TALLAHASSEE MASTER PLAN – SURFACE WATER (TMaPS): VOLUME 4

CITY OF TALLAHASSEE

LAKE JACKSON BASIN

Submitted by:
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July 2025

Geosyntec consultants

engineers | scientists | innovators

VOLUME 4

LAKE JACKSON BASIN

CITY OF TALLAHASSEE

Prepared for

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The engineering material and data contained within the enclosed report was prepared by Geosyntec Consultants, Inc. for sole use by the City of Tallahassee. This report was prepared under the supervision and direction of the respective undersigned, whose seal as a registered professional engineer is affixed below.

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Tallahassee Master Plan – Surface Water (TMaPS)

Volume 1: Executive Summary

Volume 2: Background & Approach

Volume 3: Lake Munson Basin

Volume 4: Lake Jackson Basin

Volume 5: Lake Lafayette Basin

Volume 6: Wakulla Springs and Lake Talquin

Volume 7: Non-Structural and Structural Project Development

Volume 8: Regulatory Review

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ACRONYMS AND ABBREVIATIONS

AGM	annual geometric mean
AH	Applicant's Handbook
BMAP	basin management action plan
BMP	best management practices
CDA	Concentrated Discharge Areas
cfs	cubic feet per second
Chl-a	chlorophyll *a*
City	City of Tallahassee
CN	curve number
DCIA	directly connected impervious area
DEM	Digital Elevation Model
DMR	Discharge Monitoring Report
DO	dissolved oxygen
E. coli	*Escherichia coli*
EMC	event mean concentration
EPA	U.S. Environmental Protection Agency
ERP	Environmental Resource Permit
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FIB	Fecal Indicator Bacteria
FLUCCS	Florida Land Use Cover Classification System
FSQAH	Florida Stormwater Quality Applicants Handbook
FSU	Florida State University
ft	feet
FWC	Florida Fish and Wildlife Conservation Commission
GIS	geographic information system
HA	Habitat Assessment
HOA	homeowners association

HSG	hydrologic soil group
ID	identification
IWR	Impaired Waters Rule
lb/yr	pounds per year
lb/acre/yr	pounds per acre per year
LDI	Landscape Development Intensity
LVI	Lake Vegetation Index
MARC	mean annual runoff coefficient
MARS	Megginnis Arm Regional Stormwater
mg/L	milligrams per liter
mL	milliliter
MPN	Most Probable Number
MS4	municipal separate storm sewer system
NADP	National Atmospheric Deposition Program
NAVD88	North American Vertical Datum of 1988
NHD	National Hydrological Data
NNC	Numeric Nutrient Criteria
NRCS	Natural Resource Conservation Service
NWFWMD	Northwest Florida Water Management District
OFW	Outstanding Florida Water
OSTDS	onsite sewage treatment and disposal systems
PCU	platinum-cobalt units
PO_4	orthophosphate
QAPP	Quality Assurance Project Plan
SAV	submerged aquatic vegetation
SCI	Stream Condition Index
SIMPLE-Seasonal	Spatially Integrated Model for Pollutant Loading Estimates
SPOA	Summerbrooke Property Owners Association, Inc.
SSO	sanitary sewer overflow
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement and Management

SWMM	Stormwater Management Model
TKN	total Kjeldahl nitrogen
TMaPS	Tallahassee Master Plan - Surface Water
TMDL	total maximum daily load
TN	total nitrogen
TP	total phosphorus
TSI	Trophic State Index
TSS	total suspended solids
µg/L	micrograms per liter
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WBID	waterbody identification

4 Lake Jackson Basin

4.1 Basin Overview and Project Waterbodies

The Lake Jackson basin is located in Leon County, FL north of Tallahassee and encompasses the township and ranges of: 001N 001E, 001N 001W, 002N 001E, and 002N 001W. **Figure 4-1** shows the location of the Lake Jackson basin in relation to the Tallahassee city limits and within the Leon County boundary. The basin covers 27,340 acres (42.7 square miles), of which 76.6 percent (20,948 acres) is land cover and the remaining 23.4 percent (6,392 acres) is surface water. **Exhibit 4-1** presents a map showing basin boundaries, waterbodies that are part of this study (termed primary waterbodies), tributary inputs, the extents of the City of Tallahassee (City) incorporated area, and smaller watershed areas that drain to Lake Jackson, which is the primary receiving waterbody in the basin.

