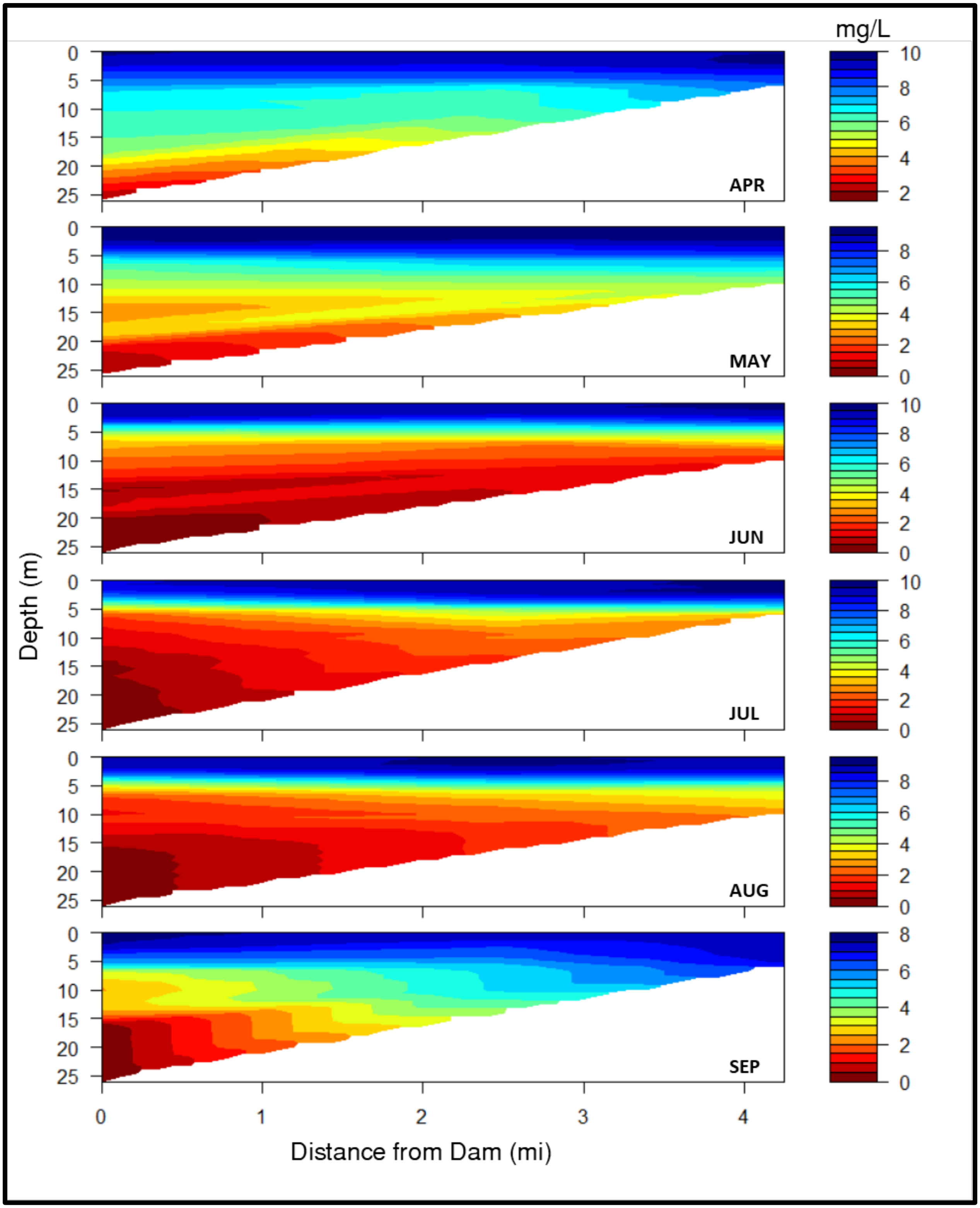

FIGURE 12 LONGITUDINAL VIEW OF LAKE JACKSON VERTICAL DO PROFILE DATA FROM THE FOREBAY (JA1), MID-LAKE (JA3), AND UPPER (JA5) STATIONS

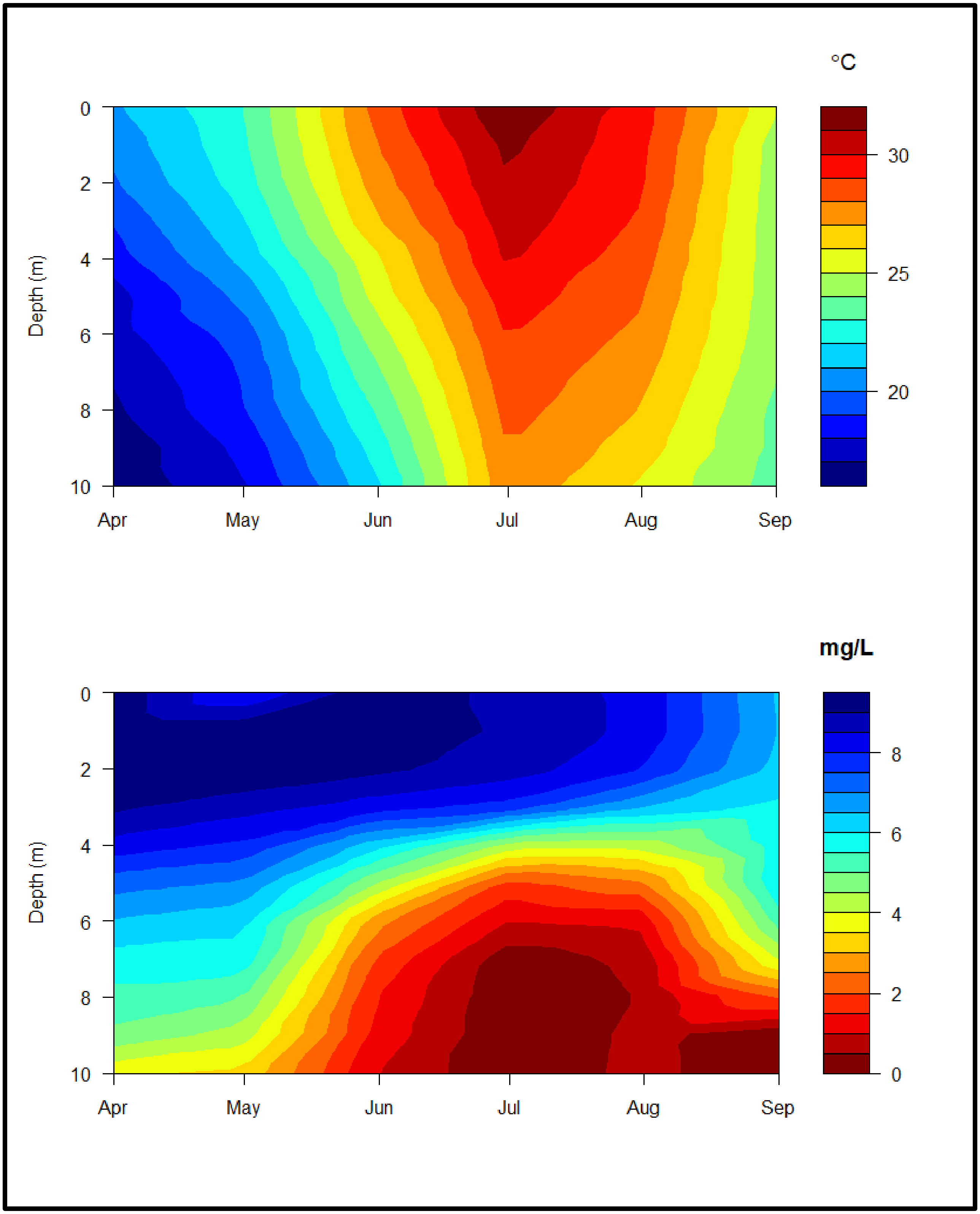

FIGURE 13 VERTICAL PROFILES OF WATER TEMPERATURE AND DISSOLVED OXYGEN IN THE TUSSAHAW CREEK ARM OF LAKE JACKSON (JA2)

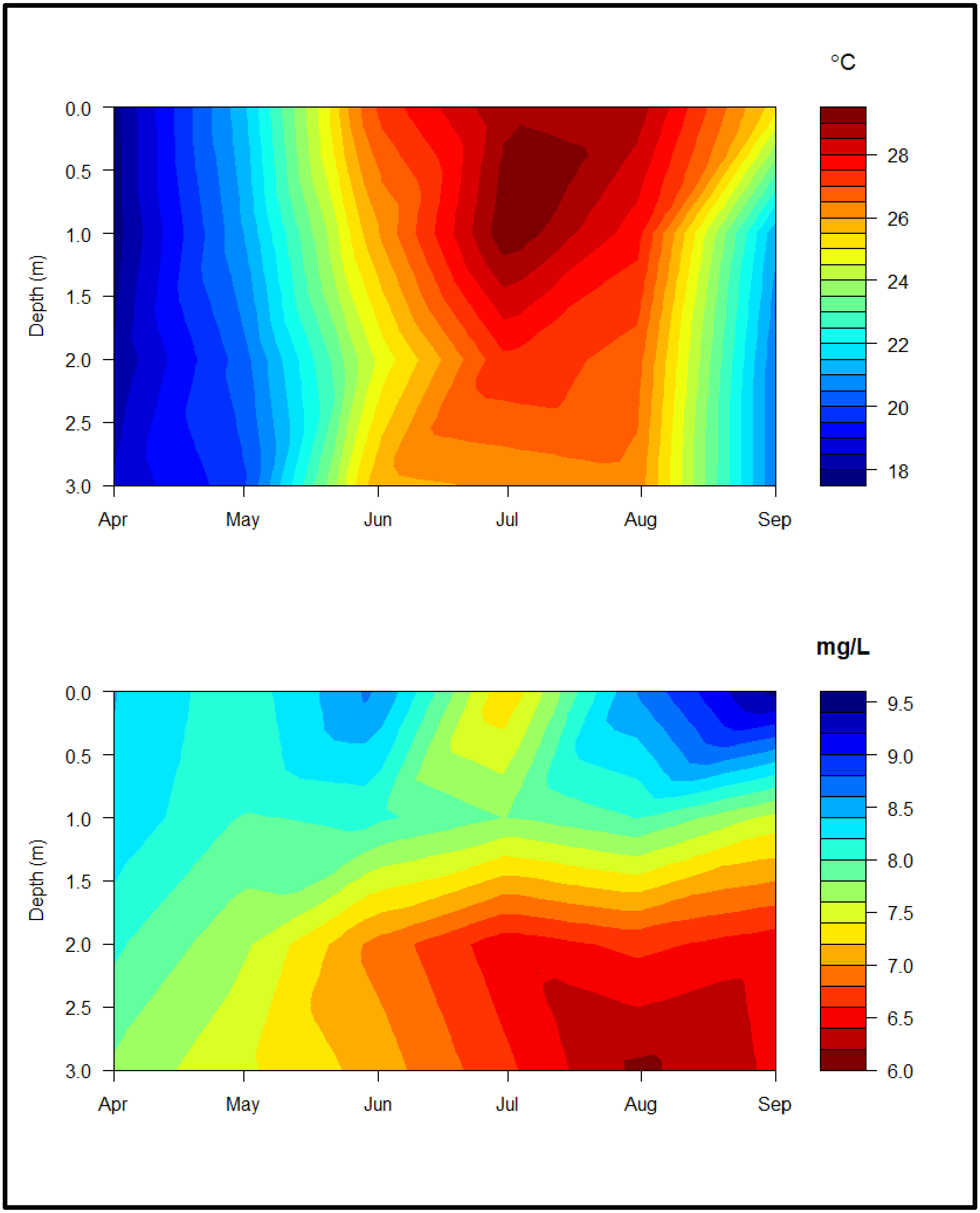

FIGURE 14 VERTICAL PROFILES OF WATER TEMPERATURE AND DISSOLVED OXYGEN IN THE YELLOW RIVER ARM OF LAKE JACKSON (JA4)

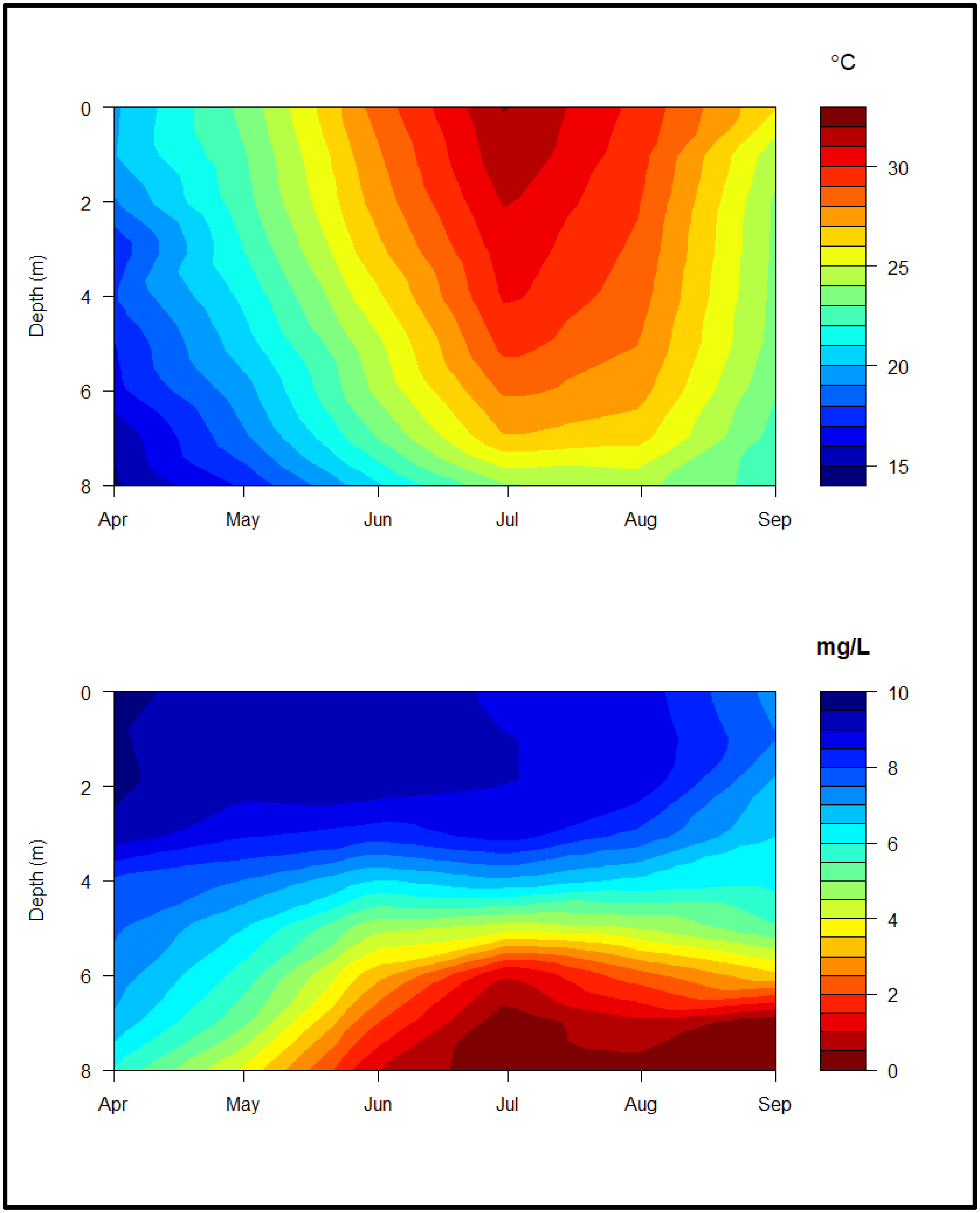

FIGURE 15 **VERTICAL PROFILES OF WATER TEMPERATURE AND DISSOLVED OXYGEN IN THE ALCOVY RIVER ARM OF LAKE JACKSON (JA6)**

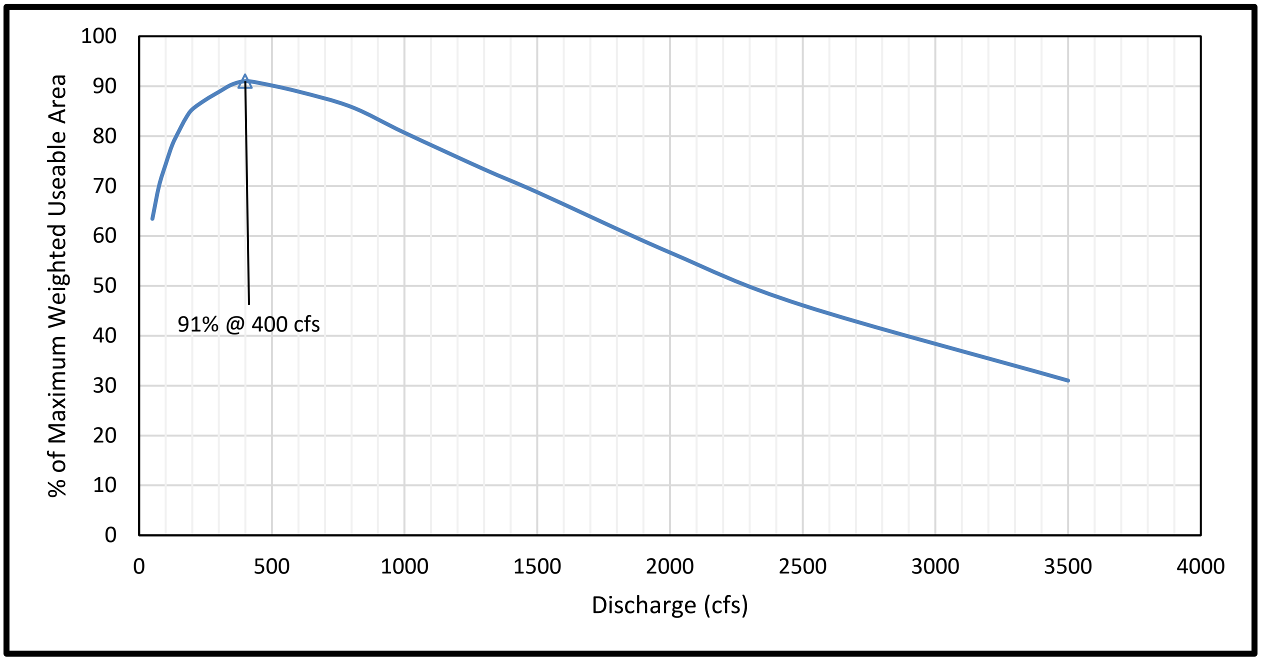

FIGURE 16 DISCHARGE AND PERCENTAGE OF MAXIMUM WEIGHTED USABLE AREA

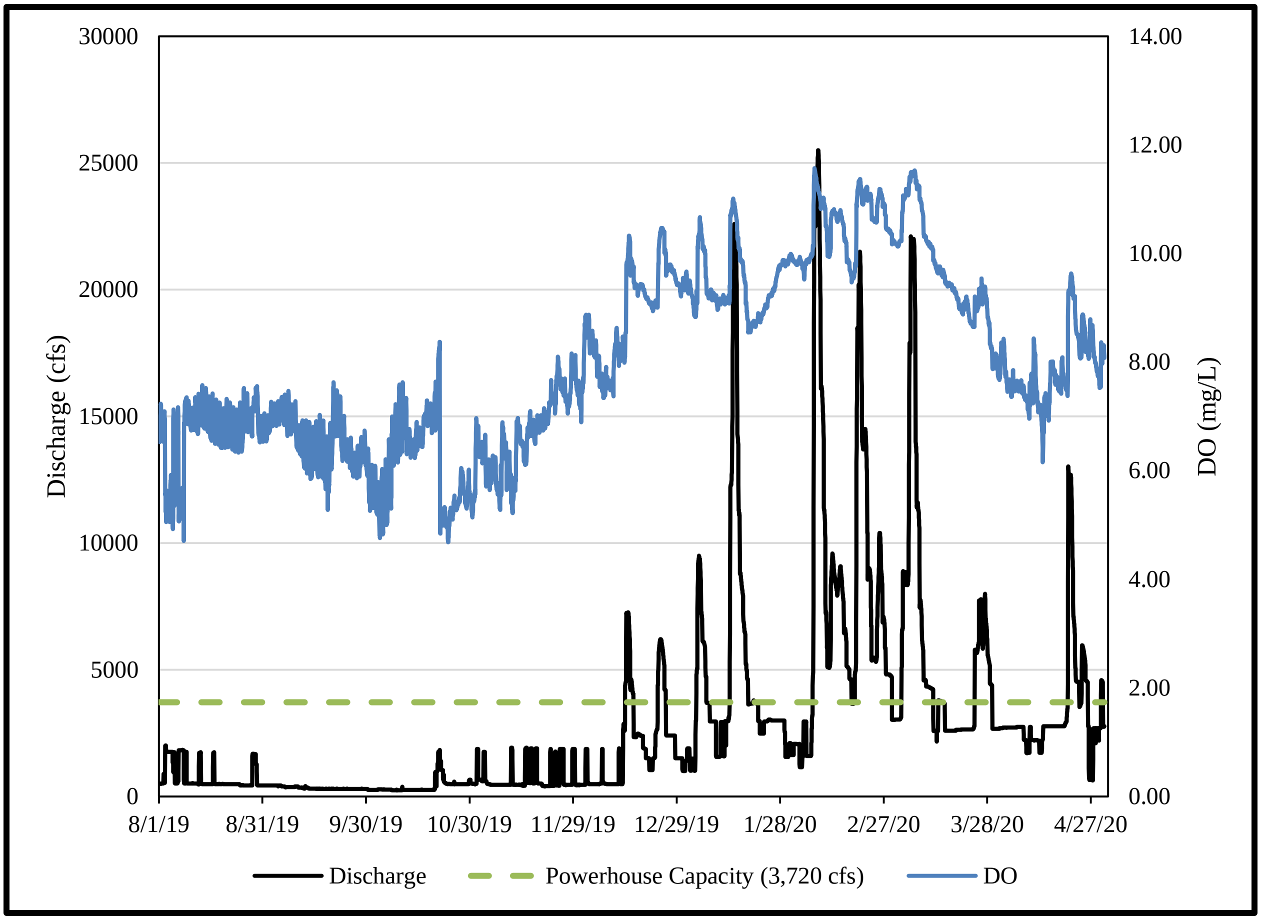

FIGURE 17 LLOYD SHOALS DAM DISCHARGE AND OCMULGEE RIVER DISSOLVED OXYGEN

APPENDIX A

WRD MUSSEL SURVEY REPORT FOR 2019

Altamaha Mollusk CCA progress, 2019

Fifty-five sites were surveyed within the Upper Ocmulgee River Between September and November 2019. Survey sites were distributed between four distinct reaches between Lake Jackson and the area immediately after the Juliette Dam. These four reaches were defined as Lake Jackson, Lloyd Shoals Tailrace, 16 Bridge to Juliette Dam, and Below Juliette Dam (figure 1-4). Of the locations specifically defined in the CCA scope of work, the initial Lloyd Shoals Tailrace initial survey has been completed. The Lake Jackson initial survey has been started but further surveys still remain to be conducted in the southern portion of the impoundment as delays acquiring dive gear and personnel, as well as weather (cold), precluded further surveys during this year's efforts. In order to assess the freshwater mussel populations in the defined upper Ocmulgee locations, Lake Jackson and the Lloyd Shoals, surveys were conducted downstream as far as Dames Ferry. Freshwater mussel species richness was similar across all reaches however species composition differed. (table 1, table 3, table 4, figures 4-14). Most notably was the presence of Elliptio dariensis, Elliptio arctata, and Villosa delumbis only below Juliette Dam. While very preliminary, this may indicate that the dam represents a barrier to these three species. Lampsilis splendida was in this group as well but a single adult male individual was collected in the 16 bridge to Juliette Dam reach midway through our 2019 survey efforts.

Length frequency histograms for species where sufficient numbers were collected across all sites Elliptio hopetonensis (figure 23), Pyganodon gibbosa (figure 27), Pyganodon cataracta (figure 26), and Utterbackia imbecillis (figure 29) population size structure followed expected bell-shaped curves with larger individuals dominating populations. Juveniles for all four of these species were collected at multiple locations and their low numbers are likely explained by size bias in sampling. Assessment of population size structure for less common species would be largely speculation are this point as an insufficient proportion of the population has been sampled.

Within Lake Jackson, two important findings were recorded. These included the lack of any live *Alasmidonta arcula* at any sites, and the collection of a single *Toxolasma pullus*. The lack of *A. arcula*, even at sites where they had been collected in 2012 is troubling. This may not indicate a real disappearance of the species and could be a explained by a lack of sufficient effort. More surveys still need to be conducted. The single *T. pullus* individual is an exciting finding as this represents a 377 river km extension of the known range of T. pullus in the Ocmulgee River. It also represents the only individual of *T. pullus* I know to have been collected from Lake Jackson.

Site Number	Field Number	Date	Reach	Species Richness	Est. Survey Area (m^2)	Survey Duration	Number of Collectors	Effort (pers./mins.)	CPUE
1	MTR20190924.1	9/24/2019	Lake Jackson	4	600	15	4	60	1.1000
2	MTR20190924.2	9/24/2019	Lake Jackson	3	1500	15	4	60	0.5167
3	MTR20190924.3	9/24/2019	Lake Jackson	2	450	15	4	60	0.0833
4	MTR20190926.1	9/26/2019	16 Br. to J. Dam	2	3000	30	2	60	1.2500
5	MTR20190926.2	9/26/2019	16 Br. to J. Dam	2	1000	30	2	60	1.4000
6	MTR20190926.3	9/26/2019	16 Br. to J. Dam	1	1500	30	2	60	0.7000
7	MTR20190926.4	9/26/2019	Below Juliette Dam	3	1200	30	2	60	0.6833
8	MTR20191001.1	10/1/2019	Tailrace	3	750	20	3	60	0.2667
9	MTR20191001.2	10/1/2019	Tailrace	4	240	21	3	60	0.3667
10	MTR20191001.3	10/1/2019	Tailrace	0	90	10	2	20	0.0000
11	MTR20191001.4	10/1/2019	Tailrace	3	600	20	3	60	1.2167
12	MTR20191001.5	10/1/2019	Tailrace	4	400	20	3	60	0.2167
13	MTR20191002.1	10/2/2019	Tailrace	1	1250	20	3	60	0.5500
14	MTR20191002.2	10/2/2019	Tailrace	3	800	20	3	60	0.0833
15	MTR20191002.3	10/2/2019	Tailrace	3	2500	20	3	60	0.1500
16	MTR20191002.4	10/2/2019	Tailrace	2	900	20	3	60	0.1000
17	MTR20191002.5	10/2/2019	Tailrace	3	500	20	3	60	1.2000
18	MTR20191002.6	10/2/2019	Tailrace	2	1125	20	3	60	0.2167
19	MTR20191003.1	10/3/2019	Tailrace	2	1000	20	3	60	0.3500
20	MTR20191003.2	10/3/2019	Tailrace	2	1000	20	3	60	0.4833
21	MTR20191003.3	10/3/2019	Below Juliette Dam	1	600	20	3	60	0.0833
22	MTR20191003.4	10/3/2019	Below Juliette Dam	1	600	20	3	60	0.0667
23	MTR20191003.5	10/3/2019	Below Juliette Dam	0	600	10	3	30	0.0000

24	MTR20191007.1	10/7/2019	Tailrace	4	900	20	3	60	0.5667
25	MTR20191007.2	10/7/2019	Tailrace	5	900	20	3	60	1.3833
26	MTR20191007.3	10/7/2019	Tailrace	5	750	20	3	60	0.9167
27	MTR20191010.1	10/10/2019	16 Br. to J. Dam	3	1000	20	4	80	1.6375
28	MTR20191010.2	10/10/2019	16 Br. to J. Dam	1	1600	15	4	60	0.0833
29	MTR20191010.3	10/10/2019	16 Br. to J. Dam	3	450	15	4	60	0.9333
30	MTR20191010.4	10/10/2019	16 Br. to J. Dam	2	600	15	4	60	0.4667
31	MTR20191010.5	10/10/2019	Below Juliette Dam	3	1200	15	4	60	0.3000
32	MTR20191010.6	10/10/2019	Below Juliette Dam	3	600	15	4	60	0.1167
33	MTR20191016.1	10/16/2019	Lake Jackson	2	160	30	2	60	0.2167
34	MTR20191016.2	10/16/2019	Lake Jackson	3	160	30	2	60	0.2167
35	MTR20191022.1	10/22/2019	Lake Jackson	1	160	30	2	60	0.0667
36	MTR20191022.2	10/22/2019	Lake Jackson	2	160	30	2	60	0.0667
37	MTR20191022.3	10/22/2019	Lake Jackson	4	200	30	2	60	0.1500
38	MTR20191022.4	10/22/2019	Lake Jackson	1	120	15	2	30	0.0667
39	MTR20191023.1	10/23/2019	Tailrace	4	160	30	2	60	0.2000
40	MTR20191023.2	10/23/2019	Tailrace	2	160	30	2	60	0.2333
41	MTR20191023.3	10/23/2019	Tailrace	3	160	30	2	60	0.1833
42	MTR20191023.4	10/23/2019	Tailrace	2	160	30	2	60	0.1167
43	MTR20191024.1	10/24/2019	Lake Jackson	2	160	30	2	60	0.0833
44	MTR20191024.2	10/24/2019	Lake Jackson	0	180	30	2	60	0.0000
45	MTR20191105.1	11/5/2019	Lake Jackson	2	1600	20	3	60	0.1500
46	MTR20191105.2	11/5/2019	Lake Jackson	3	1500	20	3	60	0.2500
47	MTR20191105.3	11/5/2019	Lake Jackson	3	1200	20	3	60	0.2333
48	MTR20191105.4	11/5/2019	Lake Jackson	2	1200	20	3	60	0.0833
49	MTR20191107.1	11/7/2019	Lake Jackson	0	1600	40	2	80	0.0000
50	MTR20191107.2	11/7/2019	Lake Jackson	1	2000	30	2	60	0.0167
51	MTR20191107.3	11/7/2019	Lake Jackson	2	800	30	2	60	0.1333
52	MTR20191107.4	11/7/2019	Lake Jackson	3	1000	30	2	60	0.2833
53	MTR20191122.1	11/22/2019	Lake Jackson	2	160	30	2	60	0.0333
54	MTR20191122.2	11/22/2019	Lake Jackson	3	160	30	2	60	1.1833

55	MTR20191122.3	11/22/2019	Lake Jackson	1	120	15	2	30	0.0333
	Total			43485			3210		

Table 1. Sites sampled within the Lake Jackson, Lloyd Shoals Tailrace, 16 bridge to Juliette Dam, and below Juliette Dam reaches of the upper Ocmulgee River during the 2019 field season.