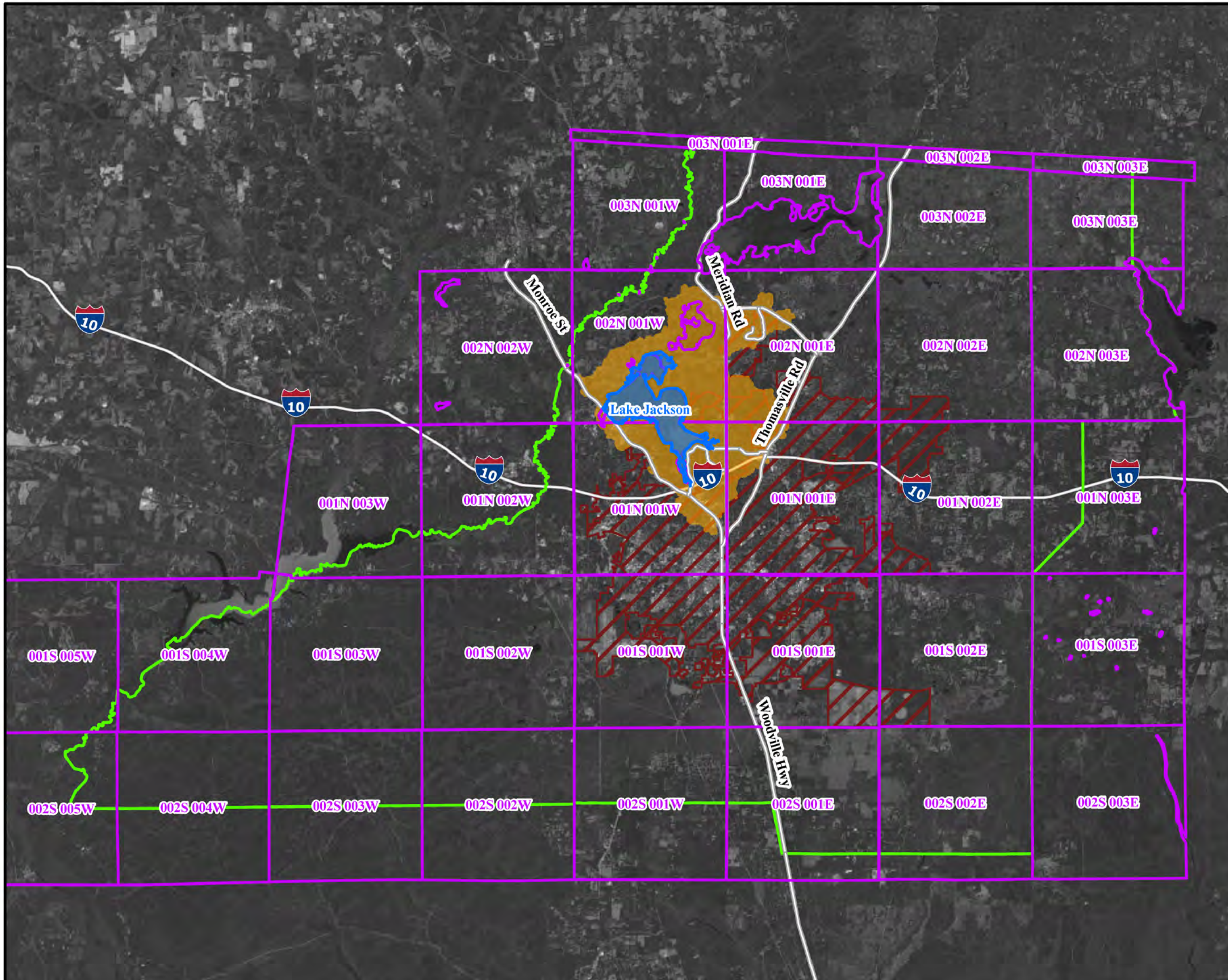
Looking at drainage to the lake (**Exhibit 4-1**), along the southern end, Megginnis Creek drains into Megginnis Arm, which flows into the southern end of the lake. East of this, Lexington Creek flows from the southeast portion of the watershed into Fords Arm. Along the southwest edge, a series of watersheds drain directly into the lake, including Okeeheepkee, Lake Jackson Mounds, Bellwood, and Harbinwood. Along the north side of Lake Jackson, three additional watersheds drain directly to the lake, Sunset, Blue Dog, and an unnamed watershed. Along the northeastern side, Carr Lake and its associated watershed drain into the northern lobe of Lake Jackson. Upstream of Carr Lake, Summerbrook Creek flows through the Summerbrook Chain of Lakes, including Lake Alyssa, Lake Somerset, and Shelly Pond draining a portion of the Bradfordville area. Along the eastern side, the Lake Overstreet watershed drains into Lake Jackson through Fords Arm. Two other unnamed watersheds drain into the eastern side of Lake Jackson and into the upper lobe of the lake. On the easternmost end of the basin, two waterbodies sit within closed watersheds (Lake Hall and Lake Elizabeth). Approximately 34 percent of the watershed is classified as developed, with a significant portion of development concentrated directly south and west of Lake Jackson. East and north of Lake Jackson (other than the Summerbrook Creek watershed) contains predominantly undeveloped and agricultural land, 54 percent and 13 percent, respectively. The City's incorporated area (shown on **Exhibit 4-1**) covers approximately 22 percent of the Lake Jackson basin along the southern and eastern sides.

For the Lake Jackson basin, the following nine primary waterbodies were identified for evaluation of potential pollutant loads and development of structural and non-structural projects to improve their water quality (as needed):

- Lake Jackson
- Carr Lake
- Summerbrook Chain of Lakes (Lake Alyssa, Somerset Lake, and Shelly Pond) and Summerbrook Creek
- Lake Overstreet
- Lake Hall

- Lexington Creek

These waterbodies are highlighted in **Exhibit 4-1** and are the focus of the analyses in the sections following this introduction.



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Legend

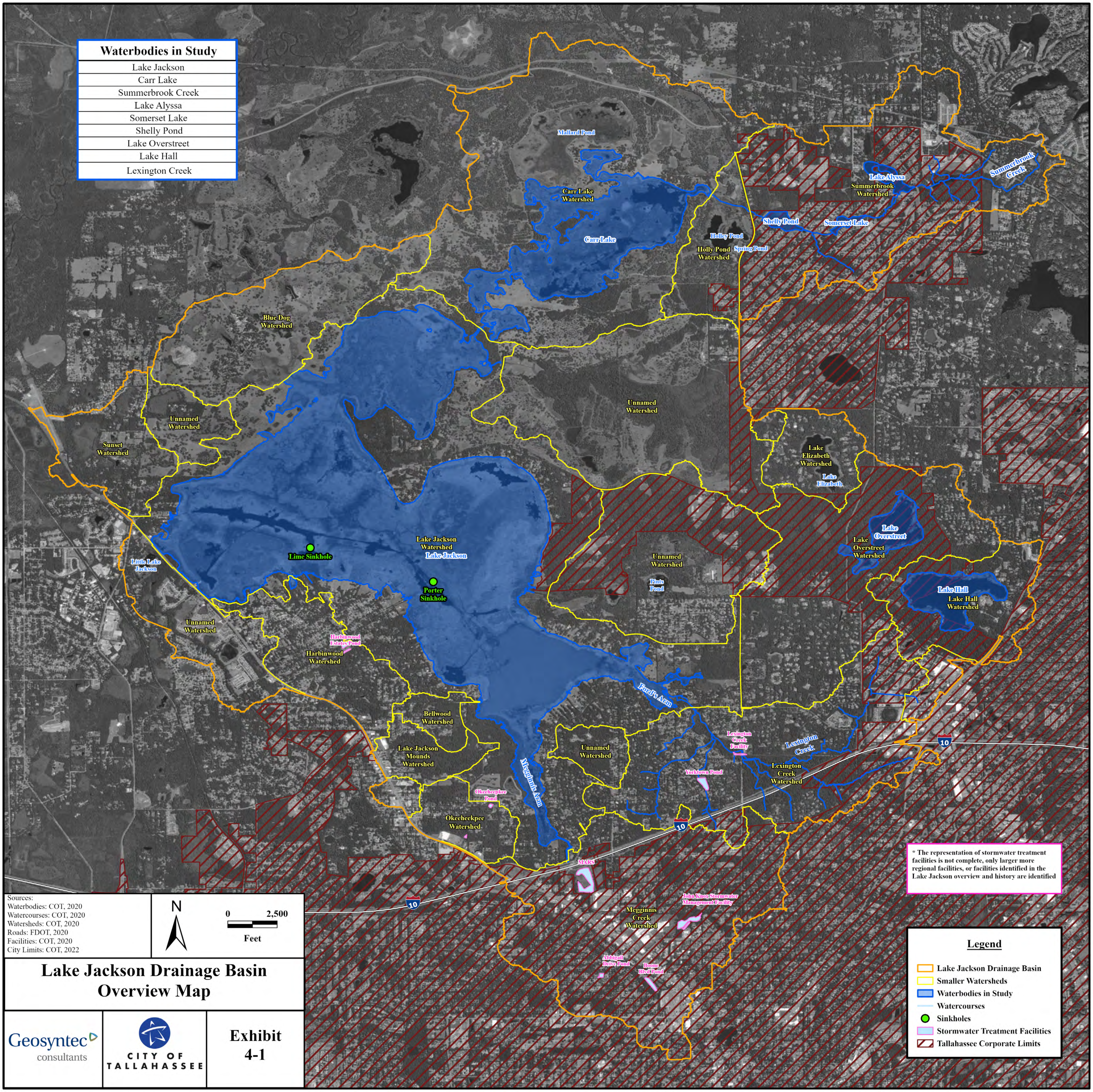
- Lake Jackson Drainage Basin
- Leon County Boundary
- Lake Jackson
- Township - Range for Leon County
- Major Roads
- Tallahassee Corporate Limits

Sources:
Waterbodies: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
City Limits: COT, 2020

Figure 4-1:
Location Map

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants


Waterbodies in Study
Lake Jackson
Carr Lake
Summerbrook Creek
Lake Alyssa
Somerset Lake
Shelly Pond
Lake Overstreet
Lake Hall
Lexington Creek
Mallard Pond
Carr Lake Watershed
Carr Lake
Holly Pond
Holly Pond Watershed
Spring Pond
Shelly Pond
Somerset Lake
Lake Alyssa
Summerbrook Watershed
Summerbrook Creek
Blue Dog Watershed
Unnamed Watershed
Sunset Watershed
Lake Elizabeth Watershed
Lake Elizabeth
Lake Overstreet
Lake Overstreet Watershed
Lake Hall
Lake Hall Watershed
Lake Jackson Watershed
Lake Jackson
Lime Sinkhole
Porter Sinkhole
Little Lake Jackson
Pints Pond
Harbinwood Estates Pond
Harbinwood Watershed
Ford's Arm
Bellwood Watershed
Lake Jackson Mounds Watershed
Okeeheepkee Pond
Okeeheepkee Watershed
Meggintis Arm
Lexington Creek Facility
Lexington Creek
Lexington Creek Watershed
Yorktown Pond
MARS
John Knox Stormwater Management Facility
Megginnis Creek Watershed
Abbigail Drive Pond
Boone Blvd Pond
10
* The representation of stormwater treatment facilities is not complete, only larger more regional facilities, or facilities identified in the Lake Jackson overview and history are identified
Legend
Lake Jackson Drainage Basin
Smaller Watersheds
Waterbodies in Study
Watercourses
Sinkholes
Stormwater Treatment Facilities
Tallahassee Corporate Limits
Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
Facilities: COT, 2020
City Limits: COT, 2022
N
0 2,500
Feet
Lake Jackson Drainage Basin Overview Map
Geosyntec consultants
CITY OF TALLAHASSEE
Exhibit 4-1

4.2 Report Review Summary

For the Lake Jackson basin, a series of reports were reviewed that provided the history and background of the basin and its waterbodies, along with data and other information to support the identification of potential sources and structural and non-structural projects to improve water quality. **Table 4-1** presents a list of the reports reviewed.

The reports range in time from the 1960s through the present and include studies on pollutant loads to the lakes and causes of water quality degradation; analyses of measured hydrologic, water quality, and biological data; and management plans to address restoration of Lake Jackson and other waterbodies within the basin. The spelling of "Megginnis" in referring to the tributary into Lake Jackson has changed throughout the years depending on the source of information but all the uses of that name refer to the same waterbody (e.g., Meginnis, McGinnis, etc.). The Summerbrook Chain of Lakes and Summerbrook Creek have various spellings and naming. Summerbrook Creek is at times called Summer Creek and Summerbrook is at times spelled Summerbrooke. For this report the spelling will be Summerbrook and the creek identified as Summerbrook Creek. The Summerbrooke Neighborhood is spelled differently.