Site Number	Field Number	Field Notes
1	MTR20190924.1	Sampled from docks at park just above dam on East shore. Area sampled extended from docks south and from shore to ~2.2 m of depth. Mussels found at all sampled depths. Deeper portions of area had a blanket of algae on the bottom.
2	MTR20190924.2	Shoreline gravel fill. Farther from shore substrate soft over sand. Mussels fairly evenly distributed at a moderate density. Sampled along shoreline south from GPS point about 2/3 of the way around the perimeter of cove
3	MTR20190924.3	Sampled at boat launch from shore. Substrate over packed sand with some silt and debris. Softer substrate started at around 6-7 ft. Too deep to sample all available habitat.
4	MTR20190926.1	Sampled 3 areas within site. Water was low and visibility was excellent. Sampled in the thalweg directly across from the launch, in a protected area downstream of launch on LDB, and west of the thalweg across from the launch. Exposed bedrock shoals upstream. mussels primarily found between rocks and in sheltered areas with sand and fine gravel.
5	MTR20190926.2	Accessed site from boat launch under bridge. Sampled both shores. Deep area upstream of ramp on LDB around submerged tree was productive. Middle of channel was a large shifting sand wedge with no mussels.
6	MTR20190926.3	Sampled shoreline of park up and downstream of boat launch. Primarily loose sand substrate with very low mussel density away from shore. Near-shore habitat was stabilized and was much better with good densities of E. hopetonensis.
7	MTR20190926.4	Sampled upstream from boat launch on RDB. Deep habitat along bank in scour around large submerged trees. Should revisit with dive gear. Mussel community differed from upstream of Juliette Dam. E. dariensis and V. delumbis were new species for the project in 2019. center channel habitat was bedrock and boulder. too deep to effectively search without SCUBA.
8	MTR20191001.1	Rocky substrate with a fine layer of silty material. Mussels primarily found in rock crevices. 1 P. gibbosa/cataracta shell found after survey/retained.
9	MTR20191001.2	Clay bank with a steep slope and a lot of LWD; Deep area was not sampled due to safety concerns.
10	MTR20191001.3	Exploratory search for 10 min., no unionids, solid bedrock, no habitats.
11	MTR20191001.4	Sampled area just upstream of bedrock outcrops. Substrate comprised of gravel, LWD, and corbicula shells. Relatively low energy area.
12	MTR20191001.5	Sampled around exposed bedrock outcrops in the middle of the river channel. Pockets of gravel distributed throughout holding mussels.
13	MTR20191002.1	Sampled both sides of the channel ~125 meters downstream from float barrier. Substrate primarily cobble along LDB and cobble/sand along RDB all mussels collected in cove on RDB.
14	MTR20191002.2	Sampled along RDB, lots of bedrock and large boulder. Very little substrate for mussels, live animals found in cracks. Lots of black-banded darters and Micropterus sp.

15	MTR20191002.3	Sampled along LDB in front of fishing beach. Shallow warm water shielded by bedrock upstream. Very few mussels in gravel with soft silt settled on top.
16	MTR20191002.4	Sampled along riffle perpendicular to flow. Boulder with gravel in between. No mussels found there. All mussels found in riffle along shore when PJD sampled along the bank.
17	MTR20191002.5	Steep bank habitat stabilized by submerged trees. Abundant mussels on upper portion of slope. Lower slope too deep to sample without SCUBA.
18	MTR20191002.6	Sampled starting on RDB and moving perpendicular to flow along the bridge. Water was deep on right band, shallowing towards left bank. Substrate bedrock and gravel with high density of Corbicula shells.
19	MTR20191003.1	Sampled pool between two riffle areas. Shoal bass and catfish and black-banded darter present. Gravel dominated by dead corbicula shells. Live adult Chinese mystery snail present and abundant.
20	MTR20191003.2	Sampled from LDB ~1/3rd across the channel. ~150m down from bridge. Habitat was riffle with predominantly pebble-stabilized sand acting as mussel habitat in pockets between boulder and bedrock. Sampled on west side of island.
21	MTR20191003.3	Accessed site from the "River House" resort. Sampled riffle habitat from LDB. Very high energy area. Mussels found in stabilized sand and gravel in pools and around LWD. ~500m downstream of dam.
22	MTR20191003.4	Sampled along RDB. Substrate coarse sand with overlying silt and LWD. Very deep off to right side many large fish… bass, striped bass, bowfin, LN gar, common carp, darter, catfish
23	MTR20191003.5	Sampled riffle along RDB below western island. Bedrock with patches of loose sand. Poor mussel substrate. No mussels found. Search terminated at .5 person hours.
24	MTR20191007.1	Sampled along RDB on east side of island. MTR sampled directly on bank, ARH sampled 5m off bank, and PJD sampled perpendicular to flow just above riffle at start. Mussels embedded in coarse sand between gravel and cobble.
25	MTR20191007.2	MTR and ARH sampled along RDB, and PJD sampled along island (LDB) on west side of island. Many mussels found along island in soft clay/silt substrate.
26	MTR20191007.3	Sampled up and downstream along steep slope on LDB. Soft substrate sloping down to deep water. Low energy area with no perceptible flow.
27	MTR20191010.1	Sampled along LDB just above spillway and powerhouse structure. Soft substrate sloping down to deeper water. Low flow. Many mussels.
28	MTR20191010.2	Sampled in the middle of the dam in shallow water. Substrate was large-grain shifty sand. Likely highly mobile at higher flows
29	MTR20191010.3	Sampled backwater along RDB behind park area. Very soft mud and silt substrate. Lots of water hyacinth along banks.
30	MTR20191010.4	Sampled along steep-soft slope on LDB. Wide slow section of river.
31	MTR20191010.5	Sampled at base of dam at the end of the path along the LDB. Pools in bedrock along base of dam.
32	MTR20191010.6	Sampled at base of dam near center of spillway in pools between bedrock.

33	MTR20191016.1	Sampled at bearing of 340° from GPS point. Encountered bridge construction debris and altered direction west to avoid entanglement. Substrate sandy with layer of silt on top. Many cans and bottles and fishing line. Large fish encountered but not identified.
34	MTR20191016.2	Sampled at 0° bearing from GPS point for 15 minutes and then moved NW on surface for ~100 ft and returned to boat at bearing of 210° while sampling for an additional 15 minutes. Substrate soft silt with numerous cans/bottles and trash. Encountered fish aggregator and bicycle. Chinese mystery snail shell.
35	MTR20191022.1	Middle channel, upstream of bridge.
36	MTR20191022.2	Site relatively uniform depth and substrate. Few mussels found.
37	MTR20191022.3	Sampled from western slope of old river channel up to near bank, then along bank at 10-15 ft of depth. Substrate near shore more sandy with considerably less silt. Relict A. arcula shell found off of boat docks at north end of transect.
38	MTR20191022.4	Lost weight belt at end of first 15-minute transect. Thus, only 0.5 person hour on this dive.
39	MTR20191023.1	Sampled parallel to river channel. Substrate bedrock/boulder on sand and gravel. Mussels in protected pockets of loose material and in cracks.
40	MTR20191023.2	High proportion of corbicula graves closer to bank
41	MTR20191023.3	Sampled from east of center channel slightly off parallel with flow towards LBD. Substrate bedrock/boulder with pockets of silty gravel.
42	MTR20191023.4	Sampled from east of center channel parallel to shore. Substrate primarily boulders and bedrock. Few mussels.
43	MTR20191024.1	GA212 bridge. Started at 2nd piling from west 350°, back 140° from boat at anchor. 2 live animals from shallower area near shore, none in channel.
44	MTR20191024.2	South of bridge just off Berry's marina.
45	MTR20191105.1	Sampled off of point on east side of lake in Alcovy arm just off of private boat launch. Substrate silty mud with sticks and logs. Shoreline artificially reinforced with gravel. Found midden with 100s of P. gibbosa shells but nothing else.
46	MTR20191105.2	Sampled site previously sampled by JMW in 2011 where A. arcula was found. No A. arcula found however first record of T. pullus from upper Ocmulgee, 377km range extension.
47	MTR20191105.3	Area previously noted to have multiple A. arcula but none were found
48	MTR20191105.4	Sampled area between and under docks in cove. Substrate soft and muddy. No A. arcula found
49	MTR20191107.1	Sampled along east bank of lake/river at site previously sampled by DNR. Substrate was packed sand and silt. Felt firm under boat but had no mussels. Few live corbicula and Campeloma snails. Water temperature was less than 17°C at ~15°C
50	MTR20191107.2	Sampled from east shore of branch out to center channel. Shallow area with 1-2 inch layer of silt and loose sand.
51	MTR20191107.3	Sampled along north shore around and under docks and boat lifts. Soft silt over sandy clay. Water temperature several degrees warmer than sites 1 and 2 and visibility was 1-2 ft. Large Chinese mystery snails observed alive.
52	MTR20191107.4	Sampled along cinderblock retaining wall

53	MTR20191122.1	Sampled towards shore @ 30° for 15 minutes then at 90° for 15 minutes only.
54	MTR20191122.2	Sampled in back of cove perpendicular to cove then redirected to parallel. Visibility was good enough to allow visual survey.
55	MTR20191122.3	Sampled perpendicular to bridge under bridge between pilings.

Table 2. Field notes for sites sampled within the Lake Jackson, Lloyd Shoals Tailrace, 16 bridge to Juliette Dam, and below Juliette Dam reaches of the upper Ocmulgee River during the 2019 field season.

Site Number	Field Number	Reach	*Alasmidonta arcula*	*Elliptio arctata*	*Elliptio dariensis*	*Elliptio hopetonensis*	*Elliptio icterina*	*Lampsilis splendida*	*Pyganodon cataracta*	*Pyganodon gibbosa*	*Toxolasma pullus*	*Utterbackia imbecillis*	*Villosa delumbis*	*Totals*
1	MTR20190924.1	Lake Jackson	--	--	--	61	--	--	1	3	--	1	--	66
2	MTR20190924.2	Lake Jackson	--	--	--	21	--	--	--	7	--	3	--	31
3	MTR20190924.3	Lake Jackson	--	--	--	--	--	--	--	4	--	1	--	5
4	MTR20190926.1	16 Br. to J. Dam	--	--	--	66	9	--	--	--	--	--	--	75
5	MTR20190926.2	16 Br. to J. Dam	--	--	--	83	1	--	--	--	--	--	--	84
6	MTR20190926.3	16 Br. to J. Dam	--	--	--	42	--	--	--	--	--	--	--	42
7	MTR20190926.4	Below Juliette Dam	--	--	17	23	--	--	--	--	--	--	1	41
8	MTR20191001.1	Tailrace	--	--	--	13	1	--	--	--	--	2	--	16
9	MTR20191001.2	Tailrace	--	--	--	12	--	--	2	1	--	7	--	22
10	MTR20191001.3	Tailrace	--	--	--	--	--	--	--	--	--	--	--	0
11	MTR20191001.4	Tailrace	--	--	--	67	--	--	5	--	--	1	--	73
12	MTR20191001.5	Tailrace	--	--	--	6	1	--	5	--	--	1	--	13
13	MTR20191002.1	Tailrace	--	--	--	33	--	--	--	--	--	--	--	33
14	MTR20191002.2	Tailrace	--	--	--	3	--	--	1	1	--	--	--	5
15	MTR20191002.3	Tailrace	--	--	--	3	--	--	3	--	--	3	--	9
16	MTR20191002.4	Tailrace	--	--	--	5	--	--	1	--	--	--	--	6

17	MTR20191002.5	Tailrace	--	--	--	29	--	--	21	--	--	22	--	72
18	MTR20191002.6	Tailrace	--	--	--	11	--	--	--	--	--	2	--	13
19	MTR20191003.1	Tailrace	--	--	--	11	--	--	10	--	--	--	--	21
20	MTR20191003.2	Tailrace	--	--	--	27	--	--	2	--	--	--	--	29
21	MTR20191003.3	Below Juliette Dam	--	--	--	5	--	--	--	--	--	--	--	5
22	MTR20191003.4	Below Juliette Dam	--	--	--	4	--	--	--	--	--	--	--	4
23	MTR20191003.5	Below Juliette Dam	--	--	--	--	--	--	--	--	--	--	--	0
24	MTR20191007.1	Tailrace	--	--	--	28	1	--	4	--	--	1	--	34
25	MTR20191007.2	Tailrace	--	--	--	52	--	1	19	6	--	5	--	83
26	MTR20191007.3	Tailrace	--	--	--	3	3	--	20	20	--	9	--	55
27	MTR20191010.1	16 Br. to J. Dam	--	--	--	127	--	--	--	2	--	2	--	131
28	MTR20191010.2	16 Br. to J. Dam	--	--	--	5	--	--	--	--	--	--	--	5
29	MTR20191010.3	16 Br. to J. Dam	--	--	--	2	--	--	--	9	--	45	--	56
30	MTR20191010.4	16 Br. to J. Dam	--	--	--	26	2	--	--	--	--	--	--	28
31	MTR20191010.5	Below Juliette Dam	--	1	3	14	--	--	--	--	--	--	--	18
32	MTR20191010.6	Below Juliette Dam	--	1	--	5	--	--	--	--	--	--	1	7
33	MTR20191016.1	Lake Jackson	--	--	--	--	--	--	--	9	--	4	--	13
34	MTR20191016.2	Lake Jackson	--	--	--	4	--	--	1	8	--	--	--	13
35	MTR20191022.1	Lake Jackson	--	--	--	--	--	--	--	4	--	--	--	4
36	MTR20191022.2	Lake Jackson	--	--	--	--	--	--	--	3	--	1	--	4
37	MTR20191022.3	Lake Jackson	1	--	--	1	--	--	--	4	--	3	--	9

38	MTR20191022.4	Lake Jackson	--	--	--	2	--	--	--	--	--	--	--	2
39	MTR20191023.1	Tailrace	--	--	--	7	--	--	1	1	--	3	--	12
40	MTR20191023.2	Tailrace	--	--	--	13	--	--	1	--	--	--	--	14
41	MTR20191023.3	Tailrace	--	--	--	8	--	--	1	--	--	2	--	11
42	MTR20191023.4	Tailrace	--	--	--	4	--	--	--	--	--	3	--	7
43	MTR20191024.1	Lake Jackson	--	--	--	--	--	--	--	3	--	2	--	5
44	MTR20191024.2	Lake Jackson	--	--	--	--	--	--	--	--	--	--	--	0
45	MTR20191105.1	Lake Jackson	--	--	--	--	--	--	--	8	--	1	--	9
46	MTR20191105.2	Lake Jackson	--	--	--	--	--	--	--	12	1	2	--	15
47	MTR20191105.3	Lake Jackson	--	--	--	1	--	--	--	12	--	1	--	14
48	MTR20191105.4	Lake Jackson	--	--	--	--	--	--	--	1	--	4	--	5
49	MTR20191107.1	Lake Jackson	--	--	--	--	--	--	--	--	--	--	--	0
50	MTR20191107.2	Lake Jackson	--	--	--	--	--	--	--	--	--	1	--	1
51	MTR20191107.3	Lake Jackson	--	--	--	--	--	--	--	5	--	3	--	8
52	MTR20191107.4	Lake Jackson	--	--	--	9	--	--	--	7	--	1	--	17
53	MTR20191122.1	Lake Jackson	--	--	--	--	--	--	--	1	--	1	--	2
54	MTR20191122.2	Lake Jackson	--	--	--	4	--	--	--	53	--	14	--	71
55	MTR20191122.3	Lake Jackson	--	--	--	--	--	--	--	1	--	--	--	1
Totals			1	2	20	840	18	1	98	185	1	151	2	1319

Table 3. Counts of freshwater mussels collected from sites sampled within the Lake Jackson, Lloyd Shoals Tailrace, 16 bridge to Juliette Dam, and below Juliette Dam reaches of the upper Ocmulgee River during the 2019 field season.

Site Number	Field Number	Reach	*Alasmidonta arcula*	*Elliptio arctata*	*Elliptio dariensis*	*Elliptio hopetonensis*	*Elliptio icterina*	*Lampsilis splendida*	*Pyganodon cataracta*	*Pyganodon gibbosa*	*Toxolasma pullus*	*Utterbackia imbecillis*	*Villosa delumbis*
1	MTR20190924.1	Lake Jackson	--	--	--	92.4	--	--	1.5	4.5	--	1.5	--
2	MTR20190924.2	Lake Jackson	--	--	--	67.7	--	--	--	22.6	--	9.7	--
3	MTR20190924.3	Lake Jackson	--	--	--	--	--	--	--	80.0	--	20.0	--
4	MTR20190926.1	16 Br. to J. Dam	--	--	--	88.0	12.0	--	--	--	--	--	--
5	MTR20190926.2	16 Br. to J. Dam	--	--	--	98.8	1.2	--	--	--	--	--	--
6	MTR20190926.3	16 Br. to J. Dam	--	--	--	100.0	--	--	--	--	--	--	--
7	MTR20190926.4	Below Juliette Dam	--	--	41.5	56.1	--	--	--	--	--	--	2.4
8	MTR20191001.1	Tailrace	--	--	--	81.3	6.3	--	--	--	--	12.5	--
9	MTR20191001.2	Tailrace	--	--	--	54.5	--	--	9.1	4.5	--	31.8	--
10	MTR20191001.3	Tailrace	--	--	--	--	--	--	--	--	--	--	--
11	MTR20191001.4	Tailrace	--	--	--	91.8	--	--	6.8	--	--	1.4	--
12	MTR20191001.5	Tailrace	--	--	--	46.2	7.7	--	38.5	--	--	7.7	--
13	MTR20191002.1	Tailrace	--	--	--	100.0	--	--	--	--	--	--	--
14	MTR20191002.2	Tailrace	--	--	--	60.0	--	--	20.0	20.0	--	--	--
15	MTR20191002.3	Tailrace	--	--	--	33.3	--	--	33.3	--	--	33.3	--
16	MTR20191002.4	Tailrace	--	--	--	83.3	--	--	16.7	--	--	--	--
17	MTR20191002.5	Tailrace	--	--	--	40.3	--	--	29.2	--	--	30.6	--
18	MTR20191002.6	Tailrace	--	--	--	84.6	--	--	--	--	--	15.4	--
19	MTR20191003.1	Tailrace	--	--	--	52.4	--	--	47.6	--	--	--	--
20	MTR20191003.2	Tailrace	--	--	--	93.1	--	--	6.9	--	--	--	--
21	MTR20191003.3	Below Juliette Dam	--	--	--	100.0	--	--	--	--	--	--	--
22	MTR20191003.4	Below Juliette Dam	--	--	--	100.0	--	--	--	--	--	--	--

23	MTR20191003.5	Below Juliette Dam	--	--	--	--	--	--	--	--	--	--	--
24	MTR20191007.1	Tailrace	--	--	--	82.4	2.9	--	11.8	--	--	2.9	--
25	MTR20191007.2	Tailrace	--	--	--	62.7	--	1.2	22.9	7.2	--	6.0	--
26	MTR20191007.3	Tailrace	--	--	--	5.5	5.5	--	36.4	36.4	--	16.4	--
27	MTR20191010.1	16 Br. to J. Dam	--	--	--	96.9	--	--	--	1.5	--	1.5	--
28	MTR20191010.2	16 Br. to J. Dam	--	--	--	100.0	--	--	--	--	--	--	--
29	MTR20191010.3	16 Br. to J. Dam	--	--	--	3.6	--	--	--	16.1	--	80.4	--
30	MTR20191010.4	16 Br. to J. Dam	--	--	--	92.9	7.1	--	--	--	--	--	--
31	MTR20191010.5	Below Juliette Dam	--	5.6	16.7	77.8	--	--	--	--	--	--	--
32	MTR20191010.6	Below Juliette Dam	--	14.3	--	71.4	--	--	--	--	--	--	14.3
33	MTR20191016.1	Lake Jackson	--	--	--	--	--	--	--	69.2	--	30.8	--
34	MTR20191016.2	Lake Jackson	--	--	--	30.8	--	--	7.7	61.5	--	--	--
35	MTR20191022.1	Lake Jackson	--	--	--	--	--	--	--	100.0	--	--	--
36	MTR20191022.2	Lake Jackson	--	--	--	--	--	--	--	75.0	--	25.0	--
37	MTR20191022.3	Lake Jackson	11.1	--	--	11.1	--	--	--	44.4	--	33.3	--
38	MTR20191022.4	Lake Jackson	--	--	--	100.0	--	--	--	--	--	--	--
39	MTR20191023.1	Tailrace	--	--	--	58.3	--	--	8.3	8.3	--	25.0	--
40	MTR20191023.2	Tailrace	--	--	--	92.9	--	--	7.1	--	--	--	--
41	MTR20191023.3	Tailrace	--	--	--	72.7	--	--	9.1	--	--	18.2	--
42	MTR20191023.4	Tailrace	--	--	--	57.1	--	--	--	--	--	42.9	--
43	MTR20191024.1	Lake Jackson	--	--	--	--	--	--	--	60.0	--	40.0	--
44	MTR20191024.2	Lake Jackson	--	--	--	--	--	--	--	--	--	--	--
45	MTR20191105.1	Lake Jackson	--	--	--	--	--	--	--	88.9	--	11.1	--
46	MTR20191105.2	Lake Jackson	--	--	--	--	--	--	--	80.0	6.7	13.3	--
47	MTR20191105.3	Lake Jackson	--	--	--	7.1	--	--	--	85.7	--	7.1	--
48	MTR20191105.4	Lake Jackson	--	--	--	--	--	--	--	20.0	--	80.0	--
49	MTR20191107.1	Lake Jackson	--	--	--	--	--	--	--	--	--	--	--
50	MTR20191107.2	Lake Jackson	--	--	--	--	--	--	--	--	--	100.0	--
51	MTR20191107.3	Lake Jackson	--	--	--	--	--	--	--	62.5	--	37.5	--
52	MTR20191107.4	Lake Jackson	--	--	--	52.9	--	--	--	41.2	--	5.9	--
53	MTR20191122.1	Lake Jackson	--	--	--	--	--	--	--	50.0	--	50.0	--

54	MTR20191122.2	Lake Jackson	--	--	--	5.6	--	--	--	74.6	--	19.7	--
55	MTR20191122.3	Lake Jackson	--	--	--	--	--	--	--	100.0	--	--	--
Totals			0.1	0.2	1.5	63.7	1.4	0.1	7.4	14.0	0.1	11.4	0.2

Table 4. Percentage composition of freshwater mussel species collected at Sites sampled within the Lake Jackson, Lloyd Shoals Tailrace, 16 bridge to Juliette Dam, and below Juliette Dam reaches of the upper Ocmulgee River during the 2019 field season.

Site Number	Field Number	Reach	*Alasmidonta arcula*	*Elliptio arctata*	*Elliptio dariensis*	*Elliptio hopetonensis*	*Elliptio icterina*	*Lampsilis splendida*	*Pyganodon cataracta*	*Pyganodon gibbosa*	*Toxolasma pullus*	*Utterbackia imbecillis*
1	MTR20190924.1	Lake Jackson	--	--	--	1.54	--	--	0.03	0.08	--	0.03
2	MTR20190924.2	Lake Jackson	--	--	--	1.13	--	--	--	0.38	--	0.16
3	MTR20190924.3	Lake Jackson	--	--	--	--	--	--	--	1.33	--	0.33
4	MTR20190926.1	16 Br. to J. Dam	--	--	--	1.47	0.20	--	--	--	--	--
5	MTR20190926.2	16 Br. to J. Dam	--	--	--	1.65	0.02	--	--	--	--	--
6	MTR20190926.3	16 Br. to J. Dam	--	--	--	1.67	--	--	--	--	--	--
7	MTR20190926.4	Below Juliette Dam	--	--	0.69	0.93	--	--	--	--	--	--
8	MTR20191001.1	Tailrace	--	--	--	1.35	0.10	--	--	--	--	0.21
9	MTR20191001.2	Tailrace	--	--	--	0.91	--	--	0.15	0.08	--	0.53
10	MTR20191001.3	Tailrace	--	--	--	--	--	--	--	--	--	--
11	MTR20191001.4	Tailrace	--	--	--	1.53	--	--	0.11	--	--	0.02
12	MTR20191001.5	Tailrace	--	--	--	0.77	0.13	--	0.64	--	--	0.13
13	MTR20191002.1	Tailrace	--	--	--	1.67	--	--	--	--	--	--
14	MTR20191002.2	Tailrace	--	--	--	1.00	--	--	0.33	0.33	--	--
15	MTR20191002.3	Tailrace	--	--	--	0.56	--	--	0.56	--	--	0.56
16	MTR20191002.4	Tailrace	--	--	--	1.39	--	--	0.28	--	--	--
17	MTR20191002.5	Tailrace	--	--	--	0.67	--	--	0.49	--	--	0.51
18	MTR20191002.6	Tailrace	--	--	--	1.41	--	--	--	--	--	0.26
19	MTR20191003.1	Tailrace	--	--	--	0.87	--	--	0.79	--	--	--
20	MTR20191003.2	Tailrace	--	--	--	1.55	--	--	0.11	--	--	--
21	MTR20191003.3	Below Juliette Dam	--	--	--	1.67	--	--	--	--	--	--
22	MTR20191003.4	Below Juliette Dam	--	--	--	1.67	--	--	--	--	--	--

23	MTR20191003.5	Below Juliette Dam	--	--	--	--	--	--	--	--	--	--
24	MTR20191007.1	Tailrace	--	--	--	1.37	0.05	--	0.20	--	--	0.05
25	MTR20191007.2	Tailrace	--	--	--	1.04	--	0.02	0.38	0.12	--	0.10
26	MTR20191007.3	Tailrace	--	--	--	0.09	0.09	--	0.61	0.61	--	0.27
27	MTR20191010.1	16 Br. to J. Dam	--	--	--	1.21	--	--	--	0.02	--	0.02
28	MTR20191010.2	16 Br. to J. Dam	--	--	--	1.67	--	--	--	--	--	--
29	MTR20191010.3	16 Br. to J. Dam	--	--	--	0.06	--	--	--	0.27	--	1.34
30	MTR20191010.4	16 Br. to J. Dam	--	--	--	1.55	0.12	--	--	--	--	--
31	MTR20191010.5	Below Juliette Dam	--	0.09	0.28	1.30	--	--	--	--	--	--
32	MTR20191010.6	Below Juliette Dam	--	0.24	--	1.19	--	--	--	--	--	--
33	MTR20191016.1	Lake Jackson	--	--	--	--	--	--	--	1.15	--	0.51
34	MTR20191016.2	Lake Jackson	--	--	--	0.51	--	--	0.13	1.03	--	--
35	MTR20191022.1	Lake Jackson	--	--	--	--	--	--	--	1.67	--	--
36	MTR20191022.2	Lake Jackson	--	--	--	--	--	--	--	1.25	--	0.42
37	MTR20191022.3	Lake Jackson	0.19	--	--	0.19	--	--	--	0.74	--	0.56
38	MTR20191022.4	Lake Jackson	--	--	--	3.33	--	--	--	--	--	--
39	MTR20191023.1	Tailrace	--	--	--	0.97	--	--	0.14	0.14	--	0.42
40	MTR20191023.2	Tailrace	--	--	--	1.55	--	--	0.12	--	--	--
41	MTR20191023.3	Tailrace	--	--	--	1.21	--	--	0.15	--	--	0.30
42	MTR20191023.4	Tailrace	--	--	--	0.95	--	--	--	--	--	0.71
43	MTR20191024.1	Lake Jackson	--	--	--	--	--	--	--	1.00	--	0.67
44	MTR20191024.2	Lake Jackson	--	--	--	--	--	--	--	--	--	--
45	MTR20191105.1	Lake Jackson	--	--	--	--	--	--	--	1.48	--	0.19
46	MTR20191105.2	Lake Jackson	--	--	--	--	--	--	--	1.33	0.11	0.22
47	MTR20191105.3	Lake Jackson	--	--	--	0.12	--	--	--	1.43	--	0.12
48	MTR20191105.4	Lake Jackson	--	--	--	--	--	--	--	0.33	--	1.33
49	MTR20191107.1	Lake Jackson	--	--	--	--	--	--	--	--	--	--
50	MTR20191107.2	Lake Jackson	--	--	--	--	--	--	--	--	--	1.67
51	MTR20191107.3	Lake Jackson	--	--	--	--	--	--	--	1.04	--	0.63
52	MTR20191107.4	Lake Jackson	--	--	--	0.88	--	--	--	0.69	--	0.10
53	MTR20191122.1	Lake Jackson	--	--	--	--	--	--	--	0.83	--	0.83

54	MTR20191122.2	Lake Jackson	--	--	--	0.09	--	--	--	1.24	--	0.33
55	MTR20191122.3	Lake Jackson	--	--	--	--	--	--	--	3.33	--	--
Totals			0.00	0.00	0.01	0.26	0.01	0.00	0.03	0.06	0.00	0.05

Table 5. Catch per unit effort (CPUE) expressed in mussels found per person-hour of search effort for freshwater mussels collected at sites sampled within the Lake Jackson, Lloyd Shoals Tailrace, 16 bridge to Juliette Dam, and below Juliette Dam reaches of the upper Ocmulgee River during the 2019 field season.