Table 4-1: Lake Jackson Basin Reference List

Report Name	Author	Year
Weblink	Home Sales of Tallahassee	2022
Email from Summerbrooke Property Owners Association	Charlie Messing	2021
Lake Jackson Dry Downs: Frequently Asked Questions	FDEP	2021
Lake Hall – Wikipedia	Open	2021
Lake Overstreet – Wikipedia	Open	2021
Lake Overstreet - Florida State Parks	FDEP	2021
Lake Overstreet Trails - Florida State Parks	FDEP	2021
Lake Ecosummary - Lake Hall	City	2020
Waterbody Summary - Lake Hall	Leon County	2020
Lake Jackson Monitoring Project	City	2020
Waterbody Summary - Summerbrook Creek	Leon County	2020
Lake Ecosummary - Lake Overstreet	City	2020
Megginnis Arm Regional Stormwater Treatment Facility Evaluation Plan (Draft)	NWFWMD	2020
Stormwater Facility and Marsh (Emails between Paul Thorpe and Mark Heidecker)	NWFWMD/ City	2020
Lake Jackson Stormwater Monitoring Quality Assurance Project Plan (Draft)	City	2020
Waterbody Summary - Lexington Creek	Leon County	2020
Lake Hall Vegetation Index Results	Leon County	2019
Comments to FDEP, Cycle 4, Group 1, Verified List	City	2019
Manhole Lining Diagram	City	2019

Table 4-1: Lake Jackson Basin Reference List

Report Name	Author	Year
Waterbody Summaries 2019 Meginnis Creek	Leon County	2019
Waterbody Summaries 2019 Lake Jackson	Leon County	2019
Septic Tank Locations: Lake Jackson Drainage Basin	City /Leon County	2019
Meginnis Arm Regional Stormwater Treatment Facility Evaluation Plan (Draft)	NWFWMD	2019
Lake Jackson Aquatic Preserve Management Plan	FDEP	2019
Lake Carr Waterbody Summary	Leon County	2019
Lake Carr Lake Vegetation Index Results for 2019	Leon County	2019
Map of Septic Systems in the Basin and Just Outside	City	2019
Draft Lake Jackson Aquatic Preserve Management Plan Comments	City	2018
City of Tallahassee Mark Heidecker Letter to Florida Department of Environmental Protection (FDEP) on Draft Lake Jackson Aquatic Preserve Management Plan.	City	2018
Governing Board editorial: Future Bright for Lake Jackson	NWFWMD	2016
Determining the Influence of Septic Tanks on Lake Jackson's Nitrogen Levels Through Transport Modeling	Faraz Ahmed	2012
Florida Forever Competitive Grants Program Description and Application Package FY 2006-2007: Sharer Road Stormwater Improvements Plan	City	2006
Leon County Lakes Ecology, Lake Carr	Sean McGlynn	2006
Bradfordville Sector Plan	Leon County	2004
Effects of Septic Systems in the Lake Jackson Watershed	NWFWMD	2000
Lake Jackson Restoration Project	Leon County	1999
Lake Jackson Management Plan Addendum (Update and Extension of the 1994 Lake Jackson Management Plan	NWFWMD	1997
Lake Jackson Management Plan	NWFWMD	1994
I-10/Megginnis Creek Stormwater Treatment Facility Project Completion Report	NWFWMD	1993
Diagnostic Study on Lake Jackson, Florida: Sources, Sinks and Solutions, Volume 1: Summary and Analysis Final Report	FSU	1991
Stormwater Management Plan, Volume III – Lake Jackson Basin	City and Leon County	1991
Expansion of the Lake Jackson Megginnis Arm Stormwater Treatment Facility Final Report	NWFWMD	1990
Evaluation of the Lake Jackson Stormwater Treatment Facility Final Report	FSU	1988
Effectiveness of the Lake Jackson Restoration Project for the Treatment of Urban Runoff	Esry and Cairns	1988
Lake Jackson Clean Lakes Restoration Project Final Construction Report	NWFWMD	1984

Table 4-1: Lake Jackson Basin Reference List

Report Name	Author	Year
Engineering Design for Lake Jackson/Megginnis Arm Restoration: Lake Jackson Project	NWFWMD	1980
Analysis of the Water-Level Fluctuations of Lake Jackson Near Tallahassee, Florida	USGS	1967

4.3 Volume Outline

The sections that follow present the results from the completion of work tasks to date including: an overview of available data; assessment of the water quality conditions in the primary waterbodies and the tributaries that drain into them; development of potential pollutant loads; identification of "hot-spot" areas, by waterbody, to target for structural and non-structural projects within the Lake Jackson basin; and recommendations for additional data collection or studies to fill data gaps and support assessment of specific stressors to the primary waterbodies. The specific tasks, with a description of the work, include:

- Task 1 – Data Collection
    - Collection and review of data for use in project analyses.
- Task 2 – Waterbody Data Review and Summary
    - Evaluation of existing water quality conditions and general health of target waterbodies using available data and studies.
    - Qualitative assessment for each waterbody to identify pollutant loading sources to focus on.
- Task 3 – Water Quality Assessment
    - Calculation of pollutant load estimates to the target waterbodies including stormwater runoff, groundwater impacted by onsite sewage treatment and disposal systems (OSTDS), point sources, lake inflow, internal recycling, and atmospheric deposition.
    - Identification of hotspots within each drainage basin and prioritization of waterbodies to target for restoration efforts.
- Task 4 – Water Quality Study Identification and Prioritization
    - Identification of potential data collection or water quality improvement studies needed to address data gaps.

Sections 4.4 through **4.9** present an overview and history for each of the primary waterbodies along with the findings and results from Tasks 1 through 3. **Section 4.10** presents a basin-wide assessment of hot-spot areas to target for structural and non-structural projects based on the data and analyses presented in **Sections 4.4** through **4.9**. **Section 4.11** presents a summary of potential stressors within target waterbodies and recommendations on data collection or studies.

4.4 Lake Jackson

This section presents the results from Tasks 1 through 3 for Lake Jackson. This includes an overview and history of the lake and basin, present impairment status of waterbodies in the basin, an overview of available data, a qualitative assessment of potential pollutant sources, and calculation of potential pollutant loads.

4.4.1 Overview and History

Lake Jackson is a clastic upland lake that is generally shallow, with some deep depressional areas. The lake is underlain by a clay substrate layer [Florida Department of Environmental Protection (FDEP), 2019]. During typical (non-dry) pool conditions, the lake is approximately 4,200 acres in size, with an average depth of 6.6 feet (ft). Less than 1 percent of the overall lake area has depths greater than 10 ft. The lake serves as the primary receiving water for the 27,590-acre Lake Jackson drainage basin (**Exhibit 4-1**).

Historical records indicate that Lake Jackson may have been utilized by Native Americans as early as 14,500 years ago. In more recent historical times, prior to the Civil War, the lake was utilized for cotton farming. In the late 19th century and early 20th century, records indicate that it was used as a hunting preserve and into the 20th century became recognized for its world-renown bass fishery. Lake Jackson's original name, Okeeheepkee, came from the Creek Indian term for "disappearing waters" (FDEP, 2019) and reflects its unique hydrologic behavior.

The lake is within a closed basin so that all runoff and seepage from the basin enters the lake but does not flow out unless water levels are extremely high. The elevation of the lowest point on the ridge separating the Lake Jackson basin from the Ochlocknee basin is around 115 ft referenced to the North American Vertical Datum of 1988 (ft-NAVD88) [U.S. Geological Survey (USGS), 1967]. Typical elevations in the lake range from 76 up to 90 ft-NAVD88.

The lake has two primary sinkholes within its boundary, Lime Sink and Porter Sink (**Exhibit 4-1**). Presently, the degree of outflow through the sinks to the Floridan Aquifer is not fully understood. Historical studies identified that under typical conditions, the sinkholes are filled with sediments (USGS, 1967, FDEP 2019). USGS surmised that when local groundwater levels go down under drought conditions, the sediment fill will collapse, allowing the lake to flow into the Floridan Aquifer (USGS, 1967). Other more recent information indicates that Lake Jackson is constantly discharging through Porter Sink. This outflow becomes clear when lake levels are low, and the water can be seen directly draining to the sink. In summer 2021, this condition occurred, and the flow out of the lake to the aquifer was documented in photos and videos. **Photo 4-1** shows the flow entering the area of the Porter Sink from the lake as it drains. **Photo 4-2** shows the Porter sinkhole and the flow moving into the aquifer.

The hydrologic cycle for the lake is such that the levels decline due to evaporation, transpiration by aquatic vegetation, and groundwater outflow (either through two lake sinks or via seepage through sediments, known as aquifer recharge). The lake will rise due to stormwater inflows from the tributaries and direct rainfall. When one exceeds the other, the lake will either drain or fill. The cycle of draining and refilling is a natural process in Lake Jackson.

Photo 4-1: Flows Draining from Lake Jackson to Porter Sink (June 14, 2021)

Photo 4-2: Flows Going to Floridan Aquifer through Porter Sink (June 14, 2021)

Since 1900, the lake has had 11 documented “dry down” events; these occurred in 1907, 1909, 1932, 1935, 1936, 1957, 1982, 1999-2000, 2006-2007, 2012 and 2021. **Photo 4-3** through **Photo 4-10** present aerial views of the lake from 1937 through the present, including the dry down events in the 1930s and mid-2000s.

The varying nature of the lake, along with the areas of permanent pool even during dry down events, is visible in the aerial imagery. The permanent pool areas become refuges for lake flora and fauna when lake levels drop. At certain times, efforts were made to block the sinkholes to try to maintain water levels in the lake, but openings reformed, and the natural drying and flooding pattern continued (USGS, 1967). Studies have identified that refilling of the lake generally occurs following extreme storm conditions, rather than just a return to normal rainfall patterns and that dry downs have natural benefits, such as oxidation of sediments or reduction of invasive plant species. **Photo 4-11** and **Photo 4-12** present views of the lake under higher water level conditions.

In the latter part of the 20th century, increased access and the construction of I-10 made the property surrounding the lake appealing to developers. Additionally, portions of the urbanized areas of Tallahassee encroached into the smaller watersheds along the southern end of the lake. Due to increased urbanization, along with the lack of an outflow from the lake, sediments and pollutants began to build up, specifically in areas receiving inflow from urbanized smaller watersheds (Megginnis Arm and Fords Arm). Studies identified declining water quality, increased sediment and nutrient loading, and increased algal productivity, as well as shifts in algal species and changes in lake habitat (issues of invasive species). Based on various studies conducted since the 1970s, the primary changes were seen in the southern end of the lake, which drains the highly urbanized areas and areas undergoing significant development. Additionally, issues were seen along the western side, where there are numerous neighborhoods at higher densities than in other areas of the basin.

A number of studies looked at the potential sources of pollutants to the lake. Sources identified include sediment loading and nutrient runoff from stormwater inflows, septic systems from various developments surrounding the lake, atmospheric deposition, and internal loading from sediments (Larock, 1991). Because the lake has no outlet, the nutrients build up in reservoirs in the lake, including lake sediments, vascular plant communities, and the water column. A study conducted in the 1990s [Florida State University (FSU), 1991] identified that the nutrients measured in the water column represent a relatively small portion of the overall nutrient budget. Sediments and stormwater inflow were identified as having similar net input to the lake water column. By far though, plants within the lake were identified as containing the largest reservoir of nutrients. Due to the shallow nature of Lake Jackson, the aquatic vegetation plays a significant role in the storage and cycling of nutrients, as well as providing critical habitat for various species. Consequently, the volume of nutrient storage and cycling results in water column measurements that may not fully reflect the impact of nutrient loading to the lake due to rapid plant uptake.