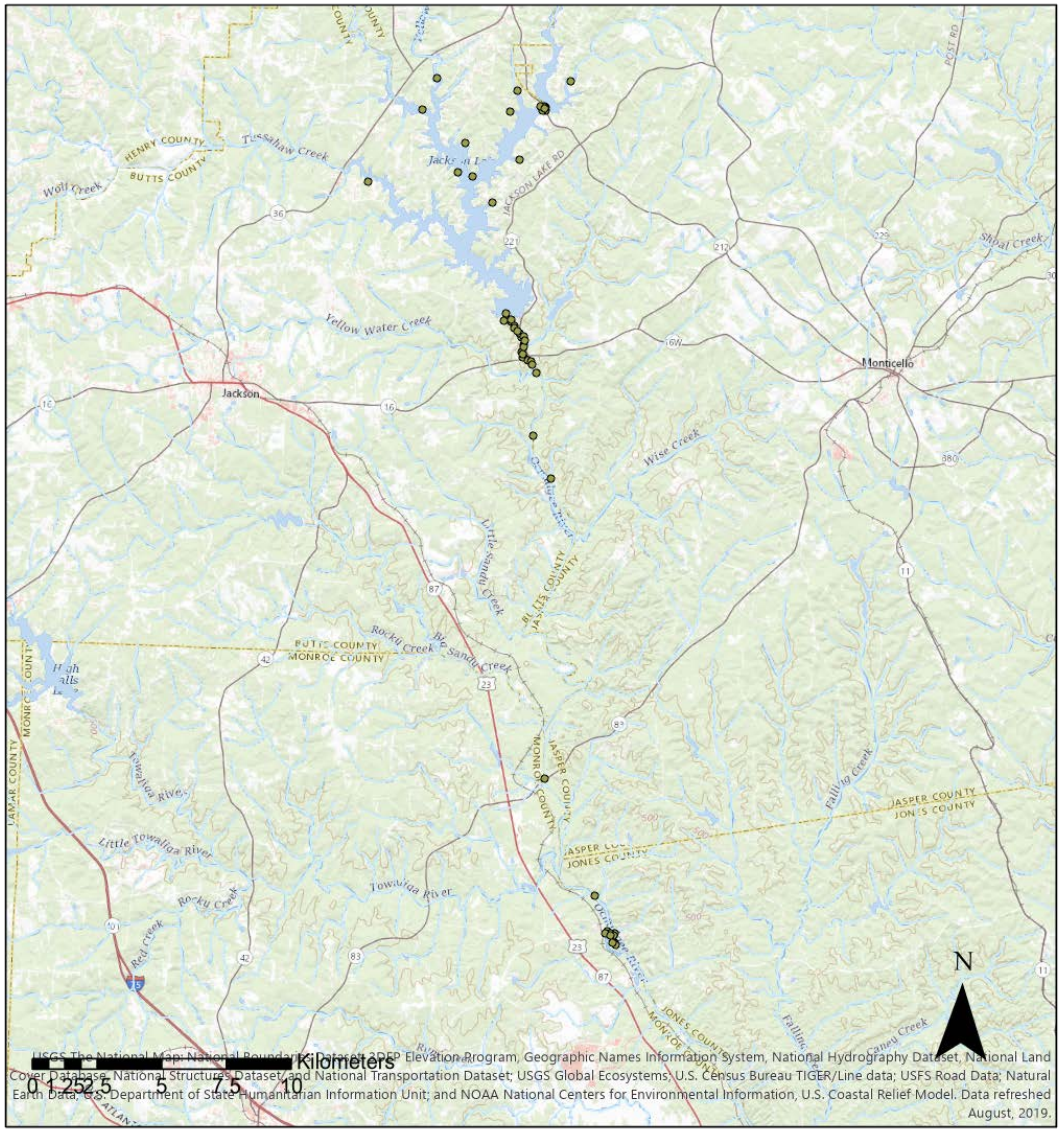

Figure 1. Full extent of sample sites within the upper Ocmulgee river sampled for freshwater mussels during the 2019 field season.

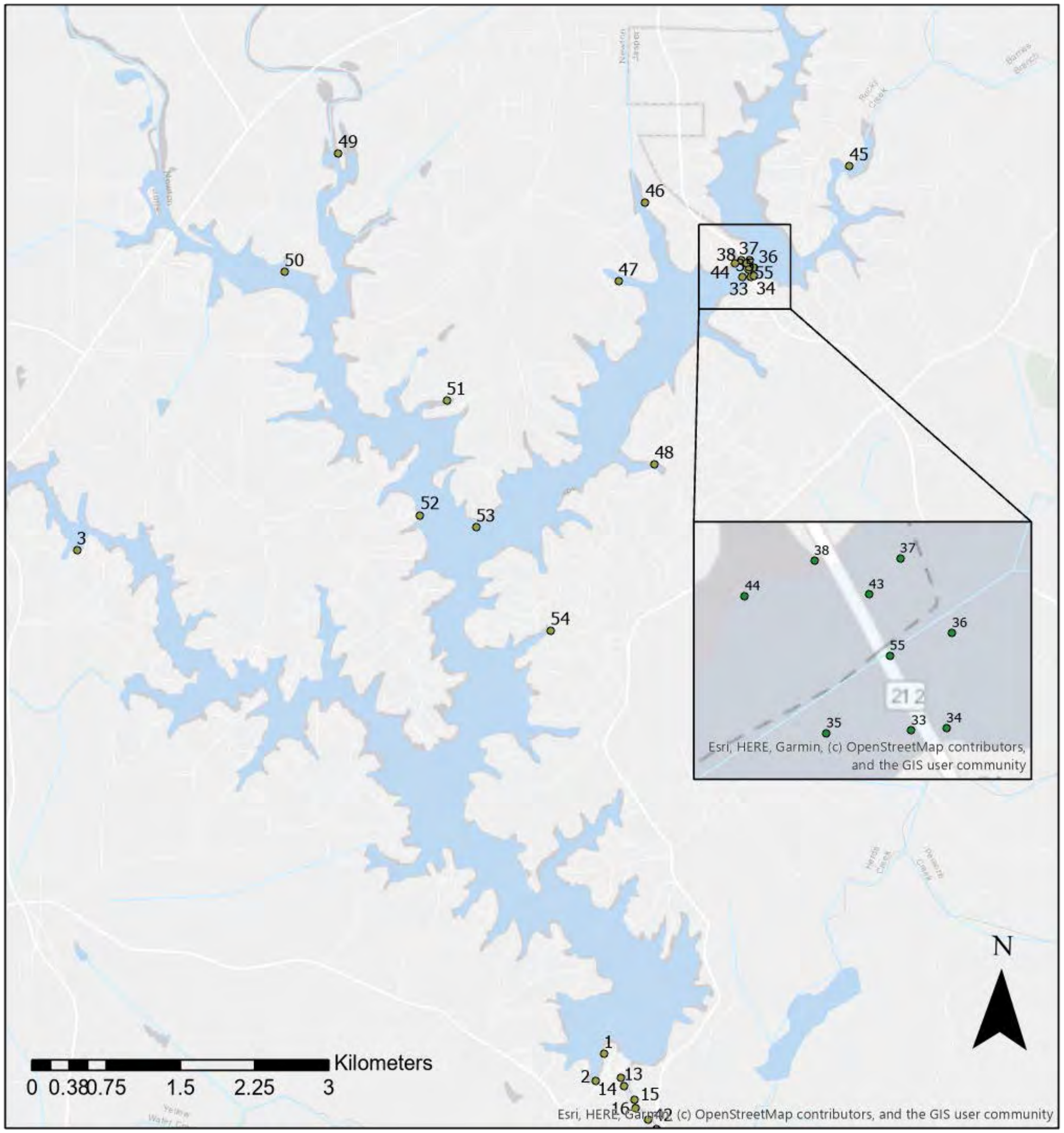

Figure 2. Sites sampled for freshwater mussels in the Lake Jackson reach of the upper Ocmulgee River during the 2019 field season.

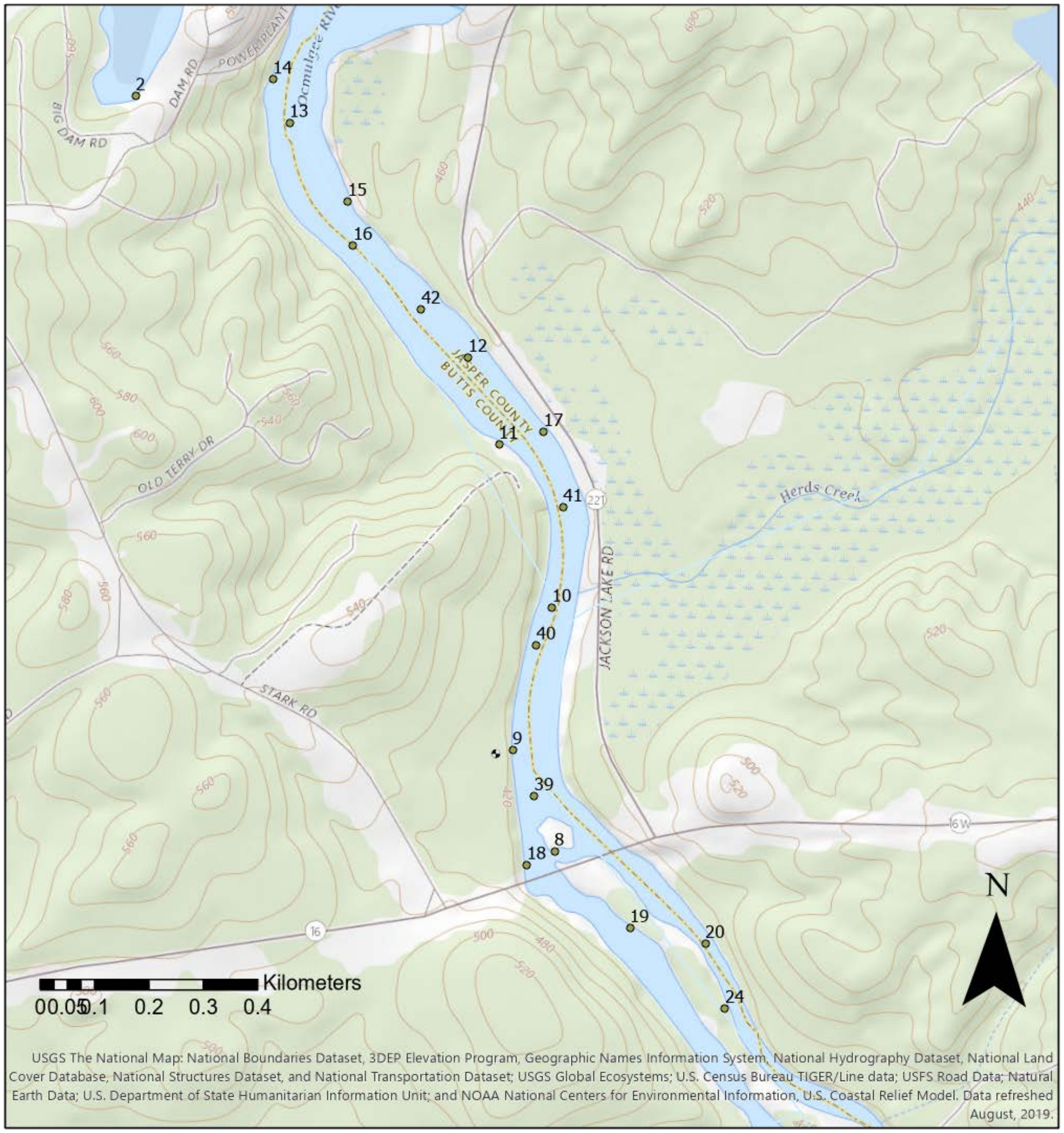

Figure 3. Sites sampled for freshwater mussels in the Lloyd Shoals Tailrace reach of the upper Ocmulgee River during the 2019 field season.

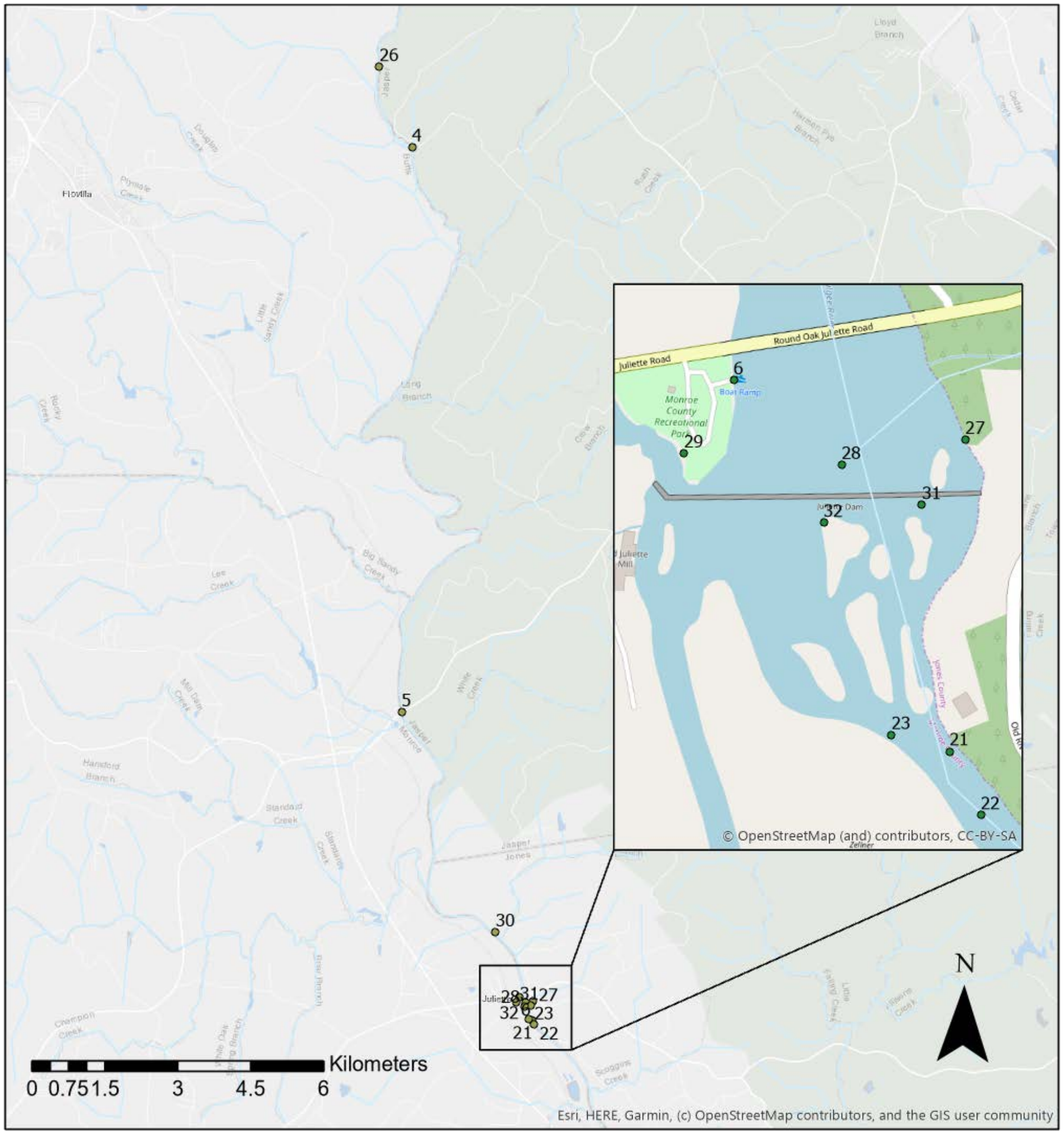

Figure 4. Sites sampled for freshwater mussels in the 16 bridge to Juliette Dam reach of the upper Ocmulgee River during the 2019 field season.

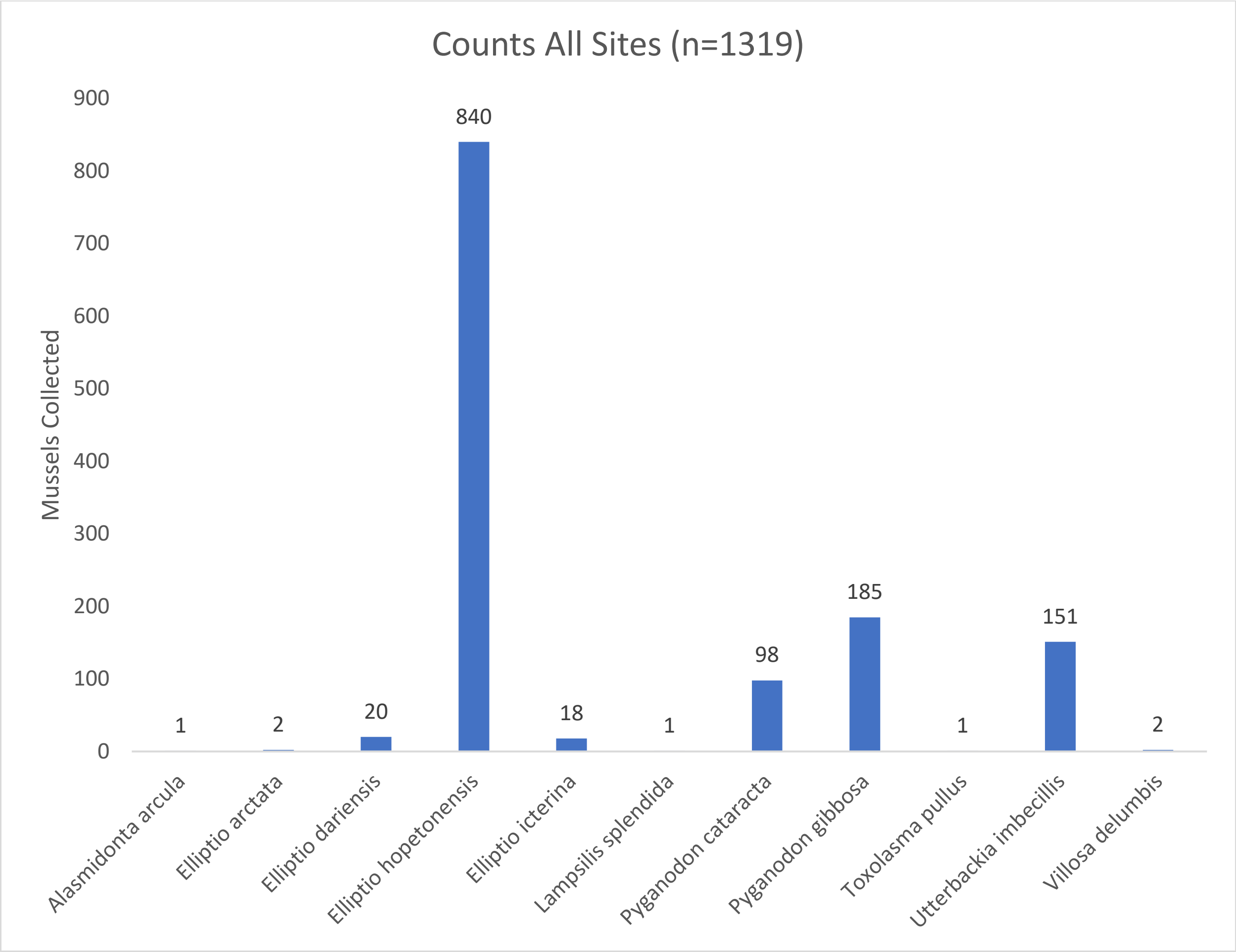

Figure 5. Counts of freshwater mussels collected from all sites sampled within the Lake Jackson, Lloyd Shoals Tailrace, 16 bridge to Juliette Dam, and below Juliette Dam reaches of the upper Ocmulgee River during the 2019 field season.

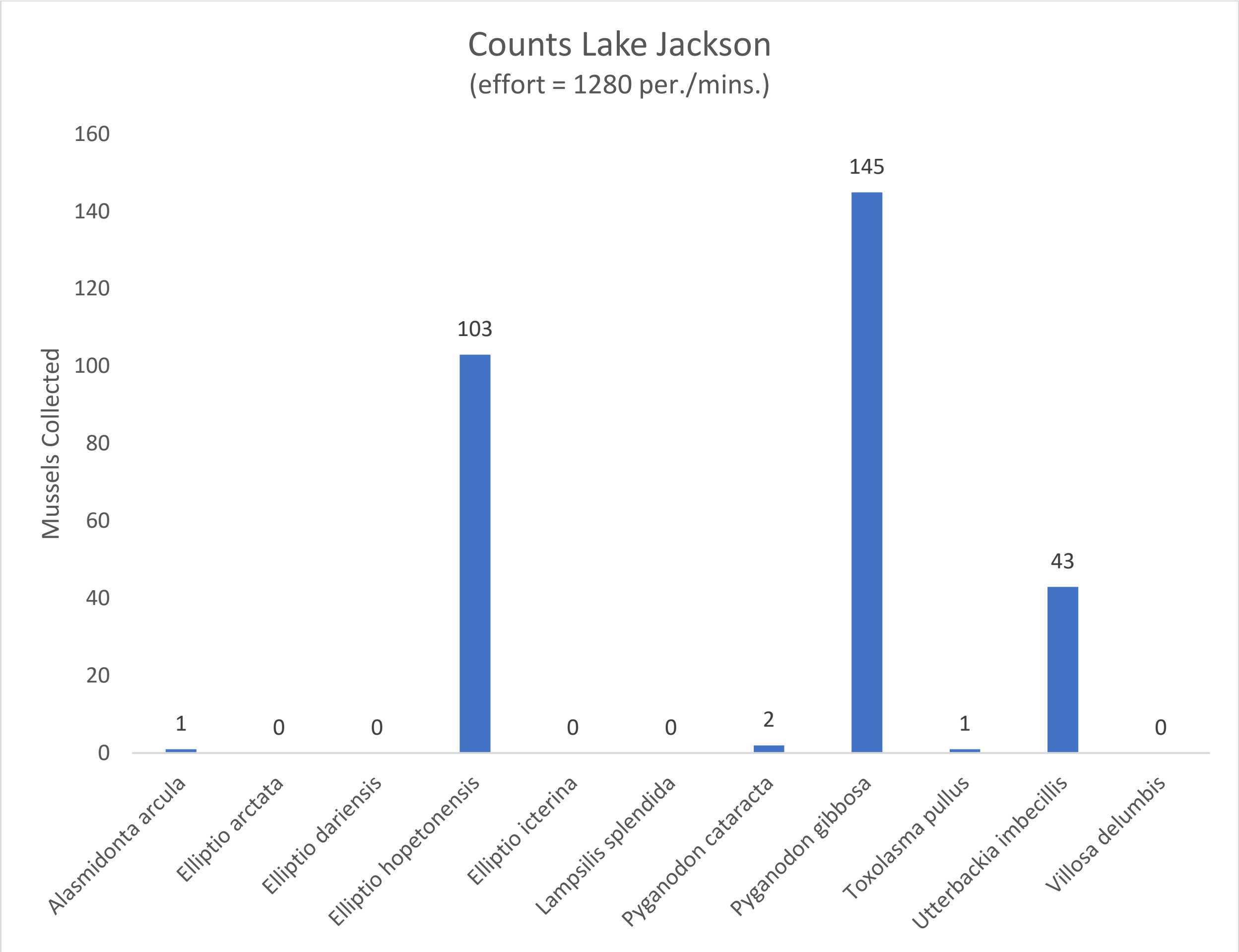

Figure 6. Counts of freshwater mussels collected from all sites sampled within the Lake Jackson reach of the upper Ocmulgee River during the 2019 field season.

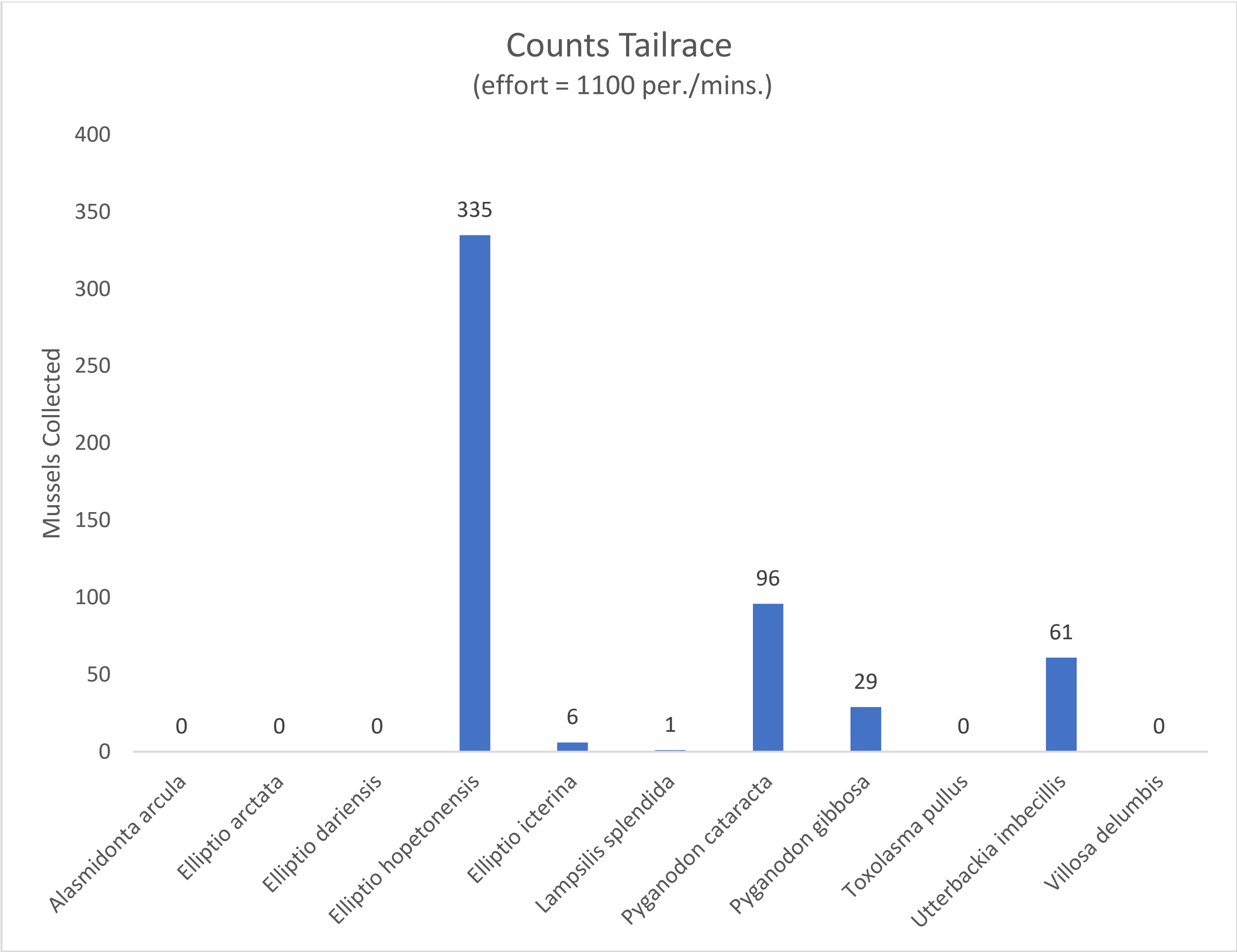

Figure 7. Counts of freshwater mussels collected from all sites sampled within the Lloyd Shoals Tailrace reach of the upper Ocmulgee River during the 2019 field season.

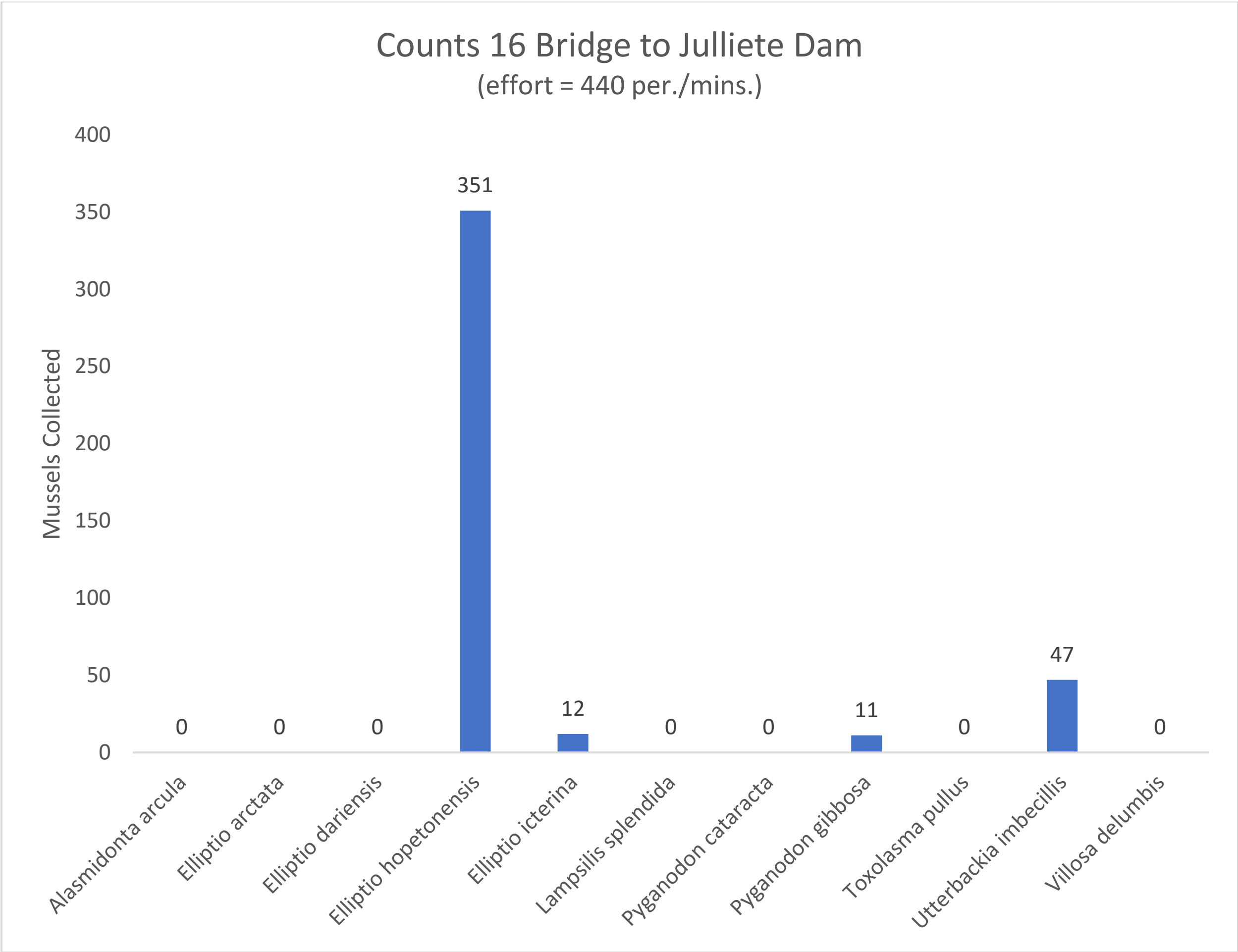

Figure 8. Counts of freshwater mussels collected from all sites sampled within the 16 bridge to Juliette Dam reach of the upper Ocmulgee River during the 2019 field season.

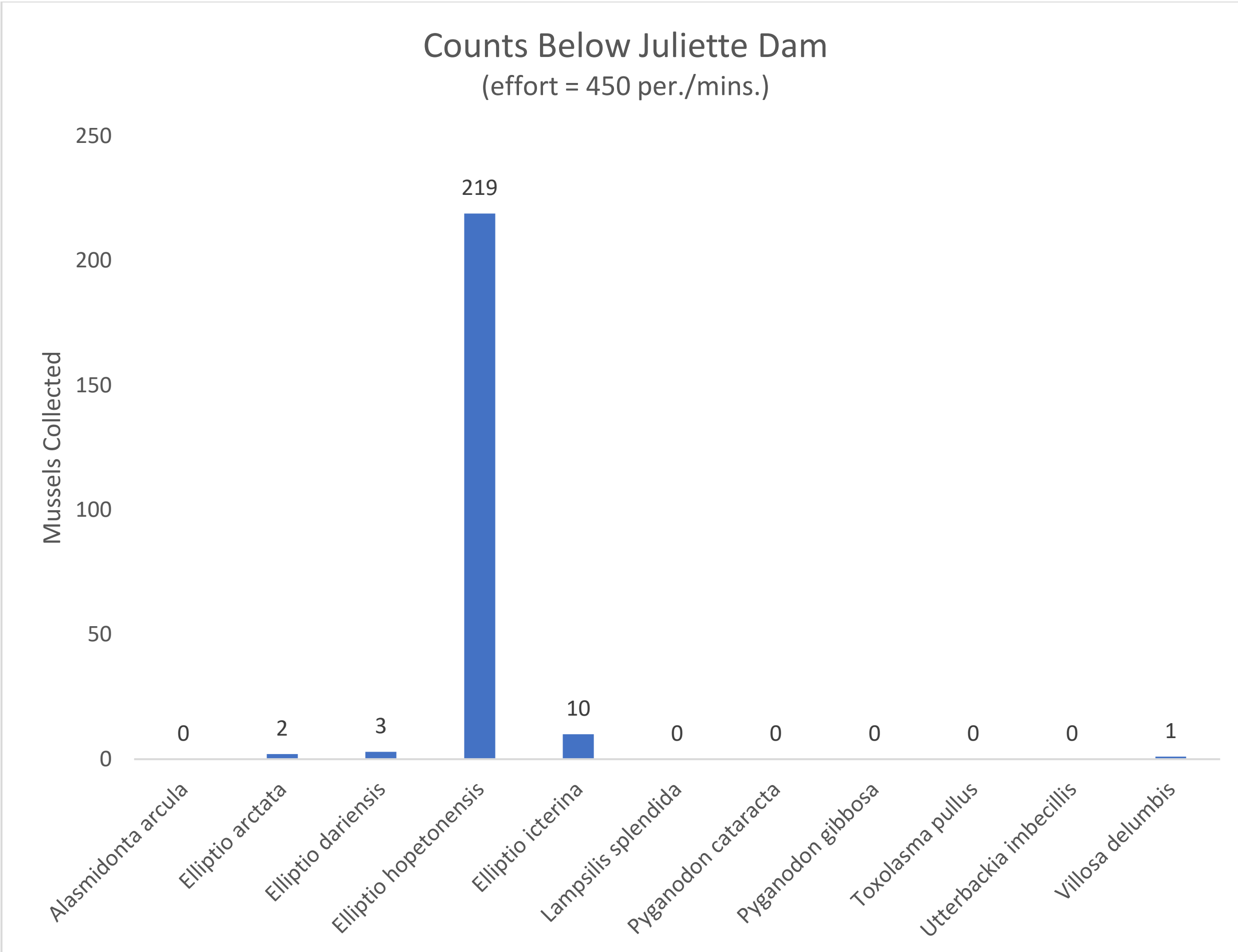

Figure 9. Counts of freshwater mussels collected from all sites sampled within the below Juliette Dam reach of the upper Ocmulgee River during the 2019 field season.

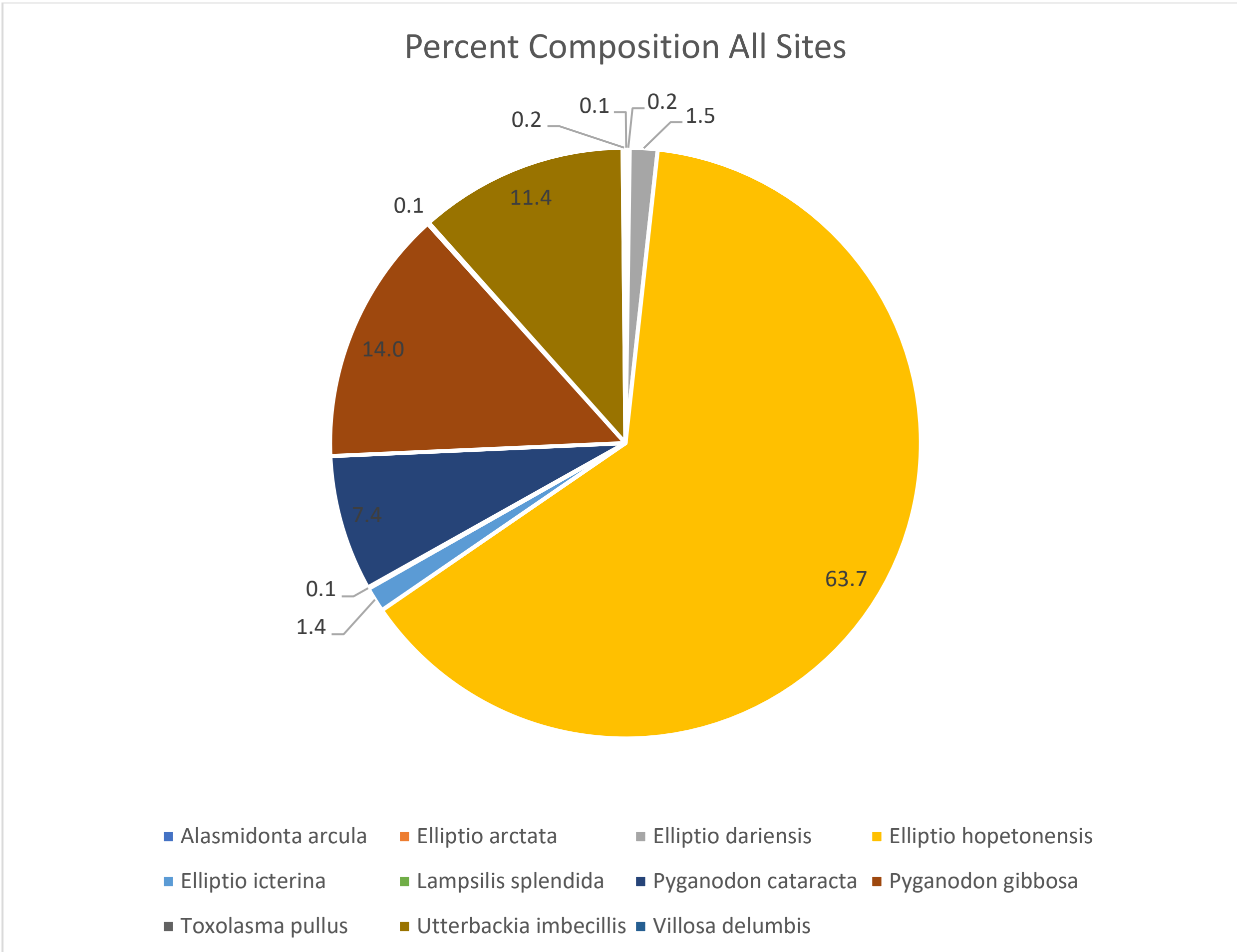

Figure 10. Percentage composition of freshwater mussel species collected at all sites sampled within the Lake Jackson, Lloyd Shoals Tailrace, 16 bridge to Juliette Dam, and below Juliette Dam reaches of the upper Ocmulgee River during the 2019 field season.

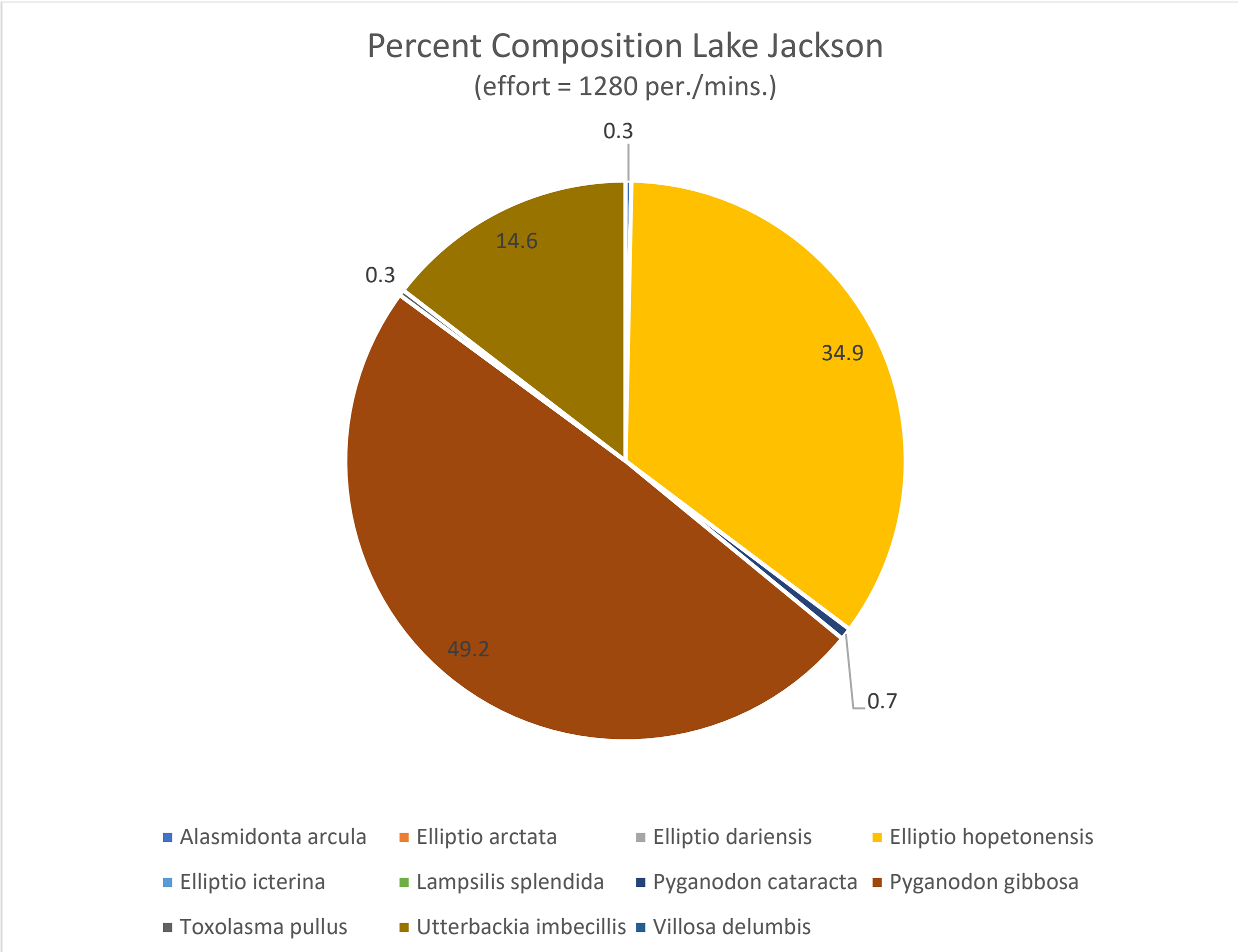

Figure 11. Percentage composition of freshwater mussel species collected at all sites sampled within the Lake Jackson reach of the upper Ocmulgee River during the 2019 field season.

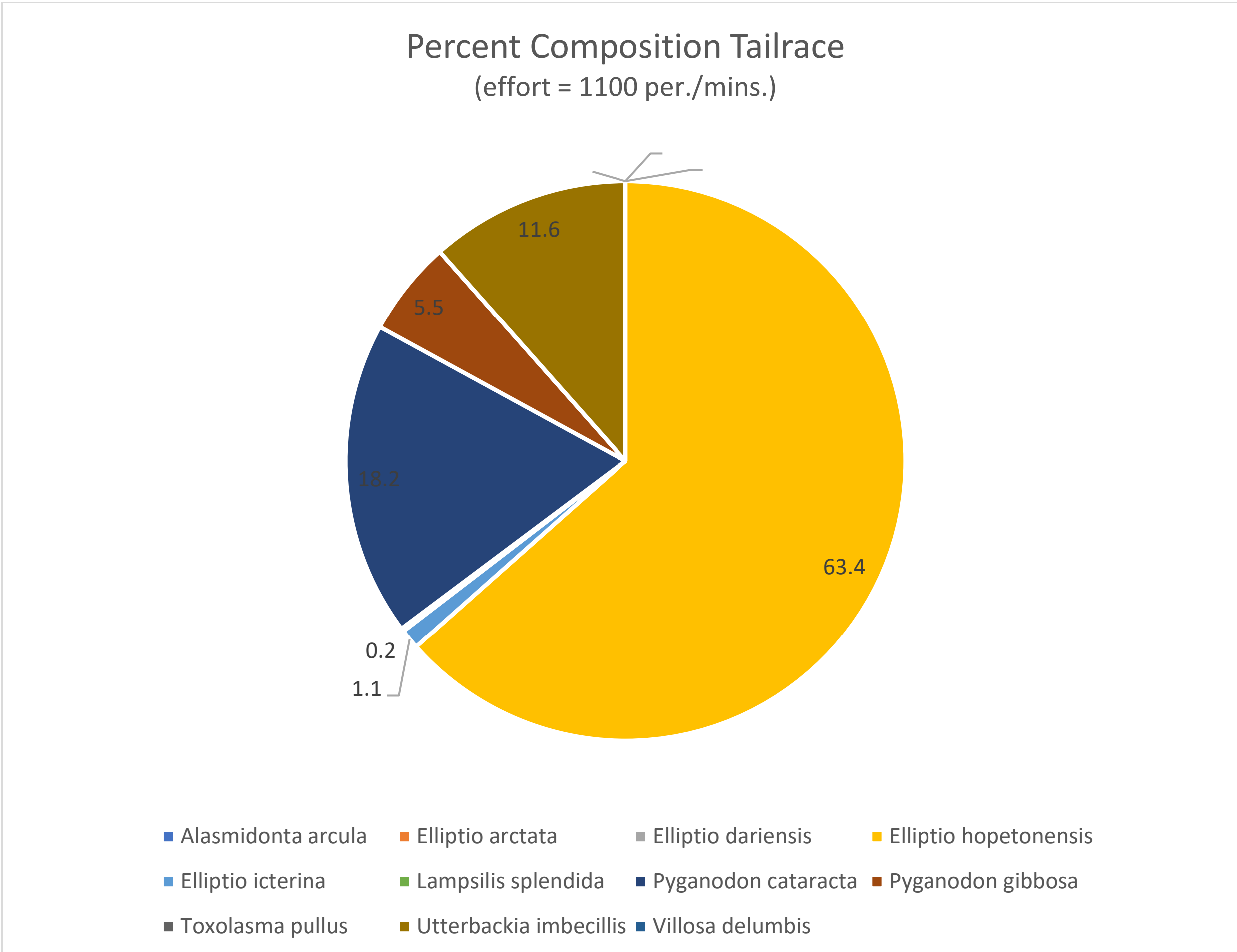

Figure 12. Percentage composition of freshwater mussel species collected at all sites sampled within the Lloyd Shoals Tailrace reach of the upper Ocmulgee River during the 2019 field season.

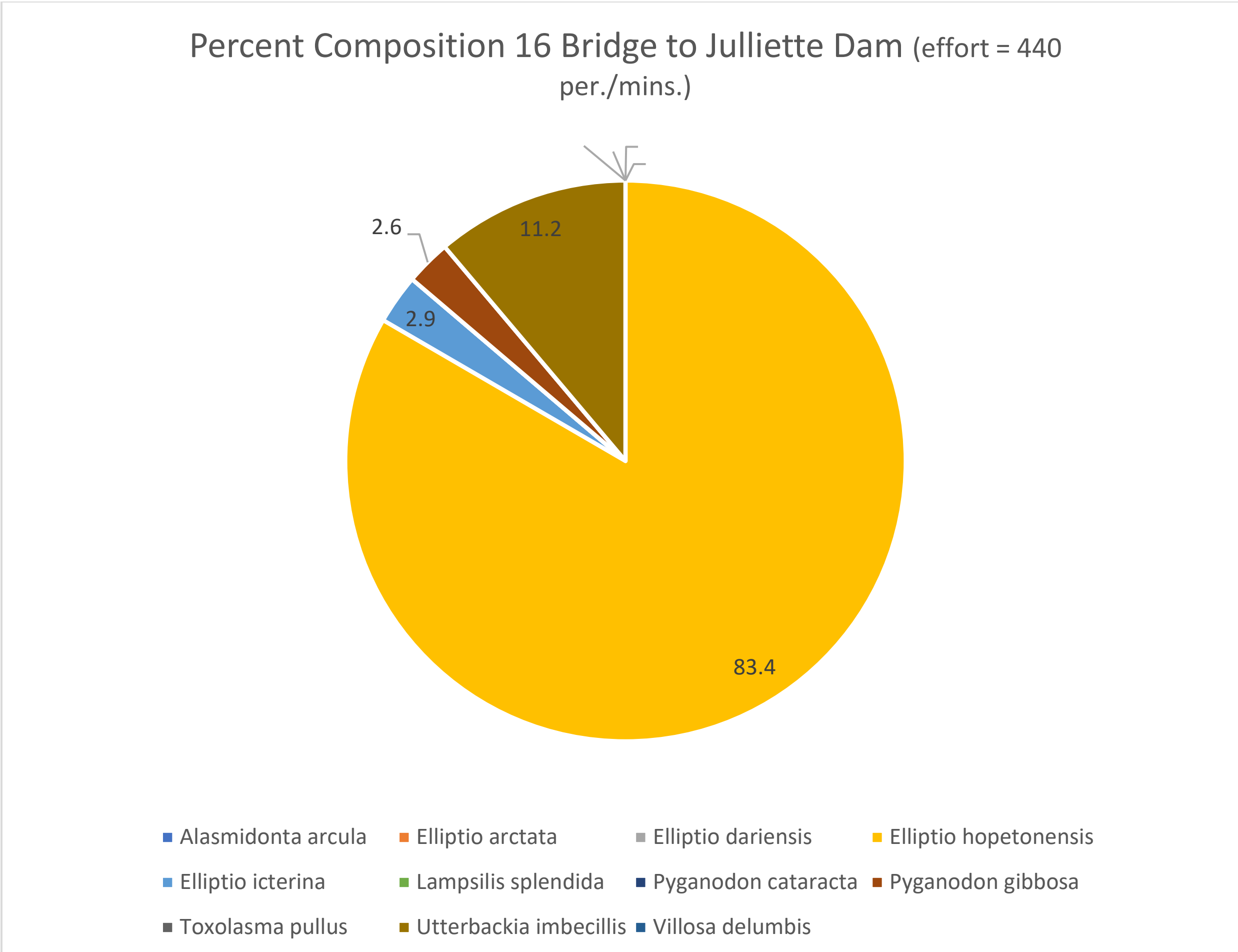

Figure 13. Percentage composition of freshwater mussel species collected at all sites sampled within the 16 bridge to Juliette Dam reach of the upper Ocmulgee River during the 2019 field season.

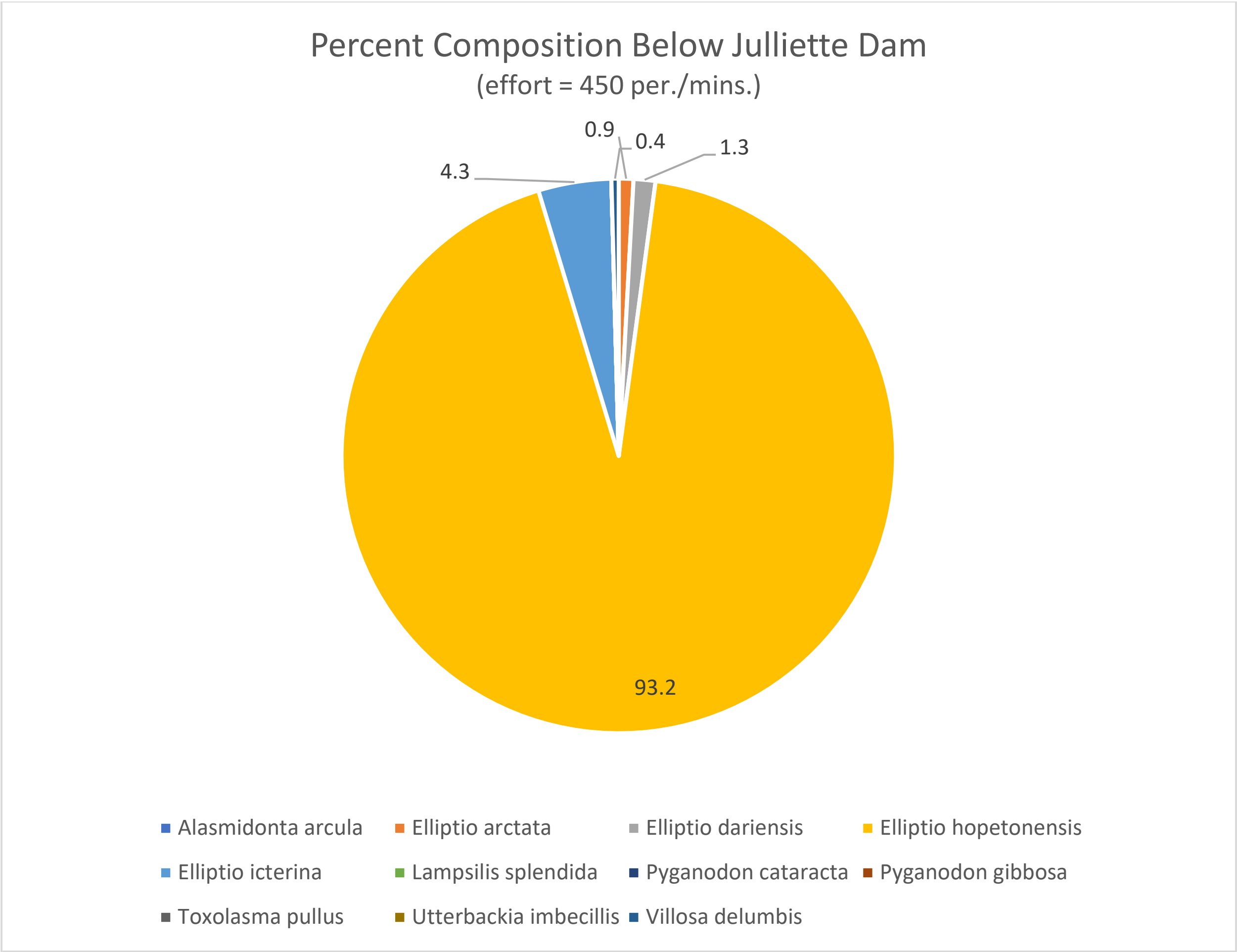

Figure 14. Percentage composition of freshwater mussel species collected at all sites sampled within the below Juliette Dam reach of the upper Ocmulgee River during the 2019 field season.

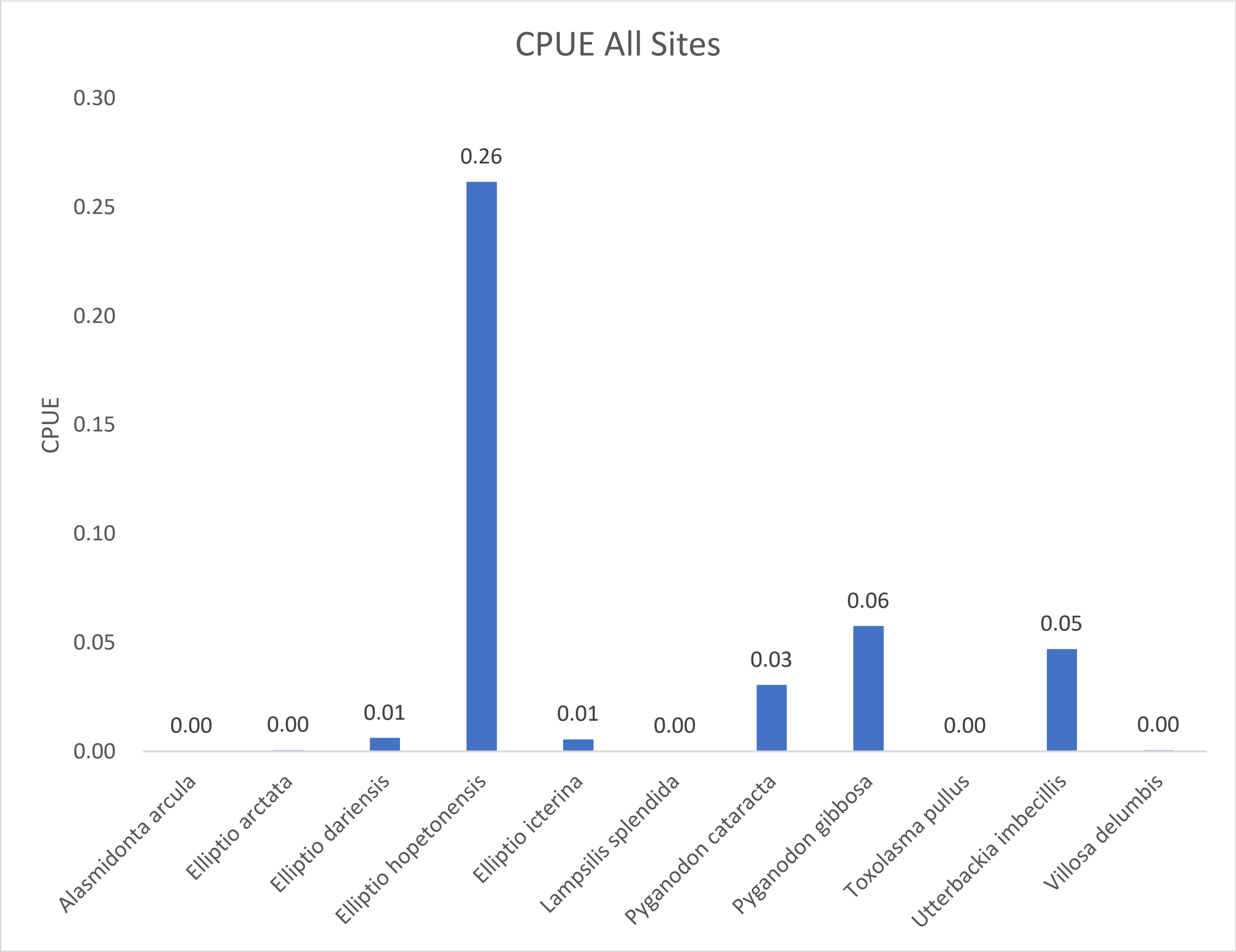

Figure 15. Catch per unit effort (CPUE) expressed in mussels found per person-hour of search effort for freshwater mussels collected at all sites sampled within the Lake Jackson, Lloyd Shoals Tailrace, 16 bridge to Juliette Dam, and below Juliette Dam reaches of the upper Ocmulgee River during the 2019 field season.