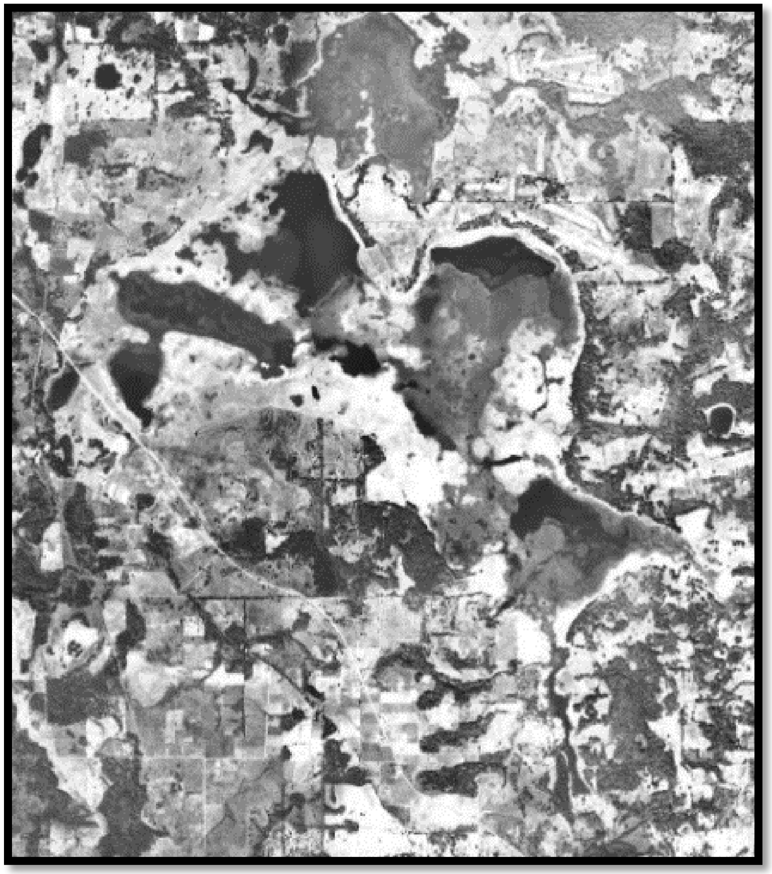


Photo 4-3: Lake Jackson Aerial – 1937

Photo 4-4: Lake Jackson Aerial – 1949

Photo 4-5: Lake Jackson Aerial – 1954

Photo 4-6: Lake Jackson Aerial – 1970

Photo 4-7: Lake Jackson Aerial – 1983

Photo 4-8: Lake Jackson Aerial – 1996

Photo 4-9: Lake Jackson Aerial – 2007

Photo 4-10: Lake Jackson Aerial – 2020

Photo 4-11: Northern Lake Site (February 2017)

Photo 4-12: Southern Lake Site (February 2017)

Multiple efforts have been undertaken to improve the lake water quality and habitat since the 1970s, when problems were identified. On the structural side, numerous stormwater treatment facilities have been built and others upgraded and retrofitted. These have generally been focused on urbanized tributaries south of Lake Jackson and into Megginnis Arm. The stormwater facilities discussed in this section are mapped in **Exhibit 4-1**.

The oldest and most significant project was the construction of the Megginnis Arm Regional Stormwater (MARS) facility. The project was completed in 1983 and funded through the U.S. Environmental Protection Agency (EPA) Clean Lakes Program. The project consists of a 130 acre-feet impoundment, along with a settling basin and a gravity filter upstream of I-10 along Megginnis Creek. Outflow from the impoundment flows through an artificial wetland area downstream of the I-10 crossing for polishing and final treatment. While the impoundment area did perform well relative to sediment removal and treatment of volume, excess flows and sediments (above design levels) overwhelmed the system. The gravity filter was clogged due to clay particles settling on the surface and, within a few years, the treatment capacity of the filter was reduced by around 50 percent. Additionally, maintenance of the MARS Facility has declined significantly over the years potentially reducing treatment capacity further. **Photo 4-13**, **Photo 4-14**, and **Photo 4-15** show the impoundment, filter marsh intake, and filter marsh, respectively, in 2021.

In 1989, the Lake Jackson Surface Water Improvement and Management (SWIM) program identified the need to expand the storage capacity of the MARS Facility. In 1990, a project was completed to increase the storage capacity by 31 percent. Around this same time, flows from I-10 and residential areas were identified as bypassing the impoundment and going directly into a diversion chamber upstream of the artificial marsh.

Other regional stormwater facility construction and retrofit projects in the impacted watersheds include Yorktown Pond, Boone Boulevard Pond, Okeeheepkee Prairie Regional Stormwater Facility, Harbinwood Estates Pond, Sharer Road pond, Abbigail Drive pond, the John Knox Stormwater Management Facility, and most recently, the Lexington Creek Facility. **Photo 4-16** shows the Boone Boulevard Pond. In addition to the various stormwater treatment facilities, several large projects were undertaken to stabilize conveyance systems to the lake that contributed to sediment loading due to erosion. **Photo 4-17** shows the stabilization along Megginnis Creek upstream of the MARS Facility.

In addition to structural best management practices (BMPs), a number of projects have focused on the removal of contaminated sediments. These removal efforts have coincided with lake dry down events, which provide the opportunity for excavation of organic sediments that add internal nutrient loading and other contaminants to the lake. Since 1990, more than 3,000,000 cubic yards of sediment have been removed from the lake bottom in the Megginnis and Ford Arm areas [Northwest Florida Water Management District (NWFWMD), 1997, Leon County, 1999].