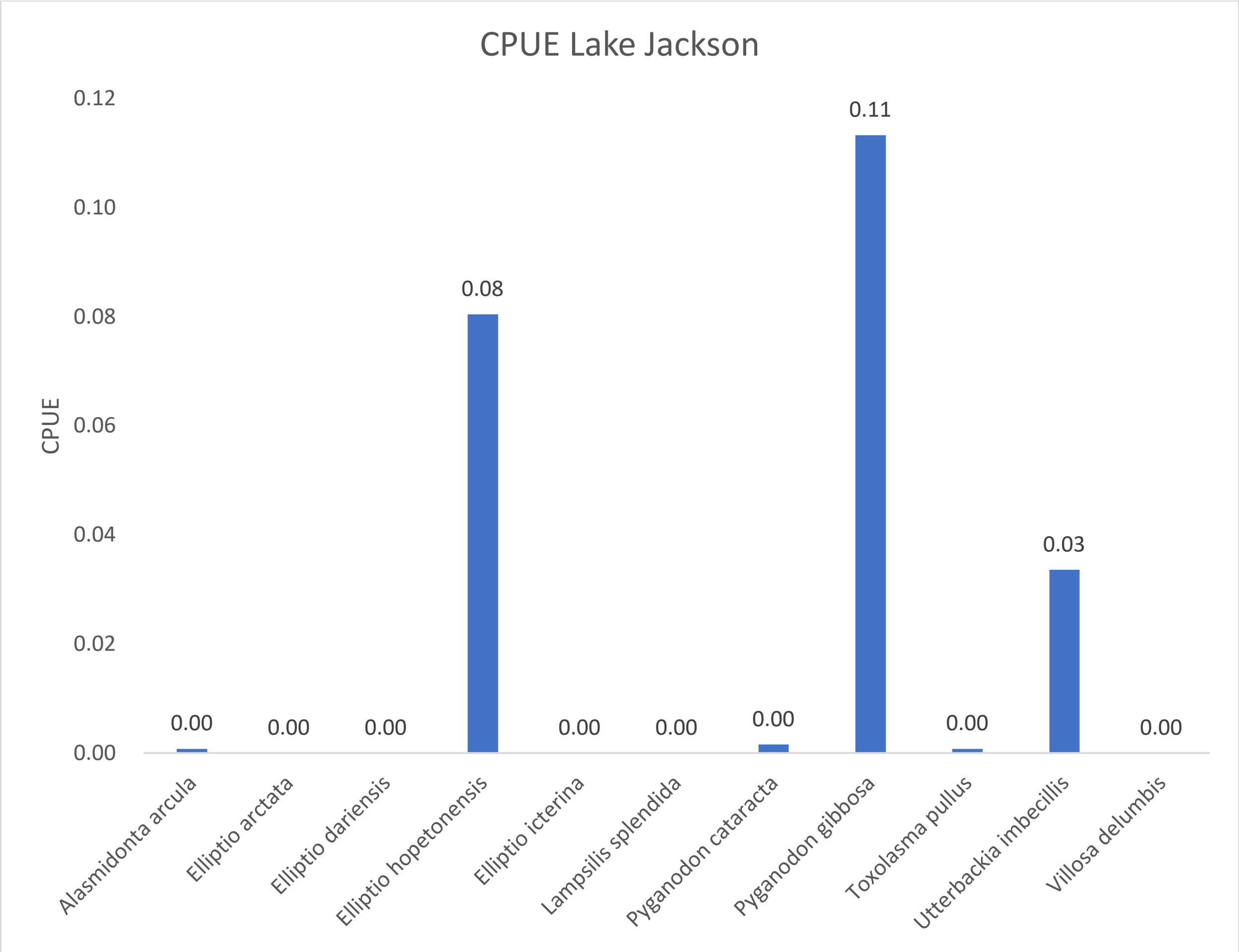

Figure 16. Catch per unit effort (CPUE) expressed in mussels found per person-hour of search effort for freshwater mussels collected at all sites sampled within the Lake Jackson reach of the upper Ocmulgee River during the 2019 field season.

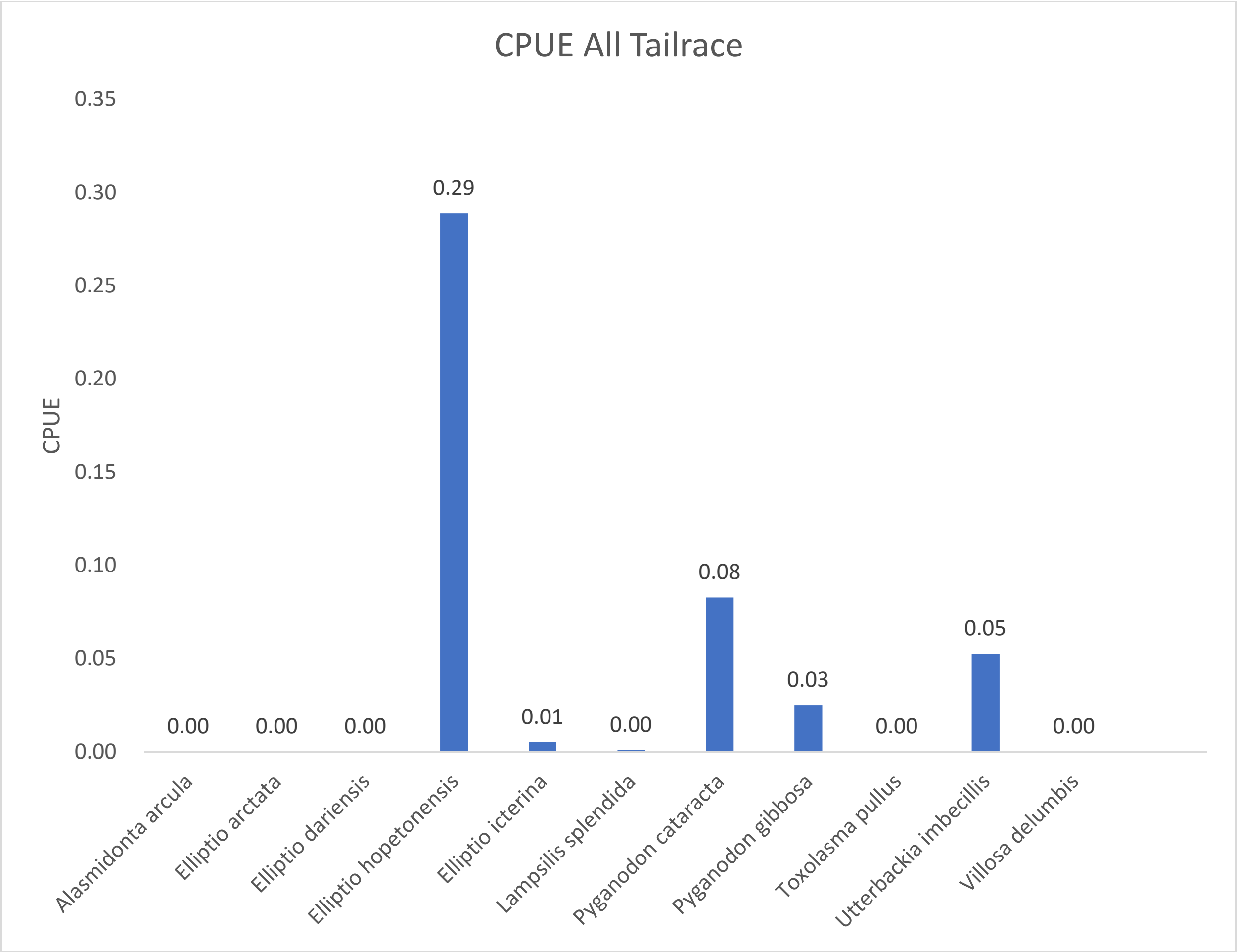

Figure 17. Catch per unit effort (CPUE) expressed in mussels found per person-hour of search effort for freshwater mussels collected at all sites sampled within the Lloyd Shoals Tailrace reach of the upper Ocmulgee River during the 2019 field season.

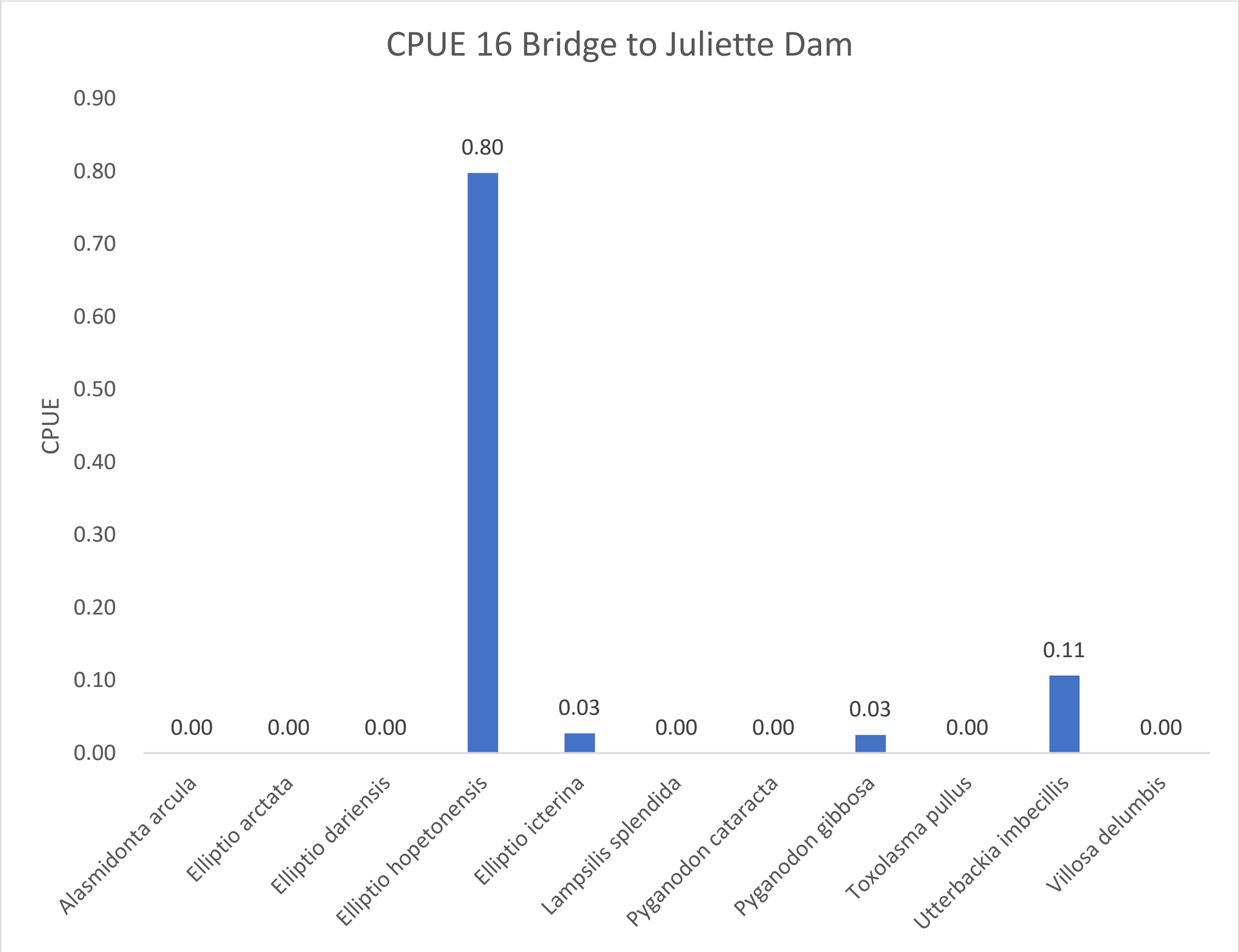

Figure 18. Catch per unit effort (CPUE) expressed in mussels found per person-hour of search effort for freshwater mussels collected at all sites sampled within the 16 bridge to Juliette Dam reach of the upper Ocmulgee River during the 2019 field season.

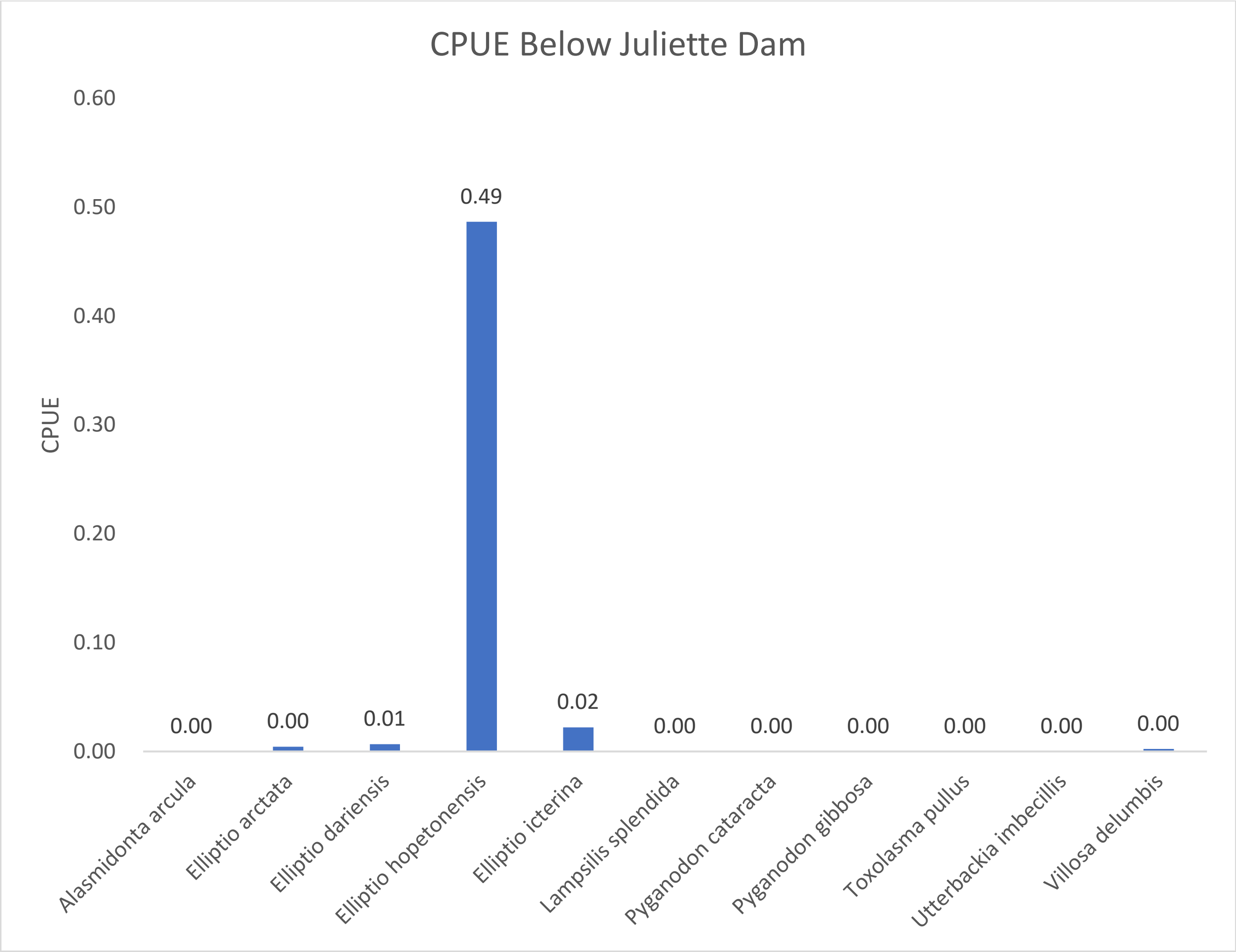

Figure 19. Catch per unit effort (CPUE) expressed in mussels found per person-hour of search effort for freshwater mussels collected at all sites sampled within the below Juliette Dam reach of the upper Ocmulgee River during the 2019 field season.

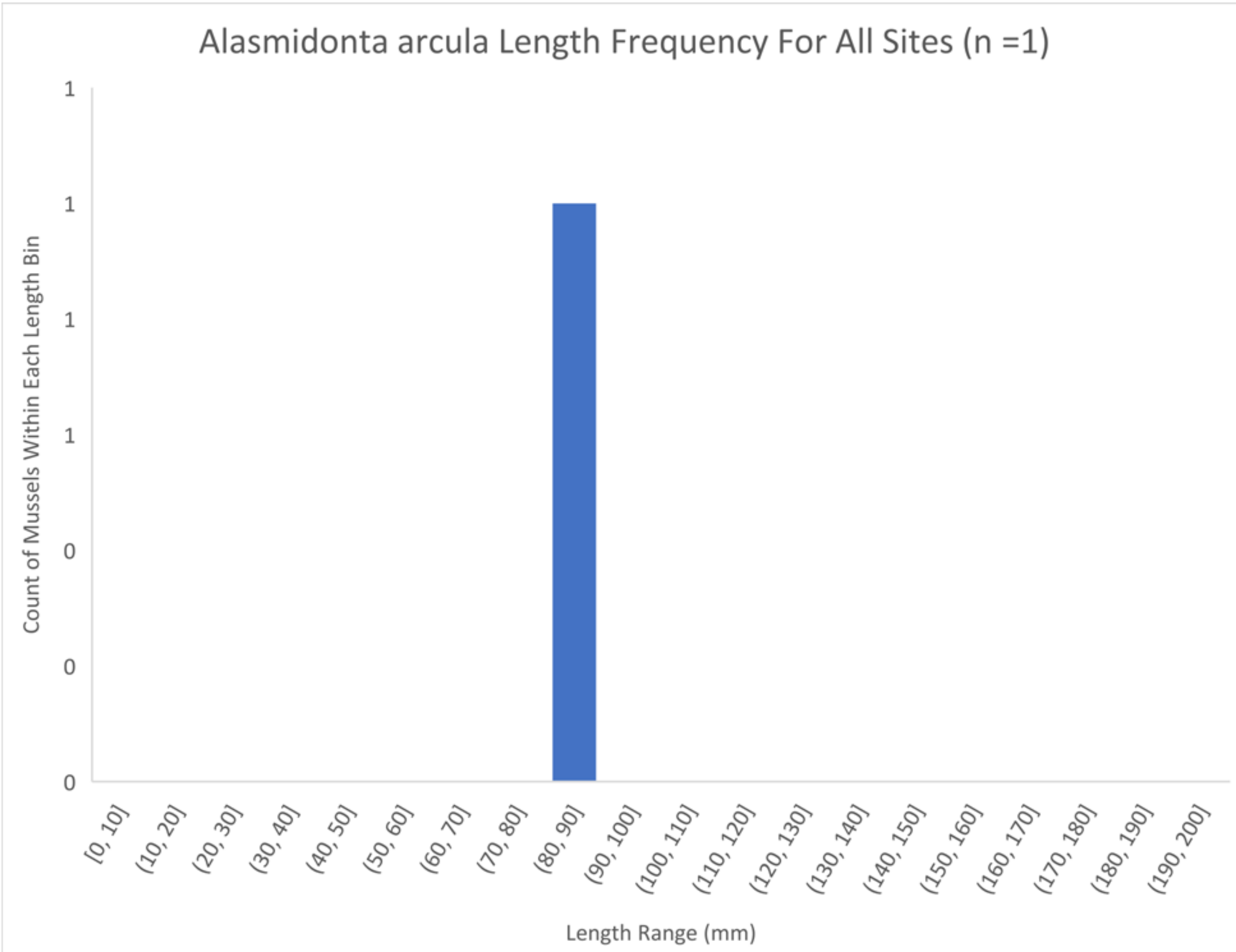

Figure 20. Length frequency histogram for individuals of *Alasmidonta arcula* across all sites sampled in the upper Ocmulgee River during the 2019 field season.

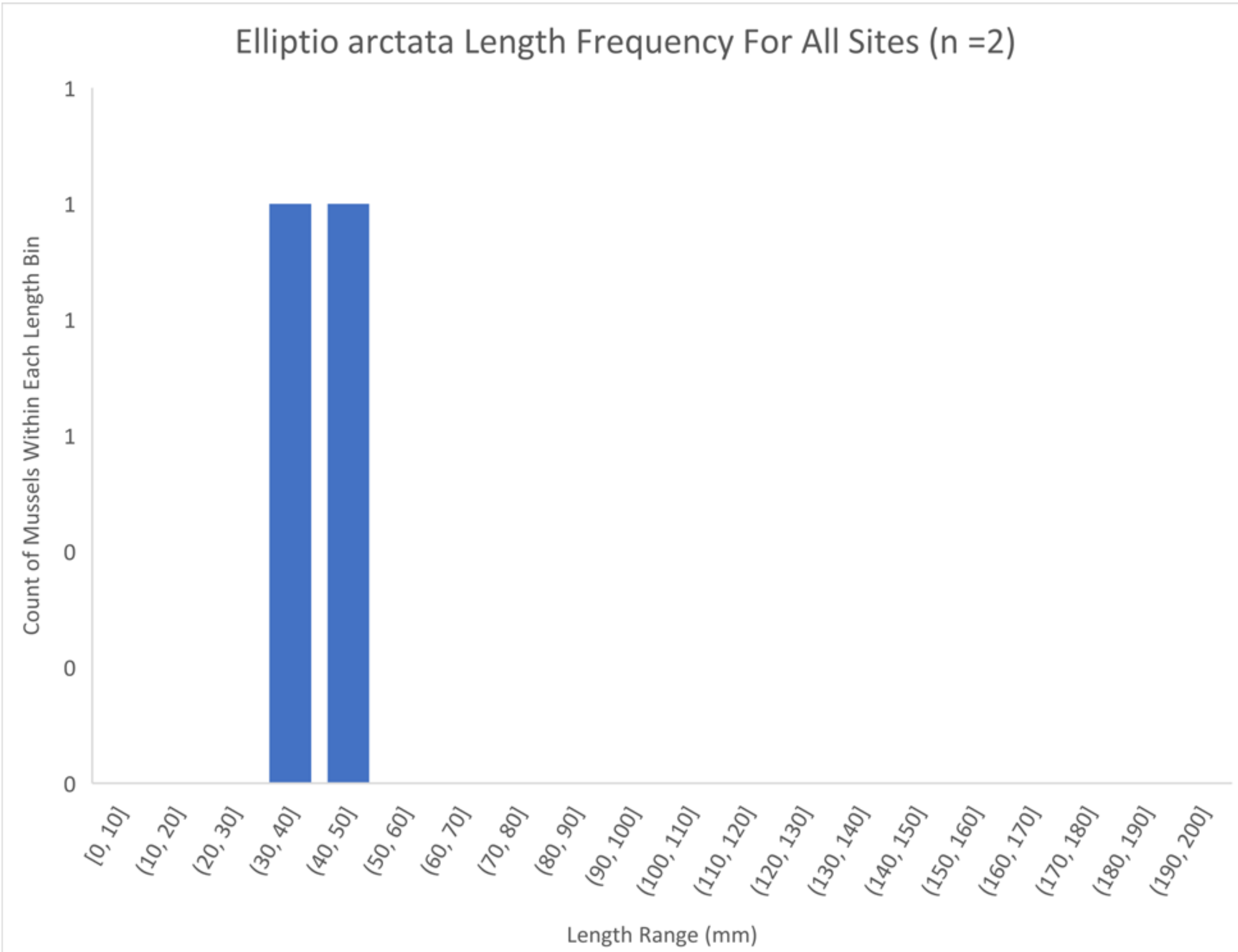

Figure 21. Length frequency histogram for individuals of *Elliptio actata* across all sites sampled in the upper Ocmulgee River during the 2019 field season.

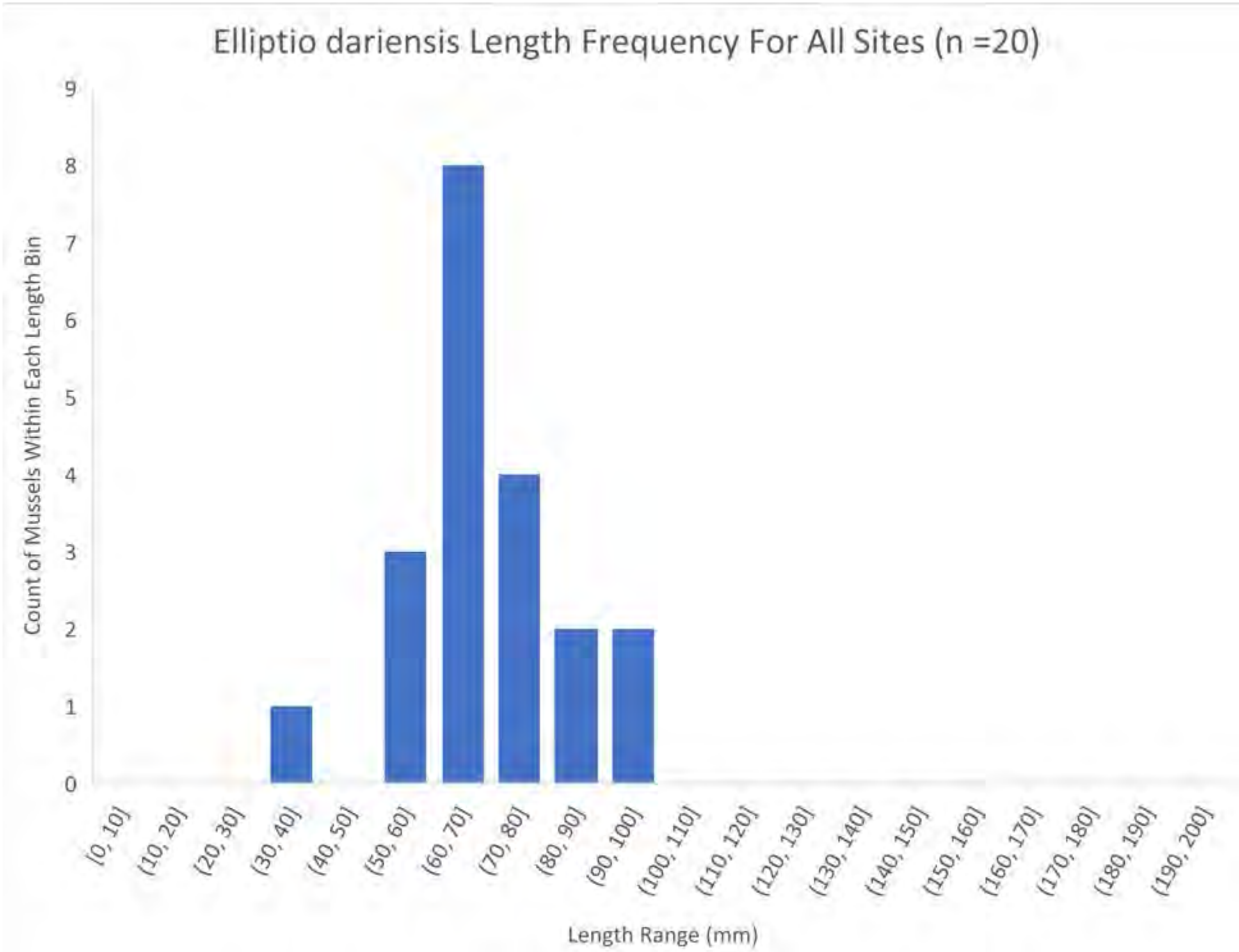

Figure 22. Length frequency histogram for individuals of *Elliptio dariensis* across all sites sampled in the upper Ocmulgee River during the 2019 field season.

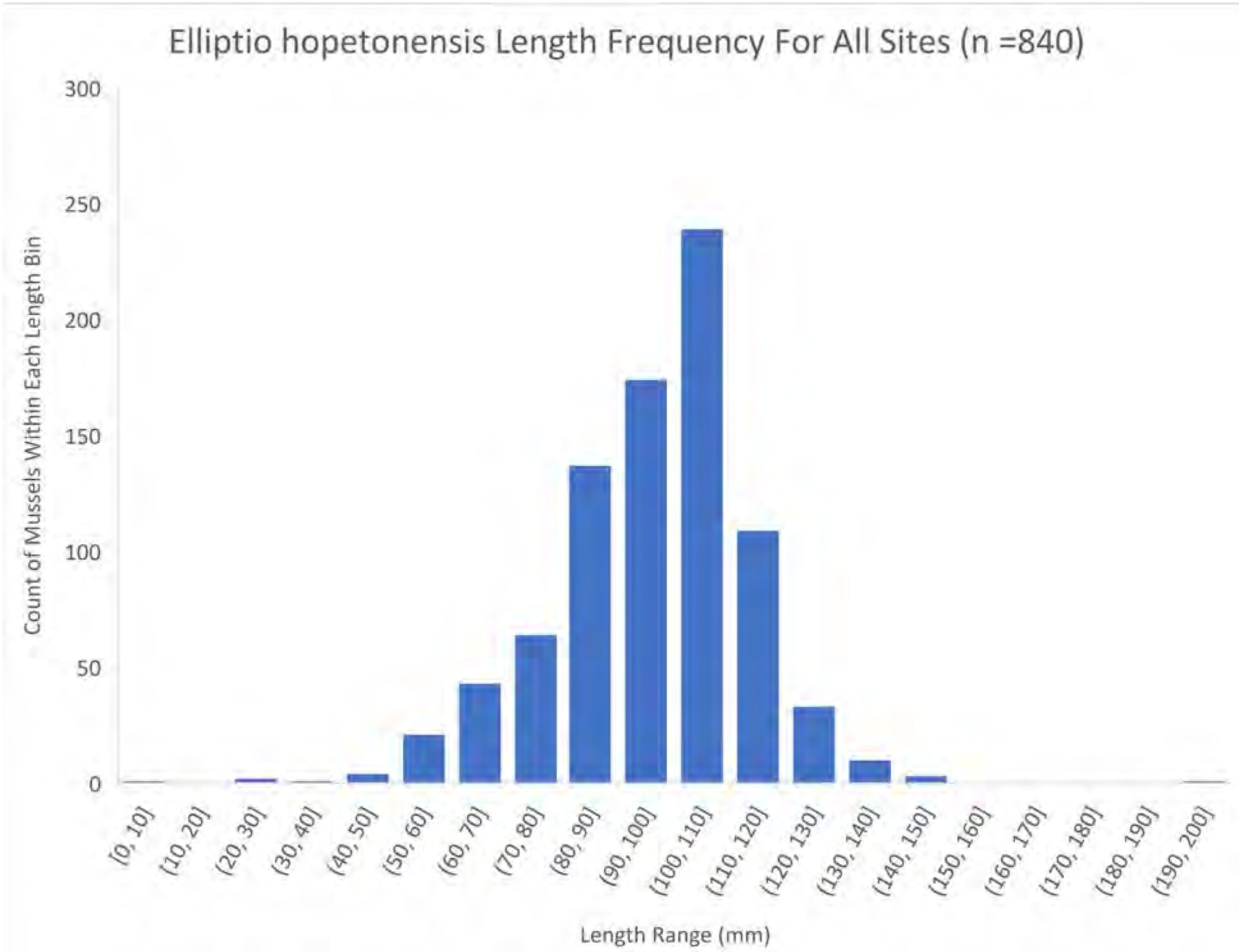

Figure 23. Length frequency histogram for individuals of *Elliptio hopetonensis* across all sites sampled in the upper Ocmulgee River during the 2019 field season.

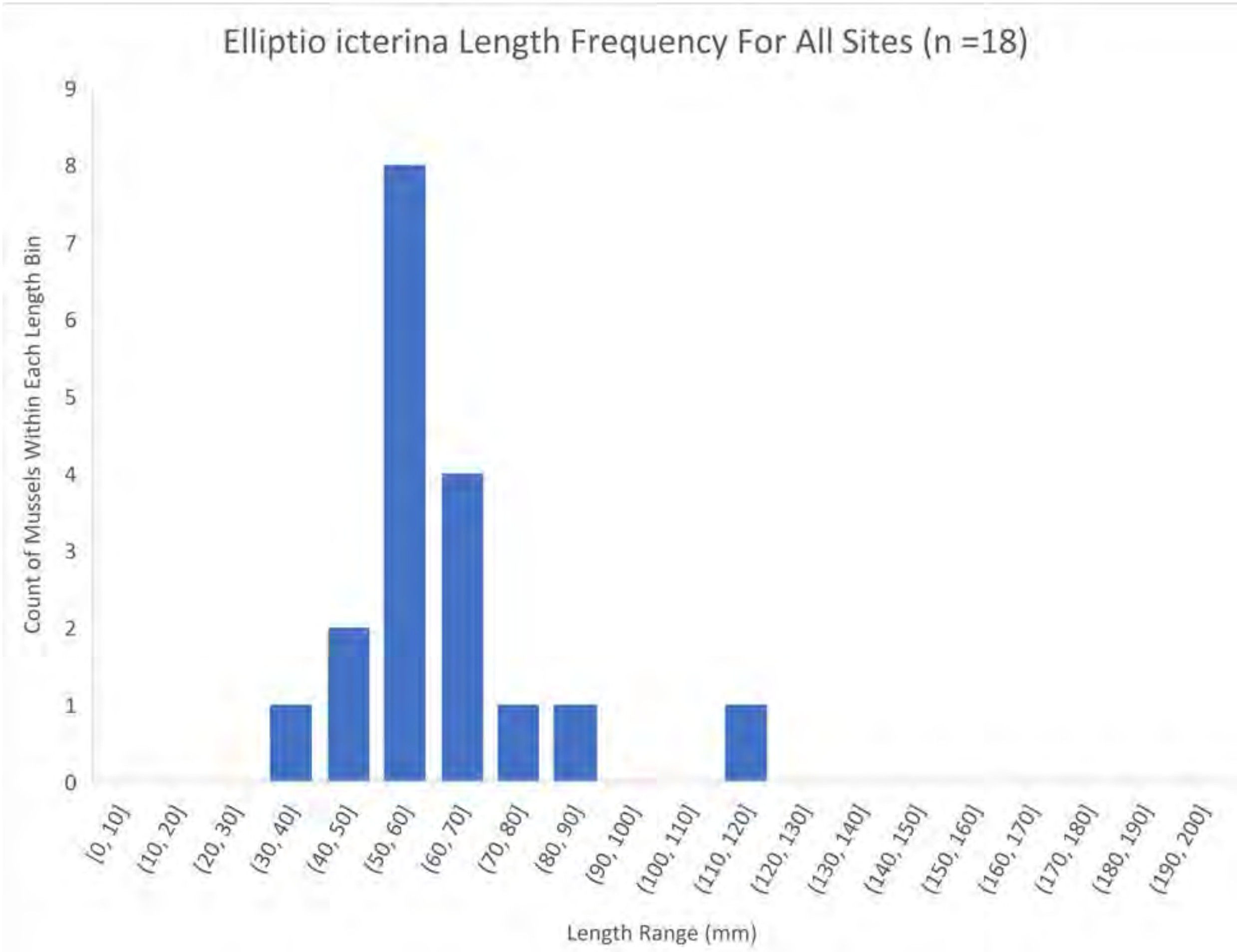

Figure 24. Length frequency histogram for individuals of *Elliptio icterina* across all sites sampled in the upper Ocmulgee River during the 2019 field season.

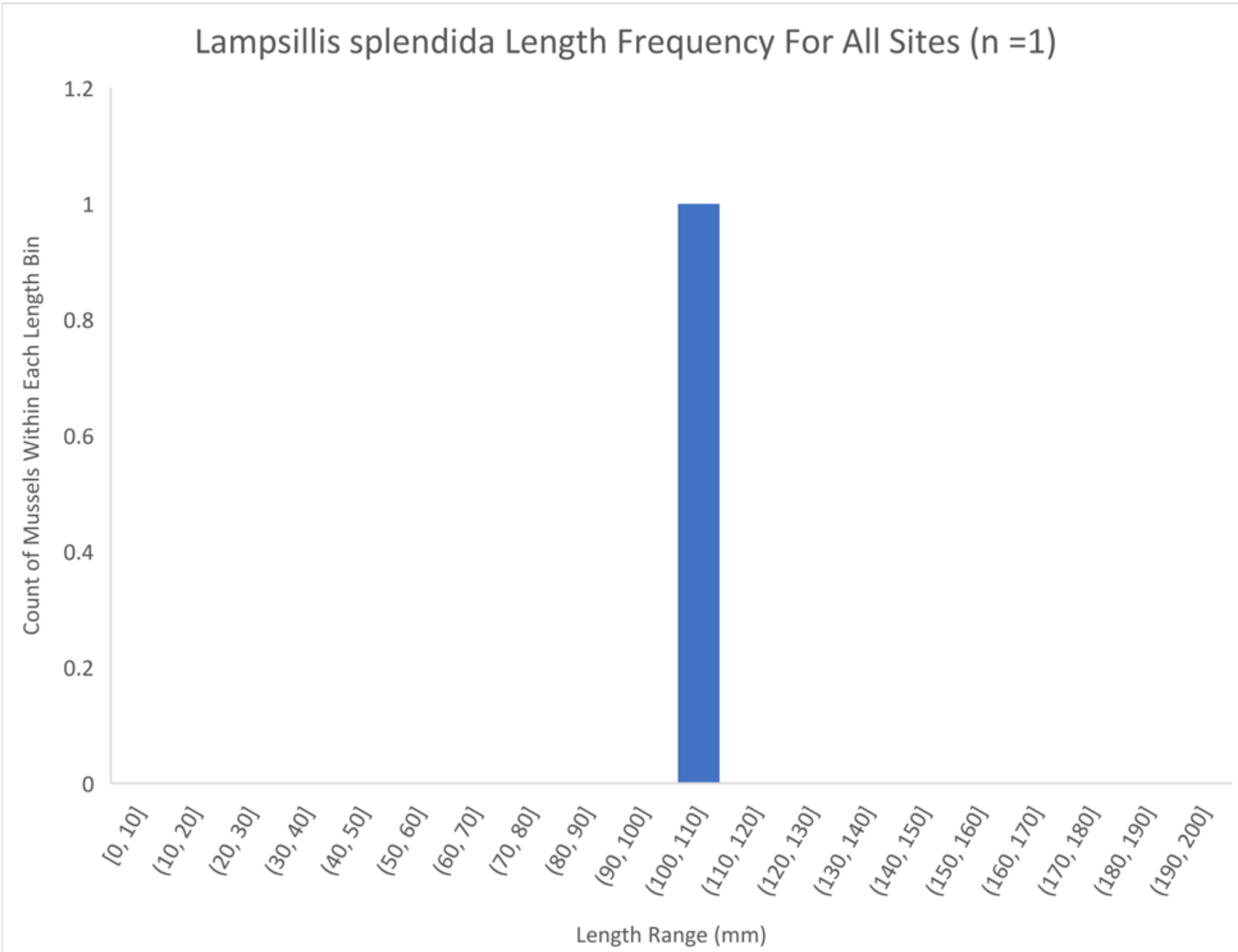

Figure 25. Length frequency histogram for individuals of *Lampsilis splendida* across all sites sampled in the upper Ocmulgee River during the 2019 field season.

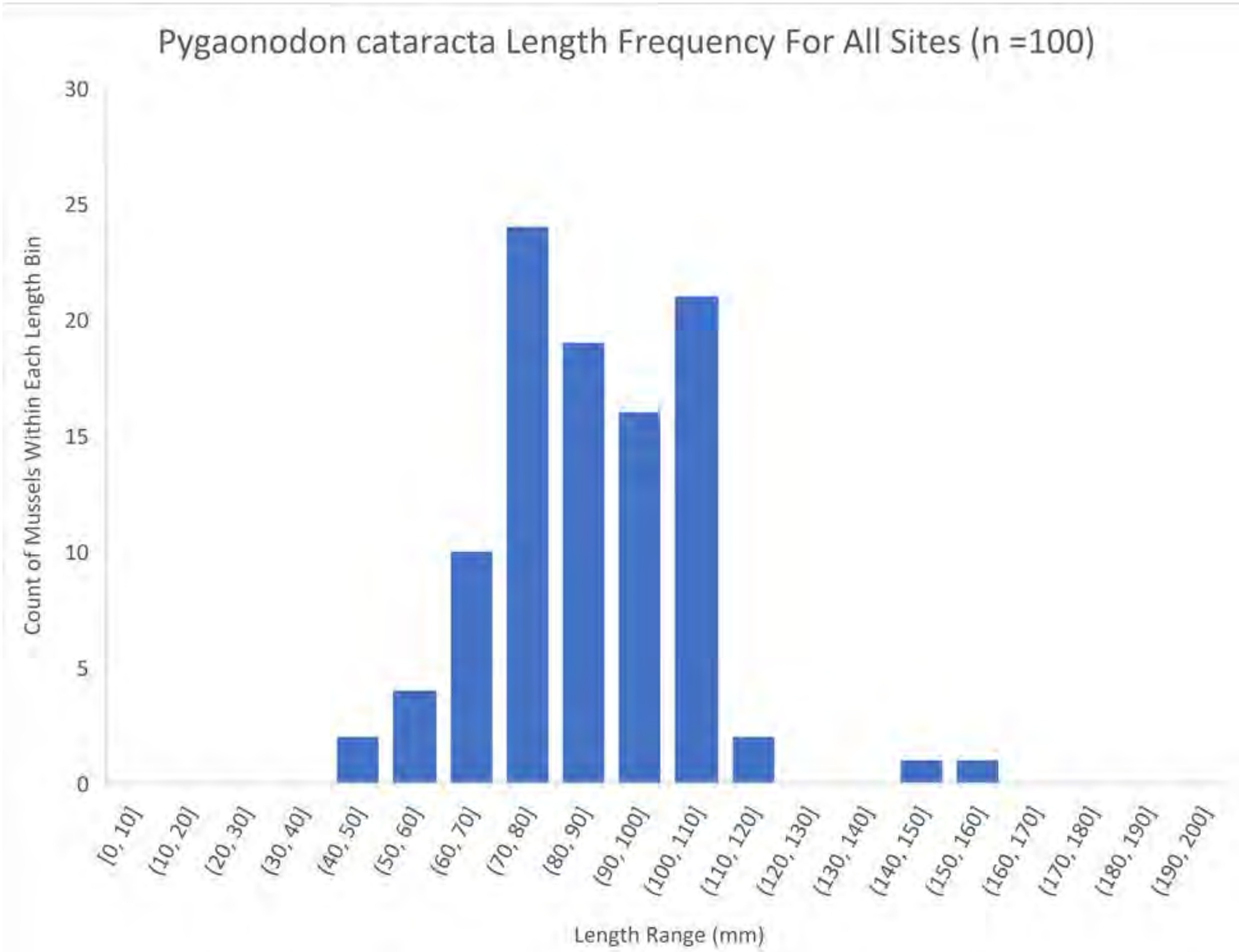

Figure 26. Length frequency histogram for individuals of *Pyganodon cataracta* across all sites sampled in the upper Ocmulgee River during the 2019 field season.

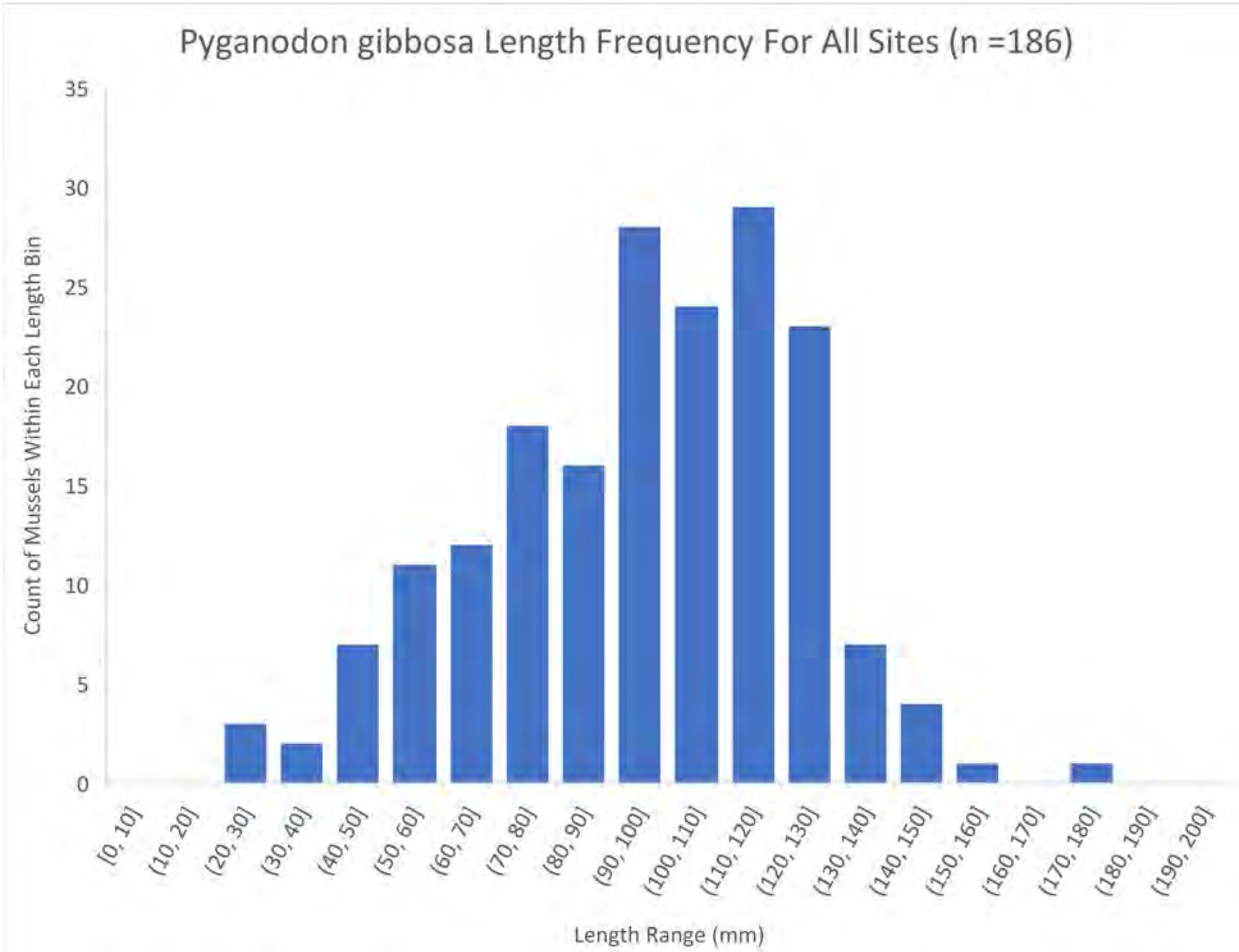

Figure 27. Length frequency histogram for individuals of *Pyganodon gibbosa* across all sites sampled in the upper Ocmulgee River during the 2019 field season.

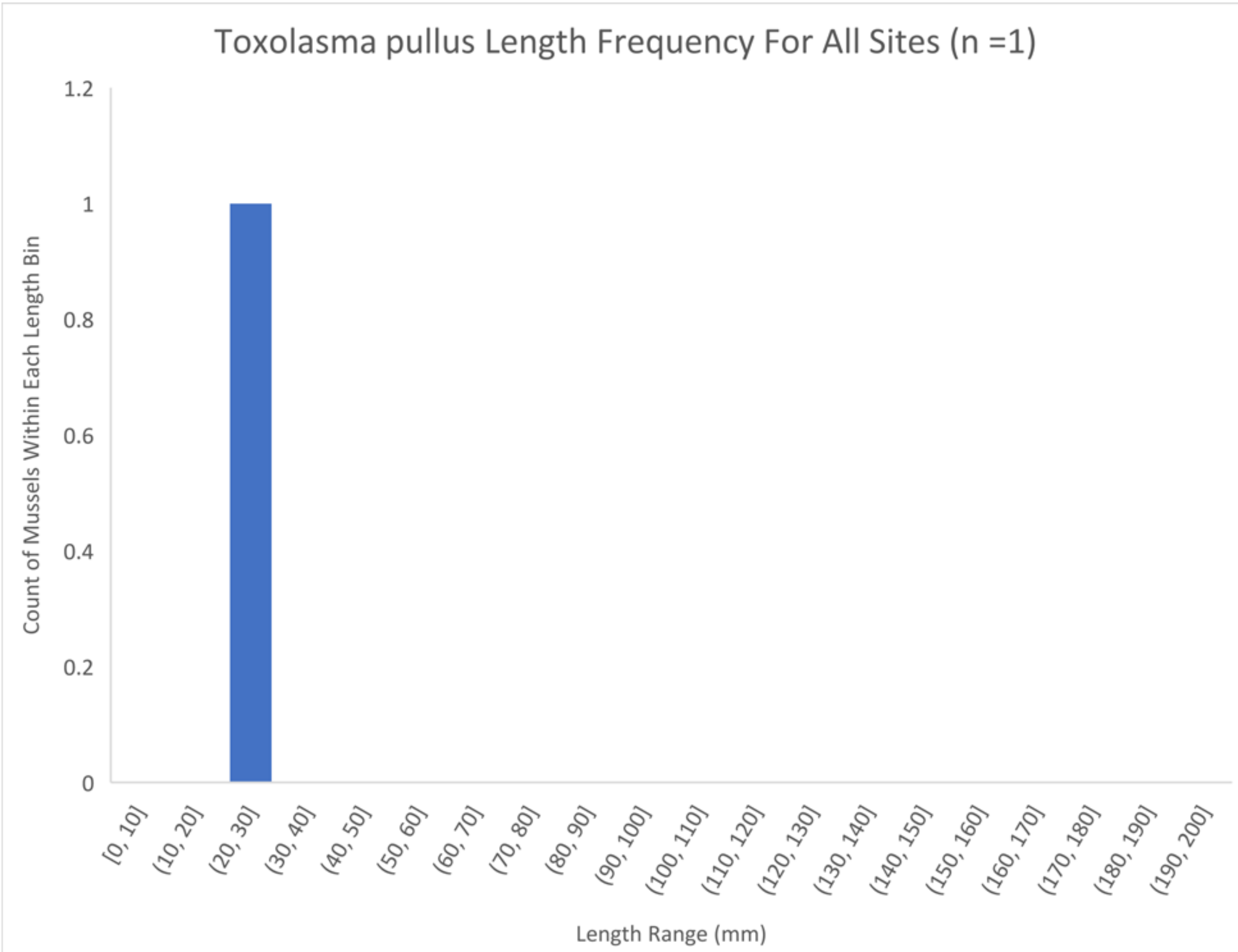

Figure 28. Length frequency histogram for individuals of *Toxolasma pullus* across all sites sampled in the upper Ocmulgee River during the 2019 field season.

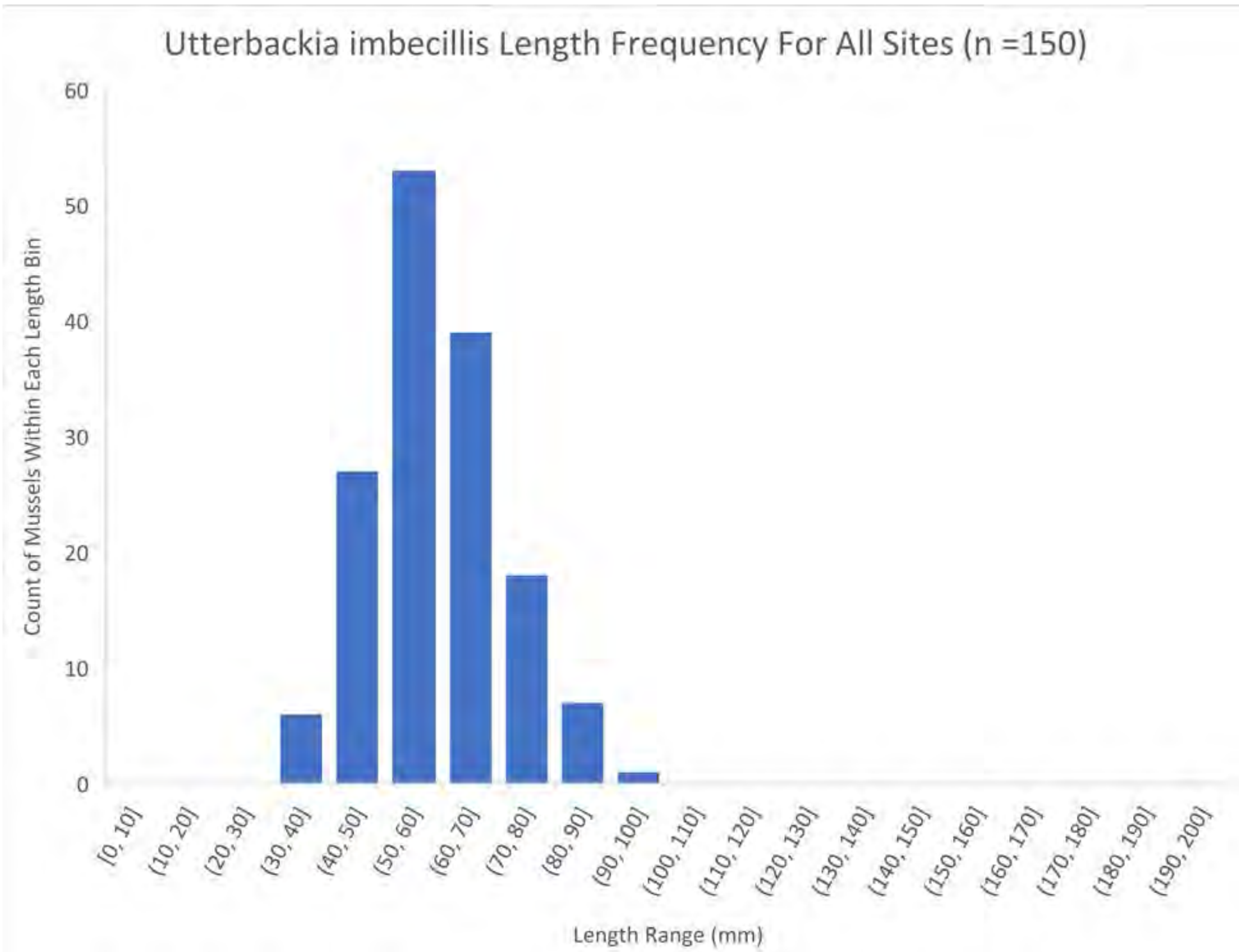

Figure 29. Length frequency histogram for individuals of *Utterbackia imbecillis* across all sites sampled in the upper Ocmulgee River during the 2019 field season.

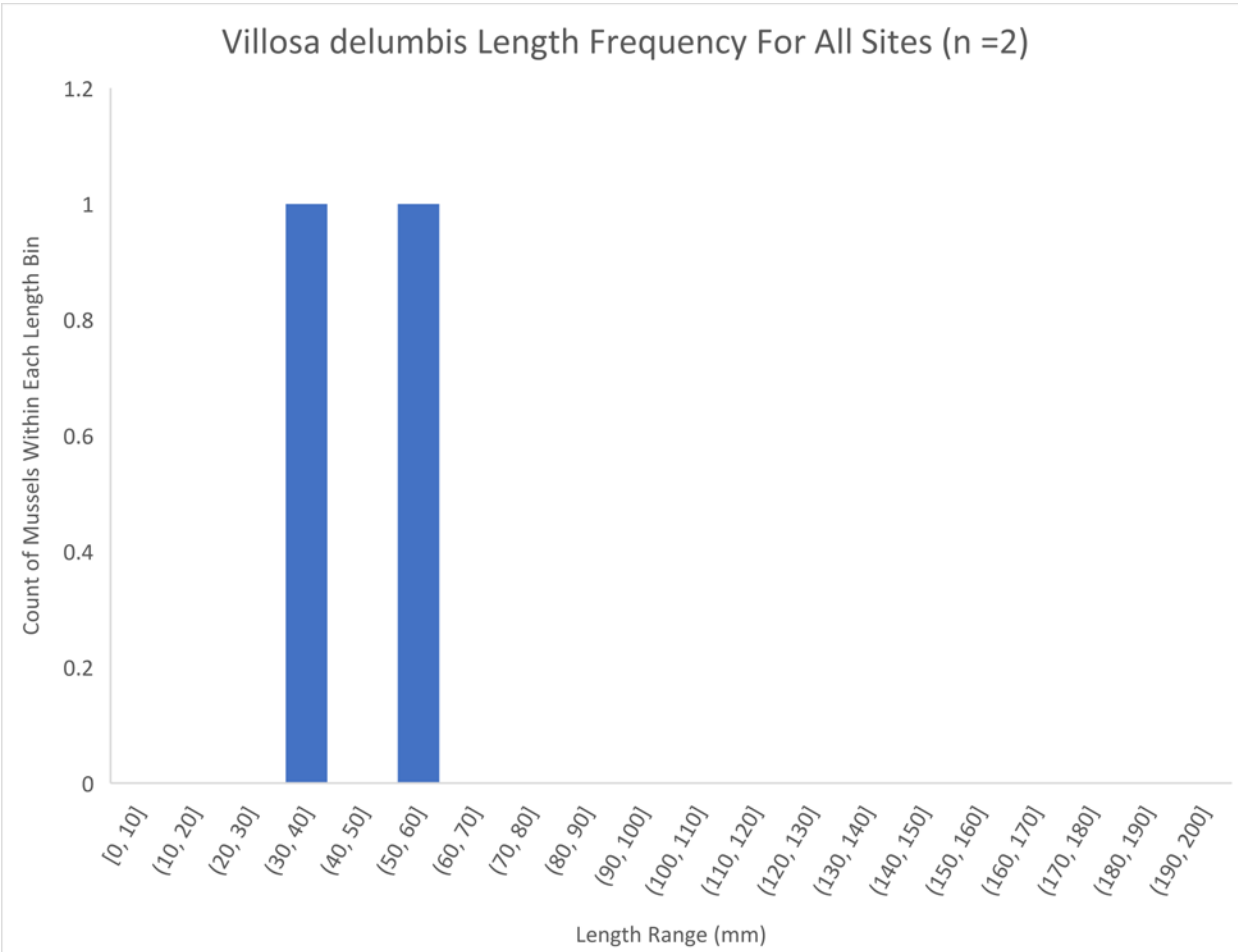

Figure 30. Length frequency histogram for individuals of *Villosa delumbis* across all sites sampled in the upper Ocmulgee River during the 2019 field season.

Figure 31. *Alasmidonta arcula* relict shell collected at site 37.

Figure 32. *Elliptio arctata* collected at site 32.

Figure 33. *Elliptio dariensis* collected at site 7.

Figure 34. *Elliptio hopetonensis* collected at site 4.

Figure 35. *Elliptio icterina* collected at site 4.

Figure 36. *Lampsilis splendid*a collected at site 25.

Figure 37. *Pyganodon cataracta* collected at site 17.

Figure 38. *Pyganodon gibbosa* collected at site 26.

Figure 39. *Toxolasma pullus* collected at site 46.

Figure 40. *Utterbackia imbecillis* collected at site 29.

Figure 41. *Villosa delumbis* collected at site 7.