Photo 4-13: MARS Facility Impoundment and Overflow (February 2021)

Photo 4-14: MARS Filter Marsh Intake (February 2021)

Photo 4-15: MARS Filter Marsh (February 2021)

Photo 4-16: Boone Boulevard Pond (February 2021)

Photo 4-17: Bank Stabilization Along Megginnis Creek

A number of studies have been undertaken to try to quantify and/or determine the impacts of septic systems on lake water quality [Larock, 1991; NWFWMD, 2000; FSU, 2012]. The studies identified the presence of fecal indicator bacteria (FIB) in certain areas of the lake downstream of watersheds with high septic tank density. Evaluations of the impacts of nutrient loading from the studies were less definitive, but septic loading was identified as important. One concern raised through the studies is that conditions in many areas around the lake are not the best for locating septic systems due to poorly drained soils and high-water tables.

Finally, a number of regulatory, ordinance, land management, and management planning efforts have looked to provide additional protection for the lake and propose future projects to restore the lake. The Florida Legislature designated Lake Jackson, Carr Lake, and Mallard Pond as aquatic preserves in 1973. In 1979, Lake Jackson was designated as an Outstanding Florida Water (OFW).

In 1990, the Leon County Board of County Commissioners established a Lake Protection District for areas draining to Lake Jackson, which limits development in certain areas to one unit per 2 acres or two units per acre if only 40 percent of the area is developed. In 1991, the City and Leon County developed a Stormwater Management Plan for Lake Jackson. This plan outlined various structural and non-structural projects to reduce flooding and improve water quality. Many of the proposed structural projects have been completed.

A Lake Jackson Management Plan, developed by the Lake Jackson Action Team, was completed in 1994 and then updated in 1997 and 2019. The plan outlines efforts in the areas of water quality, preservation and restoration, watershed management, and public education and awareness. Under these programs, ongoing water quality sampling and studies are implemented, land purchases for maintenance of natural areas are made (including the 670-acre Phipps property and the 890-acre Lake Overstreet property), structural and non-structural projects are identified, and education programs outlined.

In February of 2021 FDEP put forward a proposed study entitled the Lake Jackson Monitoring Plan (FDEP, 2021). The objectives of the study are to investigate potential sources of pollutant loading in the southeastern section of Lake Jackson and to investigate the presence and extent of filamentous algal mats and submersed aquatic macrophytes in the eastern region of Lake Jackson.

4.4.2 Regulatory Status

EPA is authorized under Section 303(d) of the Clean Water Act to assist states in the identification of impaired waterbodies and the calculation of total maximum daily loads (TMDLs) to these waterbodies. FDEP administers the 303(d) program in Florida. A waterbody on the FDEP's 303(d) list falls into one of several categories:

Category 4a – The waterbody is impaired but does not require TMDL development because a TMDL has already been completed.

Category 4b – The waterbody is impaired but will not require a TMDL to be developed because the waterbody will attain standards due to existing or proposed measures.

Category 4c – The waterbody is impaired, but the impairment is not caused by a pollutant and therefore does not require a TMDL.

Category 4d – The waterbody is impaired but the pollutant causing impairment is not known. A TMDL cannot be calculated until the pollutant is identified.

Category 4e – The waterbody is impaired, but ongoing or recently completed restoration activities are underway to restore designated uses, so a TMDL calculation is not necessary.

Category 5 – The waterbody is impaired, and a TMDL will be calculated.

Waterbodies in Florida on the FDEP's 303(d) list are impaired. Waterbodies classified in Category 5 are placed on FDEP's comprehensive Verified List. When a waterbody is placed on the Verified List, FDEP is required by law to develop a TMDL. Waterbodies classified on Categories 4a through 4e are not on the comprehensive Verified List but are considered impaired. Generally, this means that more study is needed (4d) or FDEP has identified that local efforts are expected to restore the waterbody (4b and 4e).

FDEP has the option to develop basin management action plans (BMAPs) for waterbodies that have adopted TMDLs. A BMAP is a framework for water quality restoration in various forms containing commitments at local and state levels. These broad-based plans are developed with local stakeholders, including cities and counties. Once these plans are adopted by FDEP Secretarial Order, they are legally enforceable. FDEP also has a process by which local entities can initiate restoration activities in lieu of development of a TMDL. This type of activity fits under the 4e and 4b categories. These are locally driven restoration efforts with a goal to meet water quality standards. This process is often favored because it puts control in the hands of the local stakeholders to determine what is needed to restore their waterbodies rather than FDEP dictating the terms of a load reduction and is also much faster than the traditional TMDL/BMAP pathway, which can take more than a decade.

Presently, Lake Jackson [waterbody identification (WBID) 582B] is not verified impaired for any parameters. **Exhibit 4-2** displays the three verified impaired WBIDs inside the Lake Jackson drainage basin. These are as follows.