APPENDIX B

SPORT FISH POPULATION DATA

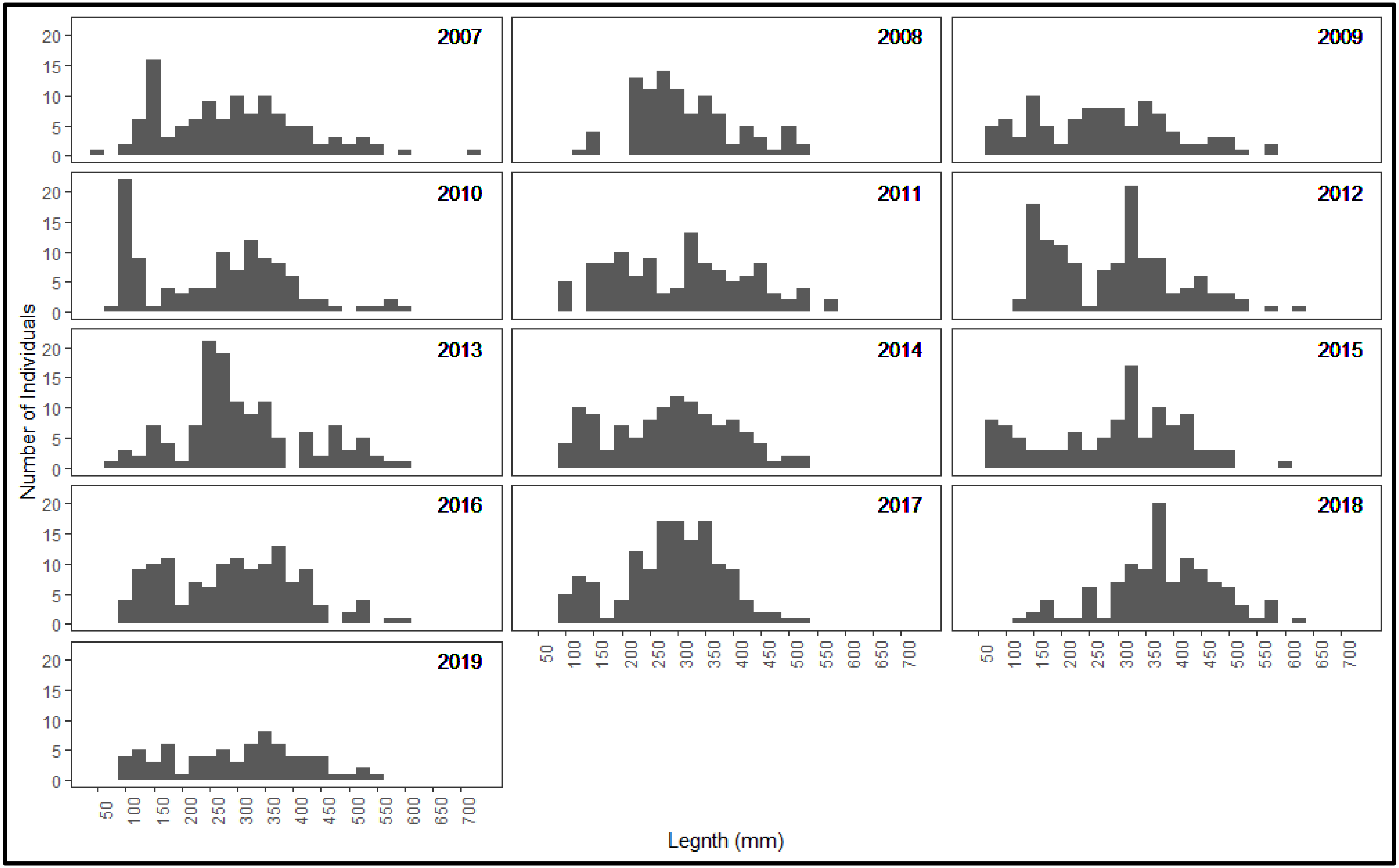

FIGURE B1 LENGTH FREQUENCY HISTOGRAMS FOR LARGEMOUTH BASS COLLECTED ON LAKE JACKSON BY GDNR

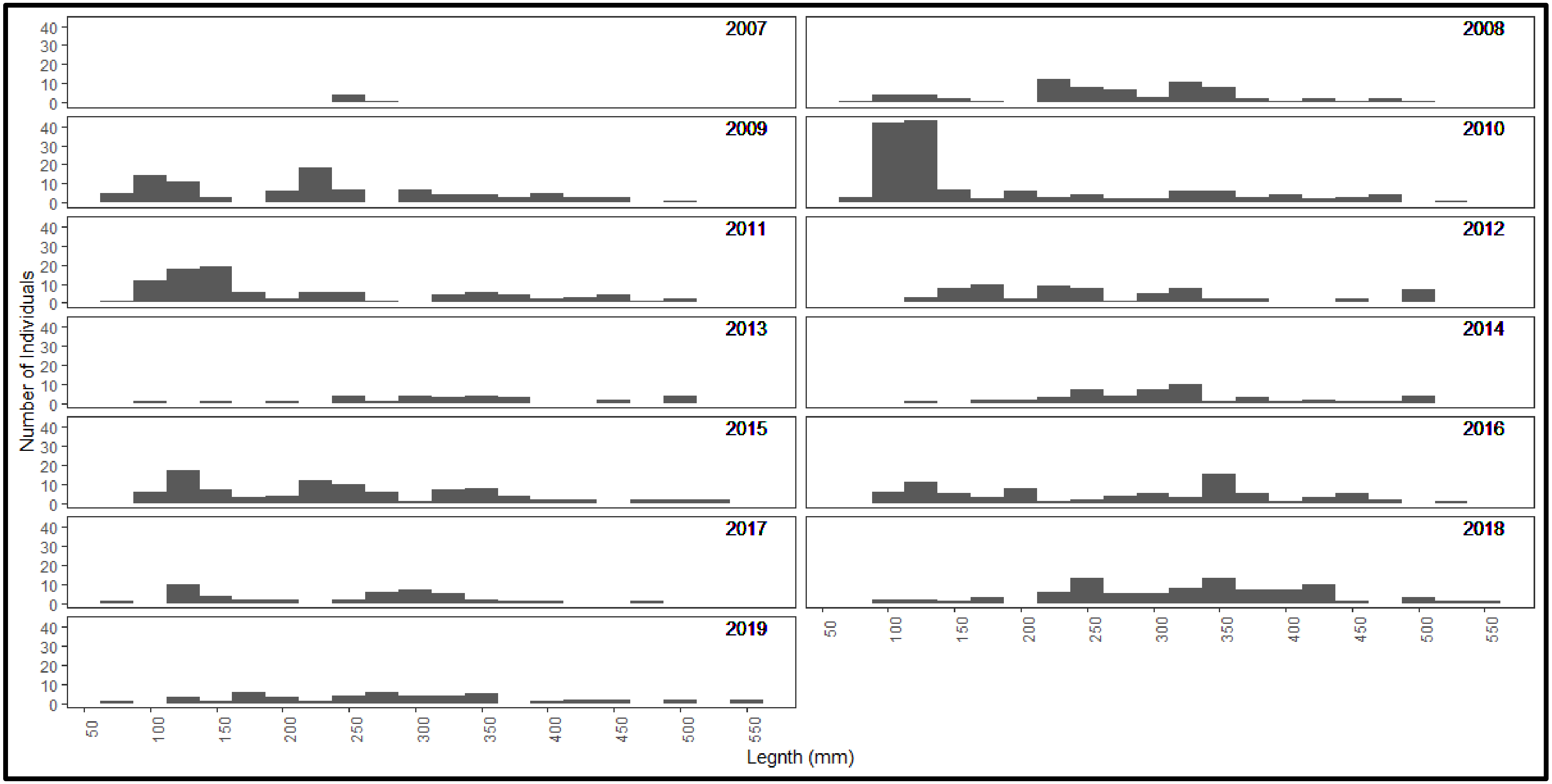

FIGURE B2 LENGTH FREQUENCY HISTOGRAMS FOR SPOTTED BASS COLLECTED ON LAKE JACKSON BY GDNR

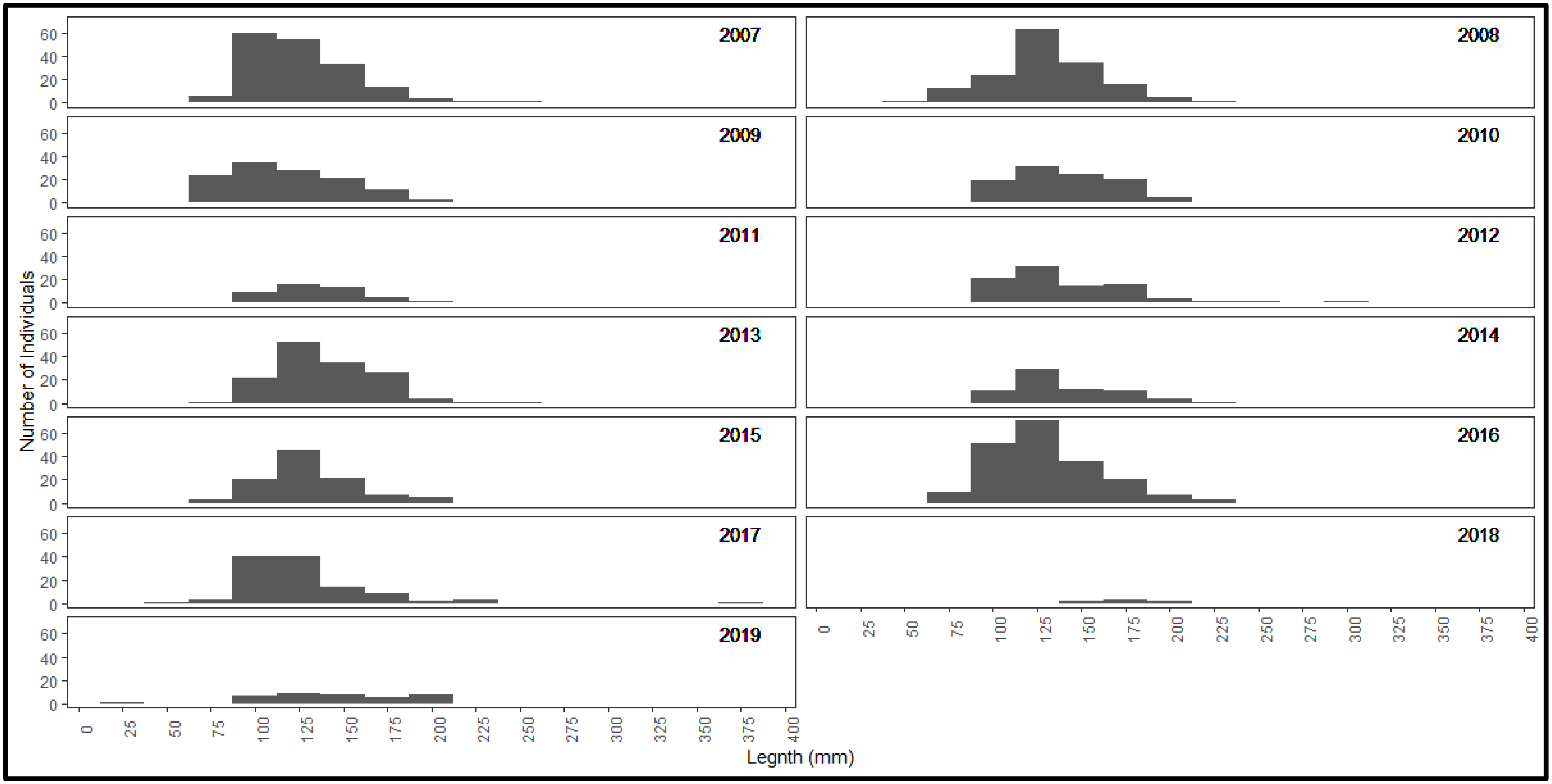

FIGURE B3 LENGTH FREQUENCY HISTOGRAMS FOR BLUEGILL COLLECTED ON LAKE JACKSON BY GDNR

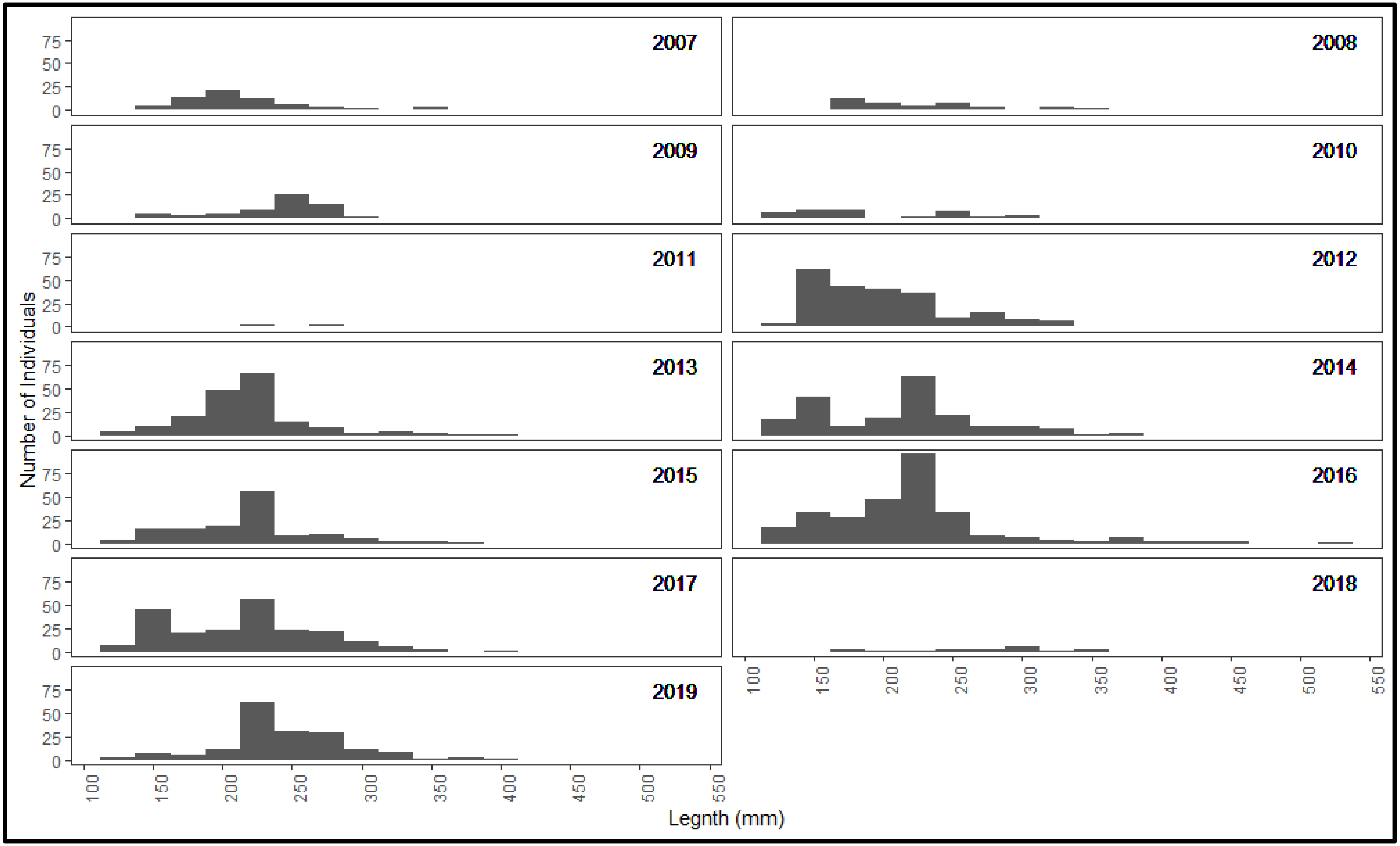

FIGURE B4 LENGTH FREQUENCY HISTOGRAMS FOR BLACK CRAPPIE COLLECTED ON LAKE JACKSON BY GDNR

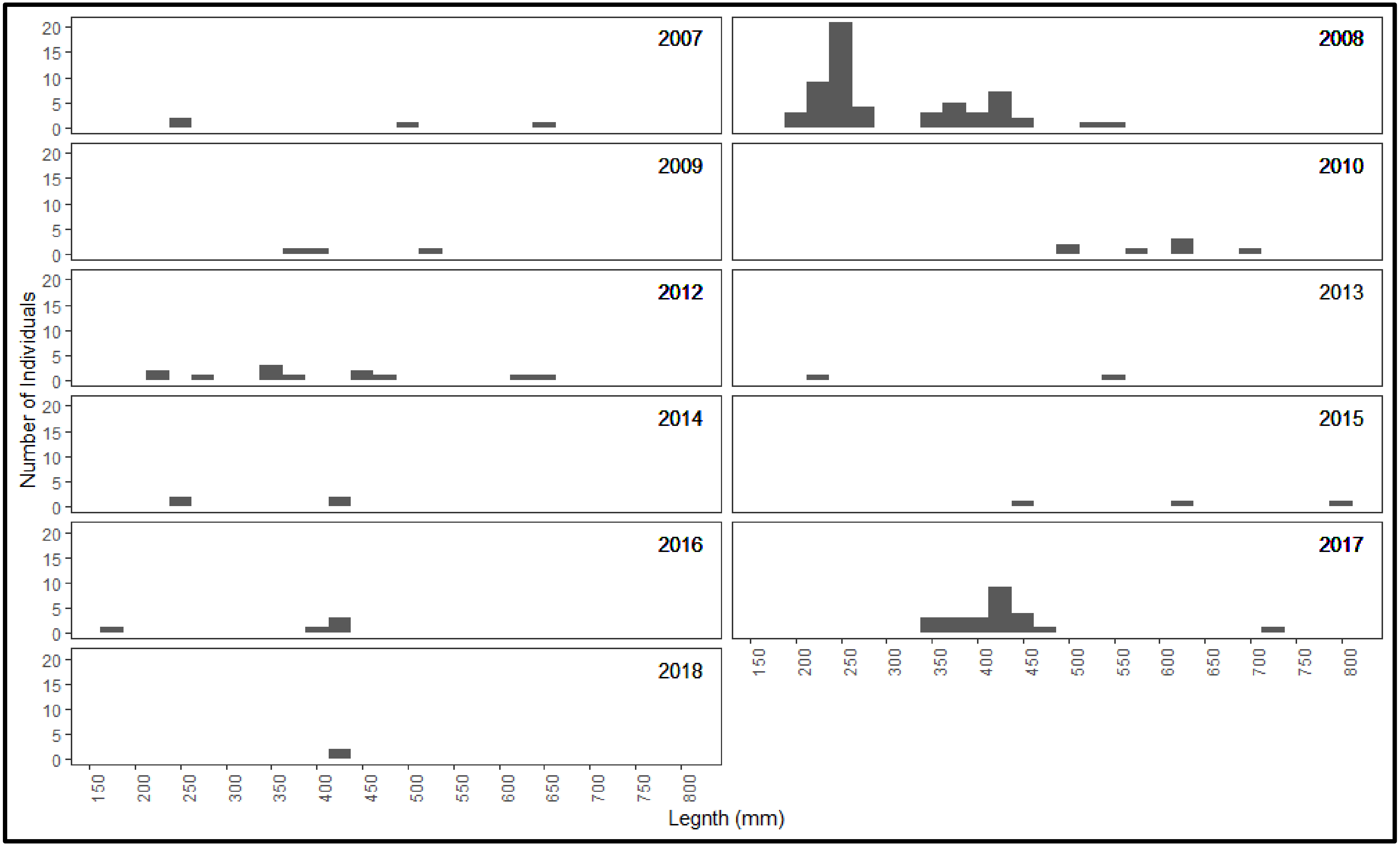

Figure B5 Length Frequency Histograms for Striped Bass Collected on Lake Jackson by GDNR

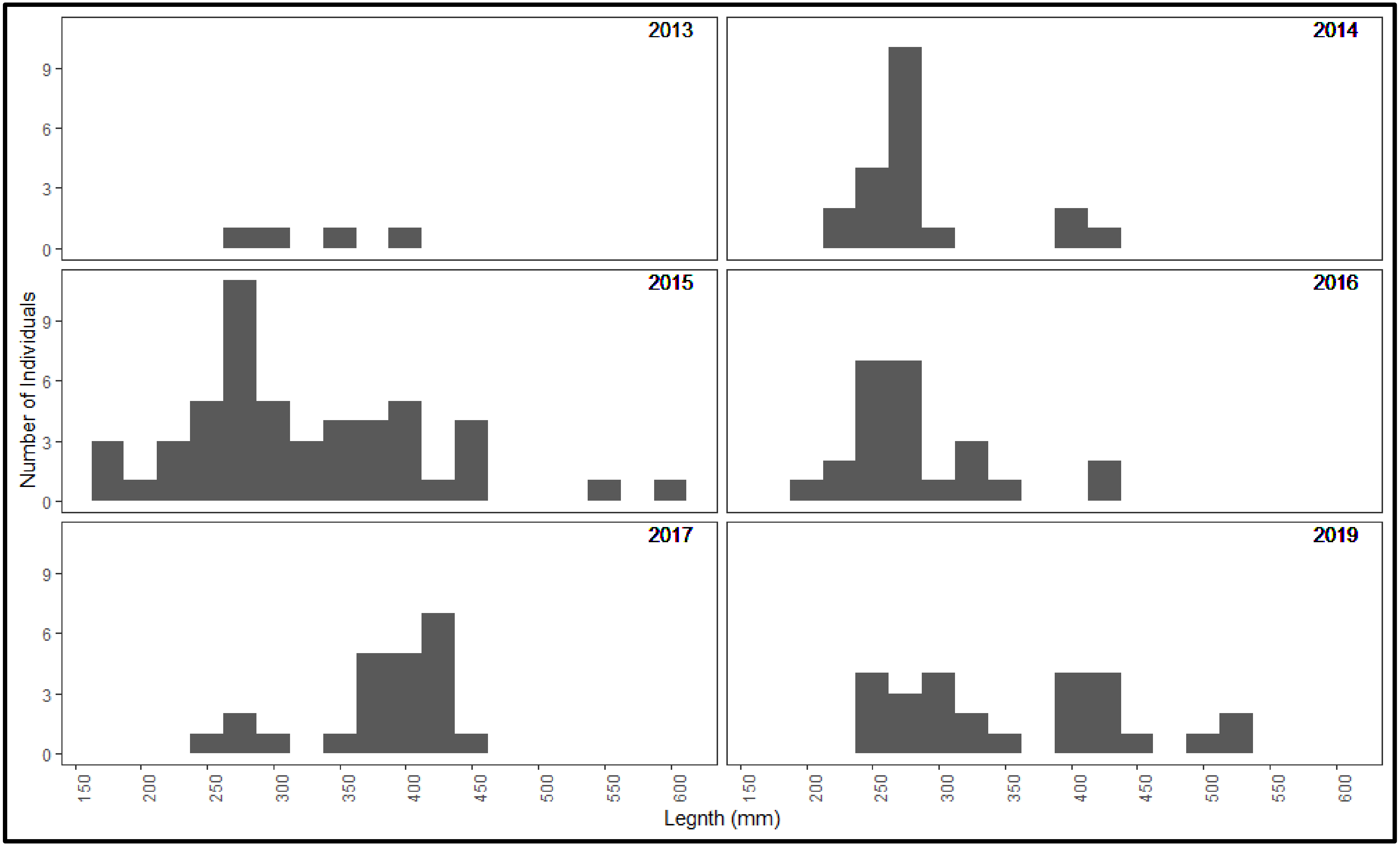

FIGURE 6 **LENGTH FREQUENCY HISTOGRAMS FOR HYBRID STRIPED BASS COLLECTED ON LAKE JACKSON BY GDNR**

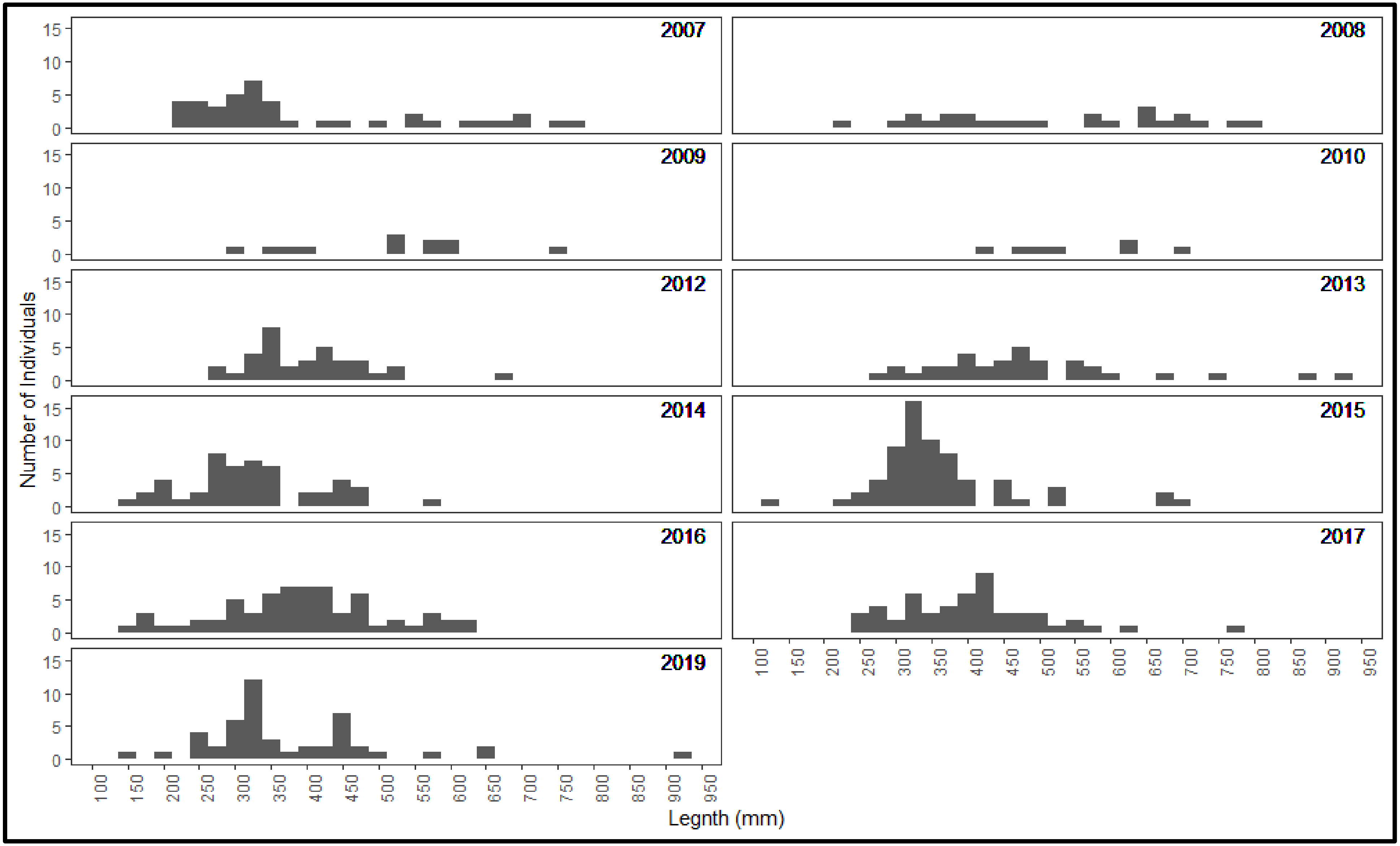

FIGURE 7 **LENGTH FREQUENCY HISTOGRAMS FOR CHANNEL CATFISH COLLECTED ON LAKE JACKSON BY GDNR**

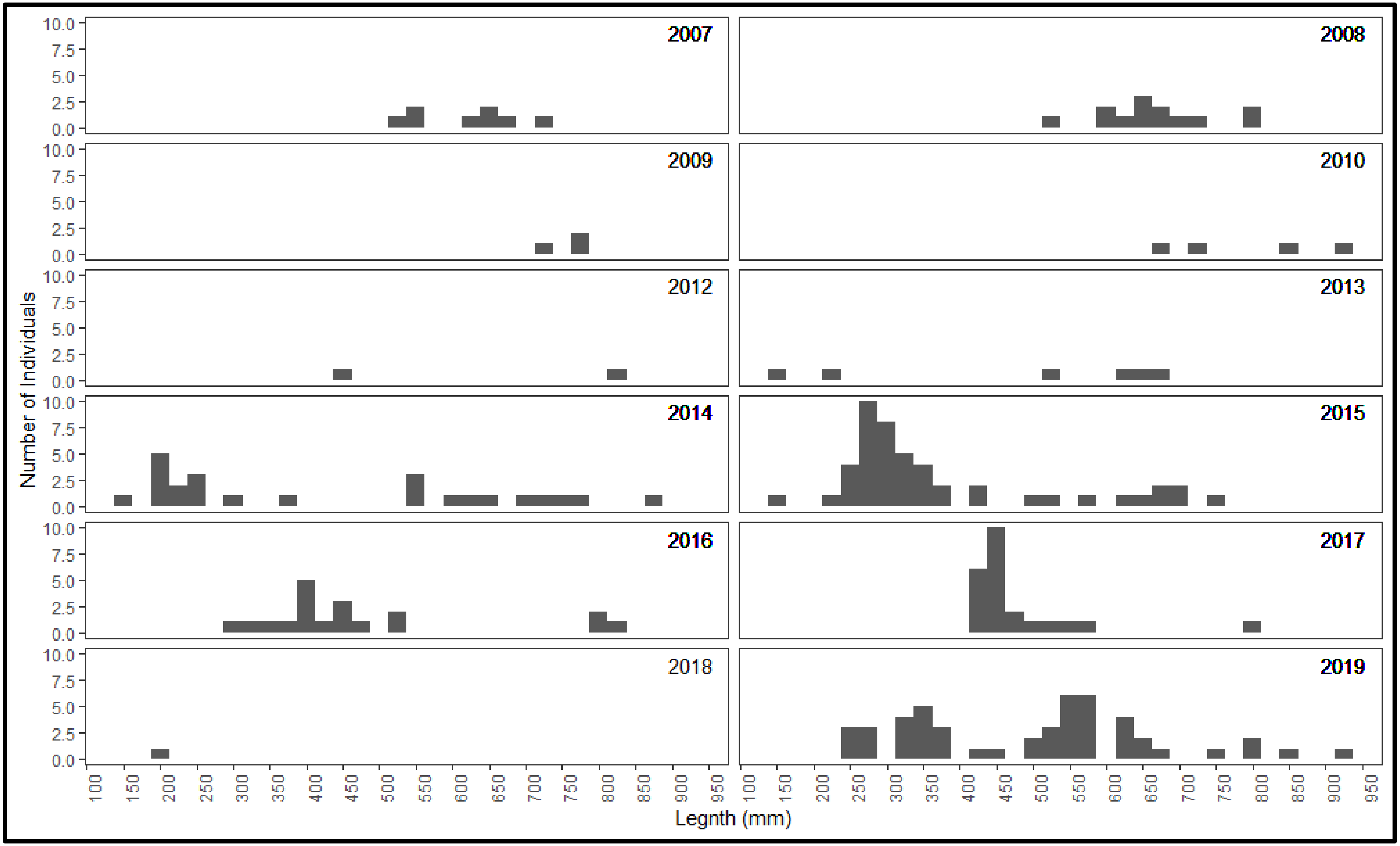

FIGURE 8 LENGTH FREQUENCY HISTOGRAMS FOR BLUE CATFISH COLLECTED ON LAKE JACKSON BY GDNR

STUDY REPORT

AMERICAN EEL ABUNDANCE AND UPSTREAM MOVEMENTS

LLOYD SHOALS HYDROELECTRIC PROJECT
(FERC NO. 2336)

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May 2020

STUDY REPORT
AMERICAN EEL ABUNDANCE AND UPSTREAM MOVEMENTS
LLOYD SHOALS HYDROELECTRIC PROJECT
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STUDY REPORT
AMERICAN EEL ABUNDANCE AND UPSTREAM MOVEMENTS
LLOYD SHOALS HYDROELECTRIC PROJECT
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1.0 INTRODUCTION

This report presents the findings of the American Eel Abundance and Upstream Movements Study conducted for the Federal Energy Regulatory Commission (FERC) relicensing of Georgia Power Company's (Georgia Power's) Lloyd Shoals Hydroelectric Project (FERC No. 2336) (Lloyd Shoals Project, the Project). The study was conducted according to the approved study plan for the Lloyd Shoals Project. The approved study plan consists of Georgia Power's Revised Study Plan (Georgia Power 2019) and the Study Plan Determination issued by FERC's Director of the Office of Energy Projects on May 20, 2019 (FERC 2019). Georgia Power will use the information generated by the study to evaluate the environmental effects of its proposed action in the Preliminary Licensing Proposal, to be filed with FERC by July 1, 2021.

The 18-megawatt Lloyd Shoals Project consists of a dam, powerhouse, and 4,750-acre reservoir (Lake Jackson, or Jackson Lake) on the Ocmulgee River in Butts, Henry, Jasper, and Newton Counties, Georgia (Figure 1; Figure 2). Georgia Power operates the Project in a modified run-of-river mode for generation during peak power demand hours to meet electrical system demand. Georgia Power is not proposing to make any major modifications to the Project under the new license. The Project does not occupy federal lands. The current license expires December 31, 2023.

1.1 OBJECTIVE

The goal of this study is to develop current baseline information on the abundance, life stages, size range, and timing of upstream movements of American Eel that approach Lloyd Shoals Dam within the project boundary. This information will enable the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) to evaluate whether passage may be needed for American Eel at Lloyd Shoals Dam. The objectives of this study are:

- Objective 1 – Identify the life stage and size range of American Eel migrating to Lloyd Shoals Dam.
- Objective 2 – Identify the timing of upstream movements of American Eel migrating to Lloyd Shoals Dam in terms of seasonality and correlation to environmental variables, including discharge, water temperature, and the percent of moon illumination.
- Objective 3 – Calculate indices of abundance of American Eel migrating to the Lloyd Shoals Project.

1.2 STUDY AREA

The study area includes the mainstem Ocmulgee River from Lloyd Shoals Dam downstream about 1.2 river miles to the Georgia Highway (Hwy) 16 bridge (Figure 3).

2.0 STUDY METHODS

The study approach followed the approved study plan (Georgia Power 2019; FERC 2019) and consisted of the elements described below.

2.1 ELECTROFISHING

Electrofishing sampling, including backpack and boat electrofishing as appropriate for depth and habitat conditions, was conducted once per month in September through December 2019 and in January and March 2020. Boat electrofishing could not be conducted in February 2020 due to high river flows associated with large rain events; average discharge for February 2020 was 8,240 cubic feet per second (cfs). Backpack electrofishing could not be conducted from December 2019 to March 2020 due to high river flows (discharge greater than 1,500 cfs). A second March 2020 sampling event and an April 2020 electrofishing event were cancelled due to COVID 19 health and safety concerns.

Four 30-minute boat electrofishing runs (totaling 2 hours of effort) were made during each sampling event to represent the range of boatable habitats available in the study area (> 2 ft water depth). A Midwest Lake Electrofishing Systems (MLES) Elite Series Boat (16 foot; 60 HP outboard) equipped with an MLES Infinity control box and powered by 6,750-watt generator was used for all boat electrofishing. The boat electrofisher was operated in pulsed direct current (DC) mode, with a pulse width of 30 Hz, with a duty cycle of 25%, and 425 volts. During each run, the boat was maneuvered slowly downstream along the shoreline while stunned eels were collected by two netters. Eels that could not be netted were noted on data sheets. All fish collected were held in a live well for processing.

Backpack electrofishing was conducted using a Smith-Root Model LR20 unit in wadeable shoals, shallow pools and backwaters, along shorelines, and in shallow pools near the base of the spillway using a standard backpack electrofisher. The backpack electrofisher was operated in pulsed DC mode, with a pulse width of 60 Hz, a duty cycle of 25 – 50%, and a voltage of 200 – 250 volts. All electrofishing was conducted under daylight conditions with two individuals netting fish.

Sampling was not conducted in July and August 2019 because water temperatures were greater than the 28°C temperature threshold set in FERC's study plan determination, as measured at the Butts County Water Intake (July 1 – 24) and continuous monitoring buoy (July 24 – August 31).

2.2 TRAPPING

Eel trapping was conducted using cylindrical 9-in by 31-in galvanized steel wire traps with 0.25-in mesh and 2-in diameter entrance openings on each end. Traps were baited with canned sardines and deployed in various locations around the tailrace area within 0.25 mi downstream of the dam (Figure 3). Traps were deployed in late afternoon, retrieved the following morning for two consecutive days in August through December 2019, and January, March, and April of 2020. Sampling could not be conducted in February 2020 due to high river flows associated with large rain events. Several traps were stolen during the course of sampling, and others were subjected to tampering (e.g., trap pulled out of water and left on Tailrace Fishing Pier; trap pulled out of water and left on riverbank).

Ramp traps have not been employed to date. Initial reconnaissance indicated the ramp trap should be located along the east end of the training wall separating the tailrace and the toe of the spillway. However, three wire traps that were deployed in the same area were stolen over the first three months of sampling. Additionally, due to the lack of available water and electrical supply, it was determined that the location was not suitable for deployment of a ramp trap.

2.3 TAGGING

All captured eels were anesthetized with Tricaine Methanesulfate (MS-222), dosed at approximately 150 milligrams per liter, measured for total length, and weighed. Captured eels were implanted with an 8 millimeter (mm) x 1.44 mm, 30 milligram passive integrated transponder (PIT) tag (Biomark HPT8) in the dorsal musculature. Tag numbers were recorded on data sheets along with the length, weight, and capture location.

2.4 DATA ANALYSIS

Data for environmental variables, including river discharge, water temperature, and percent of moon illumination, were collected for the sampling periods for correlation to eel catch. Discharge data was obtained from the U.S. Geological Survey gage located about 1 mile downstream (No. 02210500, Ocmulgee River near Jackson, Georgia). Water temperature data was obtained from the USGS gage on the Ocmulgee River at Hawkinsville (USGS No. 02215000) and the continuous tailrace monitor that is in place through July 2020 for Georgia Power's Water Resources Study (also a component of the approved study plan). A comparison of daily average water temperature data collected from the Hawkinsville gage and the continuous tailrace monitor between August 2019 and April 2020 indicated no statistical difference between the two ($t = 0.802$, $df = 1$, $p = 0.211$).

The continuous tailrace monitor consisted of a YSI EXO 3 multiparameter water quality monitor suspended at a depth of one meter and set to record water temperature and other parameters at hourly intervals. Readily available percent of moon surface illumination data was obtained online for the last day of each sampling event (Time and Date AS 2020).

The number of eels captured by date was tabulated for the entire sampling period. The eel catch by date was also evaluated for correlation to river discharge, water temperature, and percent of moon surface illumination.

3.0 RESULTS

A total of eleven American Eel were captured or observed over seven sampling events between September 2019 and April 2020 (Table 1). The total length of captured or observed eels ranged from 241 mm to approximately 450 mm. River discharge during sampling events ranged from 299 to 3,565 cfs, and water temperature ranged from 10.2 to 27.4°C. Average water temperatures were within the 10 – 28°C range from October 2019 through March 2020 (Table 2; Figure 4). There were no correlations to water temperature, discharge, and moon illumination, although this is likely due to low catch rates to date.

Most eels were captured during boat electrofishing. Backpack electrofishing could not be conducted during the December, January, or March sampling events due to high river flows (> 1,500 cfs). Traps were set for two consecutive nights during each sampling event, but no eels were captured.

During the October 2019 sampling event, all captured fish were identified to document all species that occur in the tailwater. Twenty-four species were documented. Dominant species included Redbreast Sunfish, Bluegill, Spotted Bass, Spotted Sucker, Gizzard Shad, and Largemouth Bass (Table 3).

4.0 SUMMARY

Catches of American Eel in this study are lower than those reported in a previous study using similar methods (EA Engineering, Science, and Technology, Inc. [EA] 1990). However, peak abundance in the previous study occurred in June, which was not sampled in 2019. Prolonged periods of low river flows from late summer to early fall, and high river flows in winter and early spring may have negatively impacted the likelihood of capturing eels.

The previous study found backpack electrofishing to be more effective than boat electrofishing at capturing eels (EA 1990). Backpack electrofishing effectiveness in the current study may be improved by shifting efforts to the shoal complex immediately downstream of Hwy 16 where previous sampling events were focused. Although just beyond the downstream extent of the current study area, that reach has more prevalent shoals, is more conducive to wading at a range of flows, and is likely to yield a higher catch of eels than the more limited shoals available upstream of Hwy 16.

Eels captured in the current study ranged from 241 mm to an estimated 450 mm total length. Based on a previous study in the Altamaha River, American Eel within this size range may be between three to seven years old (Helfman et al 1984). This indicates that American Eel are continuing to recruit into the Lloyd Shoals tailwater area.

Sampling has been impacted by the COVID-19 pandemic and may continue to be affected into the near future. The necessity of individuals being in close proximity during electrofishing puts sampling crews at increased risk. Trapping activities are planned to continue through July 2020 under the current study plan, and may be supplemented with dip-netting, visual observation at nighttime, and/or hook-and-line sampling. Additionally, it may be possible to locate a ramp trap from the concrete abutment immediately below the powerhouse, which is a secure area.

Georgia Power has been consulting with NMFS and FWS about the study findings and adapting the sampling methods to Covid-19 restrictions and site-specific constraints. Georgia Power will prepare an addendum to this study report that updates the sampling results to July 2020 and summarizes the agency consultation, and will file the addendum prior to the Study Results Meeting now scheduled for July 29, 2020.

5.0 REFERENCES

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Helfman, Gene S., E.L. Bozeman, and E.B. Brothers. 1984. Size, Age, and Sex of American Eels in a Georgia River. Transactions of the American Fisheries Society 113:132-141.

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TABLE 1 AMERICAN EELS OBSERVED OR CAPTURED IN THE STUDY AREA BETWEEN SEPTEMBER 2019 AND APRIL 2020

DATE	LENGTH (MM)	WEIGHT (G)	TAG NUMBER	NOTES
10/24/2019	375	90	982F126058800404	-
10/24/2019	346	69	928F126058800499	-
11/25/2019	200	-	-	not captured; estimated length
1/20/2020	311	46	982F126058800424	-
1/20/2020	299	45	982F126058800456	-
1/20/2020	300	-	-	not captured; estimated length
1/20/2020	300	-	-	not captured; estimated length
1/20/2020	300	-	-	not captured; estimated length
1/20/2020	450	-	-	not captured; estimated length
1/20/2020	450	-	-	not captured; estimated length
3/11/2020	241	21	982F126058800413	-

TABLE 2 SUMMARY OF ENVIRONMENTAL AND CAPTURE DATA FROM EEL STUDY SAMPLING EVENTS

DATE	MOON (% VISIBLE)	DISCHARGE (CFS)	WATER TEMPERATURE (°C)	TOTAL EELS CAPTURED OR OBSERVED		
				BOAT	BACKPACK	TRAP
09/27/2019	1.9	299	27.4	0	0	0[3]
10/25/2019	9.3	493	20.8	1	1	0[3]
11/26/2019	0.1	1,288	13.7	1	0	0[3]
12/17/2019	69.9	2,870	10.2	0	NSF[1]	0[3]
01/21/2020	11	3,565	13.6	6	NSF	0[3]
03/12/2020	89.9	3,020	13.9	1	NSF	0
04/10/2020	81.1	2,230	20.2	NSC[2]	NSC	0

[1] NSF = not sampled due to high flows
[2] NSC = not sampled due to COVID-19
[3] Traps vandalized

TABLE 3 SUMMARY OF NON-EEL FISH SPECIES CAPTURED IN OCTOBER 2019

COMMON NAME	RANGE OF TOTAL LENGTH (MM)	NUMBER CAPTURED	PERCENT ABUNDANCE
Redbreast Sunfish	46 - 191	67	21.0%
Bluegill	36 - 216	55	17.2%
Spotted Bass	83 - 521	39	12.2%
Spotted Sucker	136 - 486	36	11.3%
Gizzard Shad	283 - 440	25	7.8%
Largemouth Bass	125 - 558	25	7.8%
Lepomis sp.	35 - 112	18	5.6%
Redear Sunfish	160 - 330	9	2.8%
Yellow Bullhead	57 - 245	6	1.9%
Golden Redhorse	389 - 512	5	1.6%
Longear Sunfish	122 - 162	5	1.6%
Blackbanded Darter	51 - 76	4	1.3%
Ocmulgee shiner	64 - 98	4	1.3%
Blue Catfish	572 - 708	3	0.9%
Longnose Gar	311 - 924	3	0.9%
Striped Jumprock	485 - 493	3	0.9%
Common Carp	655 - 765	2	0.6%
Green Sunfish	77 - 83	2	0.6%
Brown Bullhead	71 - 125	2	0.6%
Brassy Jumprock	398	1	0.3%
Flathead Catfish	465	1	0.3%
Grass Carp	928	1	0.3%
Snail Bullhead	206	1	0.3%
Spottail Shiner	93	1	0.3%
Warmouth	147	1	0.3%

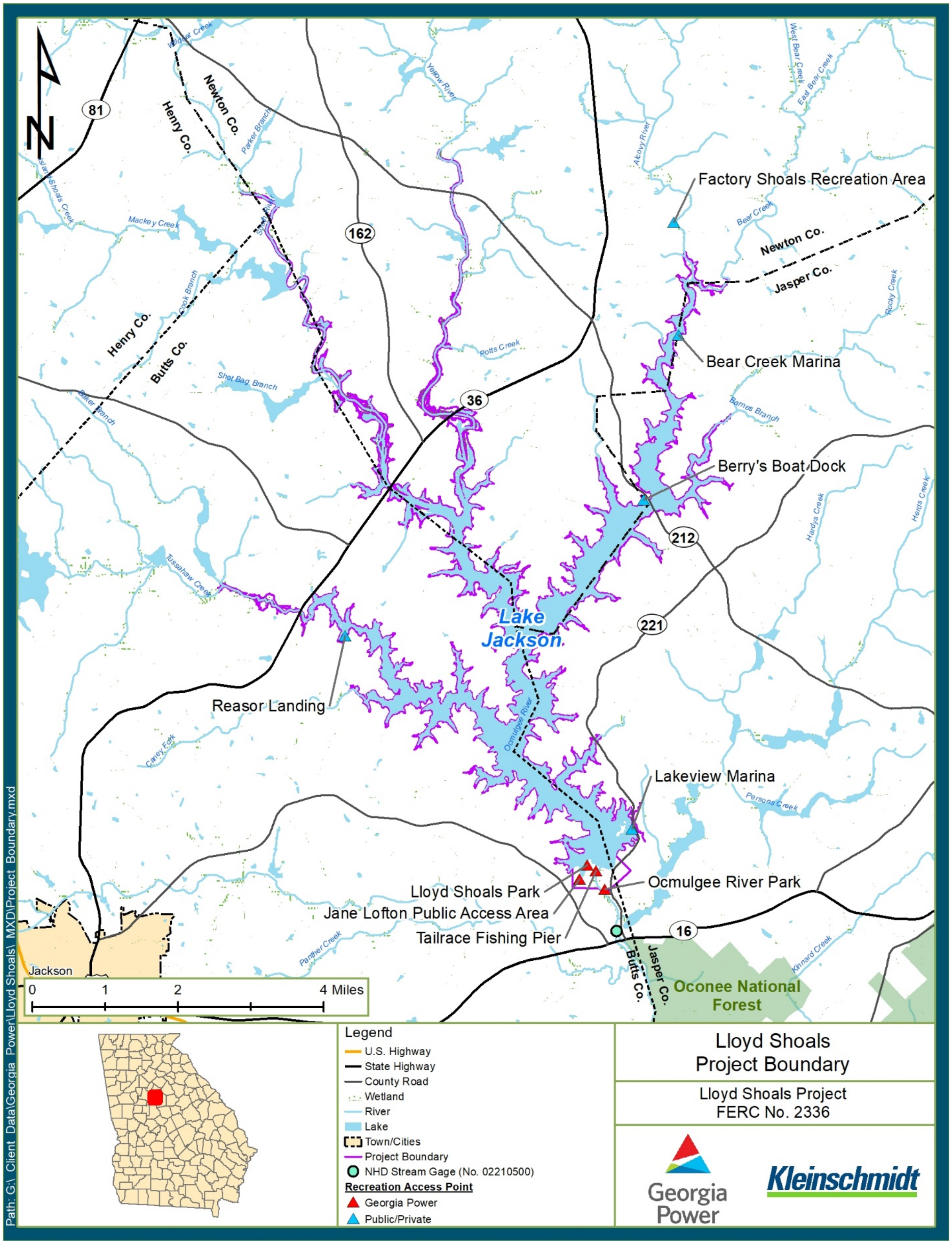

FIGURE 1 LLOYD SHOALS PROJECT BOUNDARY

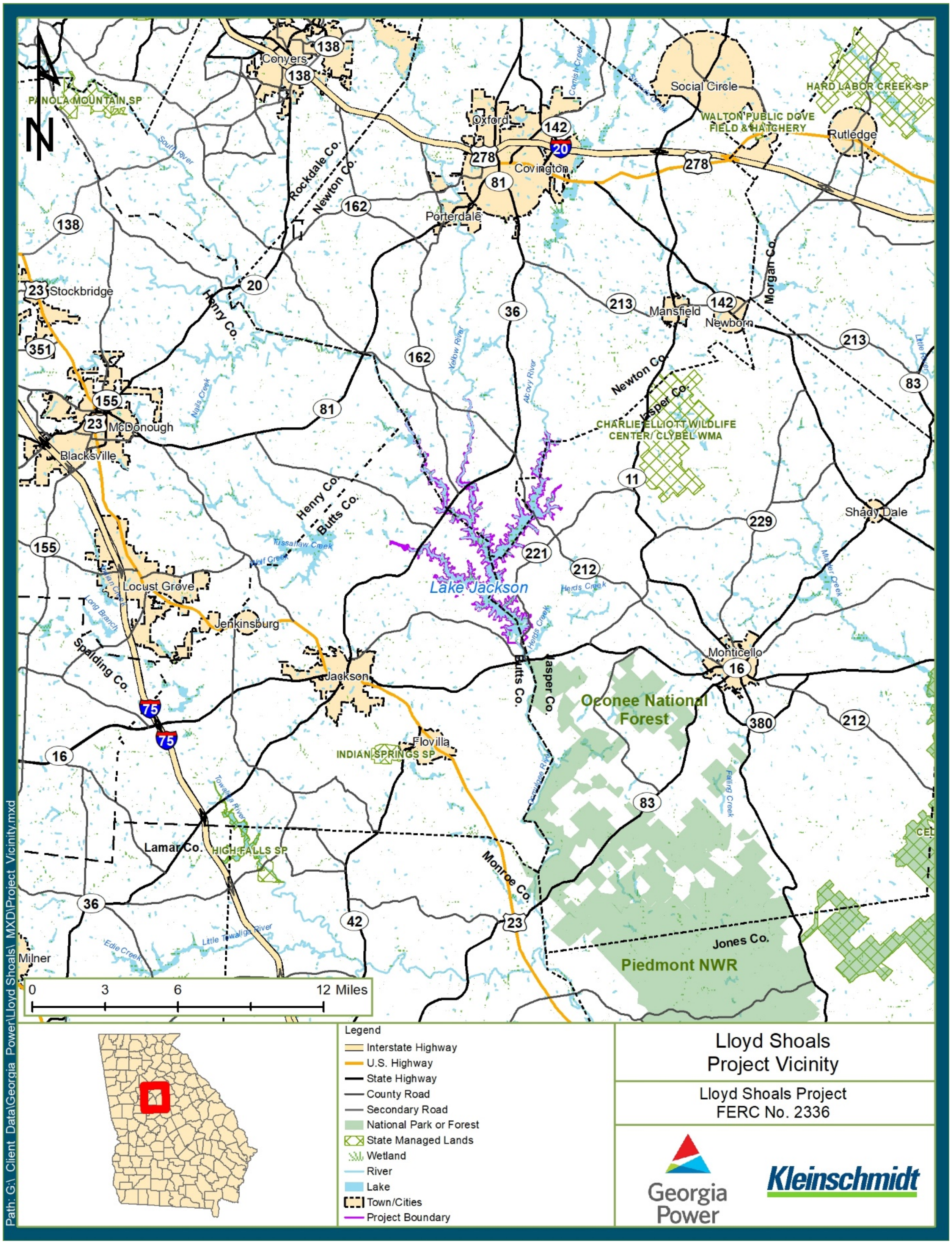

FIGURE 2 LLOYD SHOALS PROJECT VICINITY

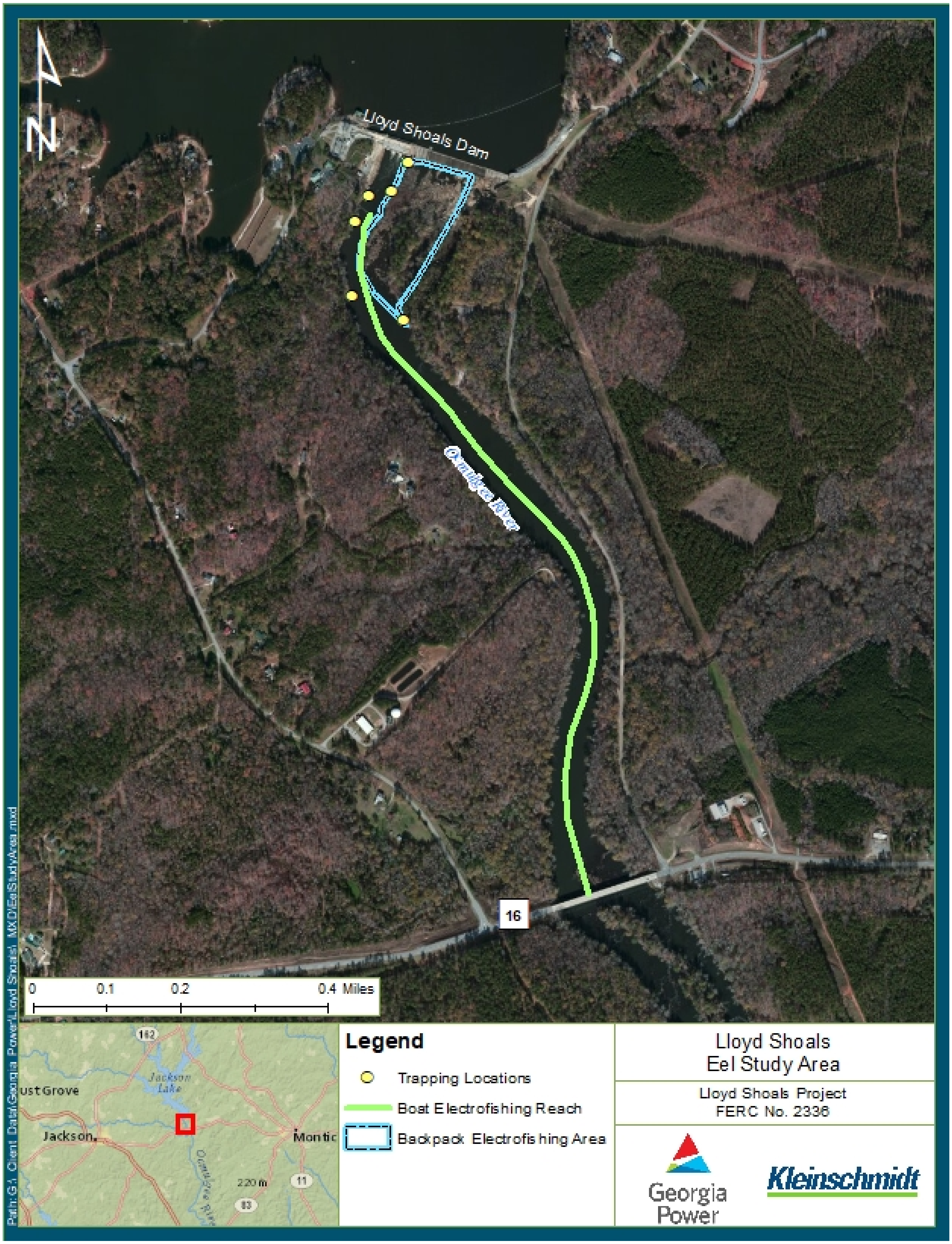

FIGURE 3 AMERICAN EEL STUDY AREA

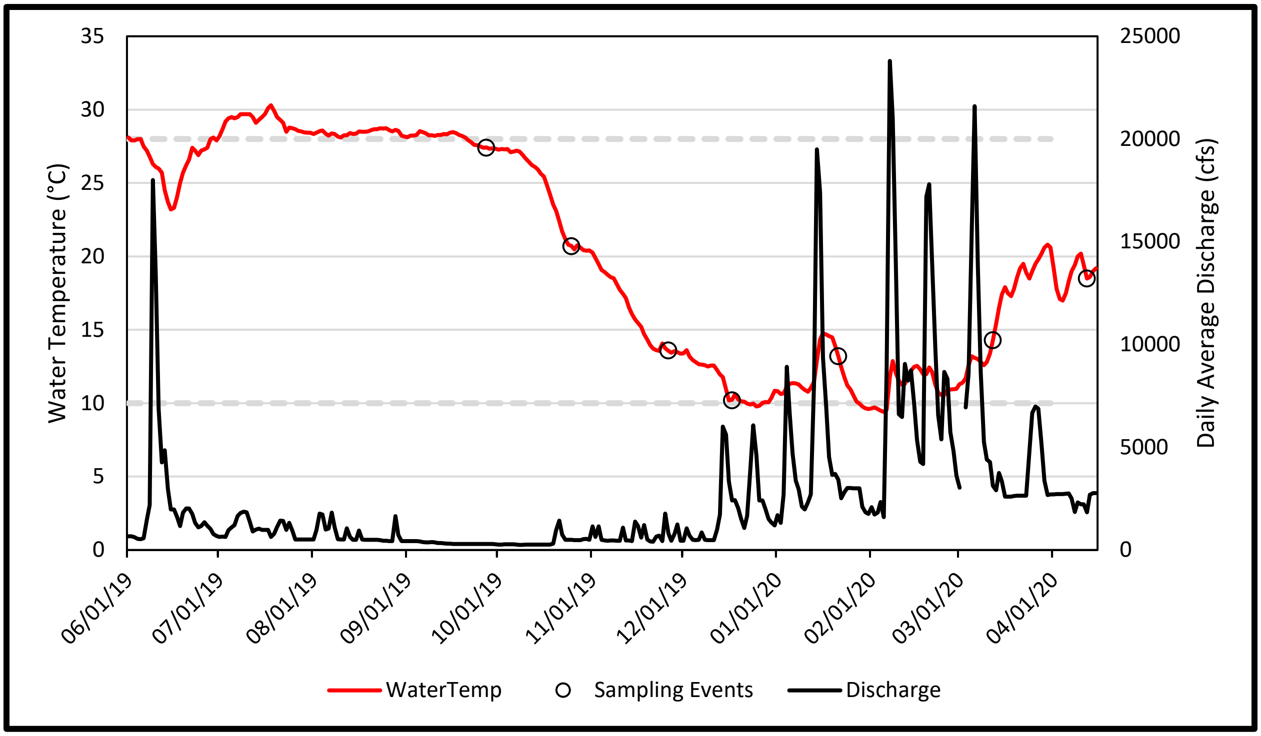

FIGURE 4 SAMPLING EVENTS, DAILY AVERAGE DISCHARGE, AND WATER TEMPERATURE