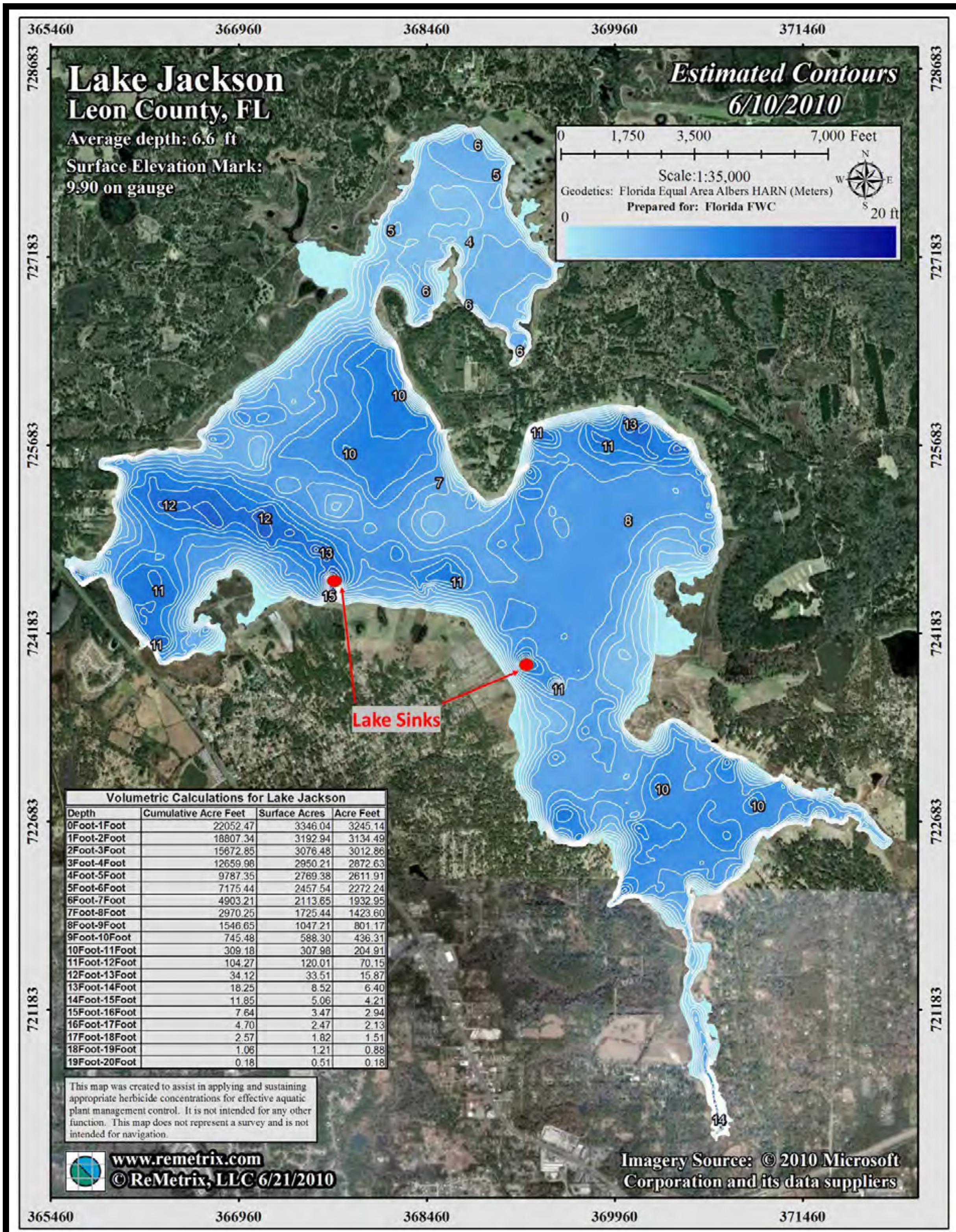
- Lexington Creek (WBID 758), which flows directly into Lake Jackson through Fords Arm in the southeast portion of the lake, is currently listed as a Category 5 impairment for *Escherichia coli* (*E. coli*). Anthropogenic sources have been confirmed as the source of the impairment by using genetic marker and chemical tracer data. A point of note is that there are data discrepancy issues between data collected by Leon County and FDEP that may impact the impairment status. This will be discussed further in later sections.
- Lake Overstreet Drain (WBID 689), which is adjacent to Lake Jackson, is impaired for fecal coliform. However, fecal coliform is no longer the applicable FIB parameter for its waterbody classification. *E. coli* will be included in the upcoming Strategic Monitoring Plan to collect the new applicable FIB parameter data while the WBID remains on the Verified List for a fecal coliform impairment. While the WBID encompasses the closed basins for Lake Hall and Lake Elizabeth, the impaired reach is along the drainageway downstream of Lake Overstreet upstream of the discharge into Fords Arm.
- Jackson Heights Creek (WBID 746A), which buttresses Lake Jackson from the western portion of the lake, is impaired for iron. It is worth noting that FDEP is in the process of further evaluating the iron impairment to determine if the iron content is due to natural conditions or if additional data can help qualify the waterbody to meet the delisting requirements established in 62-303.720 Florida Administrative Code (F.A.C.).

4.4.3 Waterbody Data Review and Summary

This section presents an overview of available data and data sources for Lake Jackson and the Lake Jackson basin including bathymetry, land use, soils, septic systems, hydrologic measurements, surface water quality, groundwater quality, biological, stormwater treatment facilities, and atmospheric deposition.

4.4.3.1 Bathymetry

The bathymetric information for Lake Jackson is from ReMetrix, LLC (2010) and is intended for assisting the Florida Fish and Wildlife Conservation Commission (FWC) in herbicide application as part of its aquatic plant management control initiative (**Figure 4-2**). The map is not based upon survey data. However, the map is based on conditions after the 1999-2000 sediment removal project and should reasonably reflect conditions in the lake today.



Volumetric Calculations for Lake Jackson

Depth	Cumulative Acre Feet	Surface Acres	Acre Feet
0Foot-1Foot	22052.47	3346.04	3245.14
1Foot-2Foot	18807.34	3192.94	3134.49
2Foot-3Foot	15672.85	3076.48	3012.86
3Foot-4Foot	12659.98	2950.21	2872.63
4Foot-5Foot	9787.35	2769.38	2611.91
5Foot-6Foot	7175.44	2457.54	2272.24
6Foot-7Foot	4903.21	2113.65	1932.95
7Foot-8Foot	2970.25	1725.44	1423.60
8Foot-9Foot	1546.65	1047.21	801.17
9Foot-10Foot	745.48	588.30	436.31
10Foot-11Foot	309.18	307.98	204.91
11Foot-12Foot	104.27	120.01	70.15
12Foot-13Foot	34.12	33.51	15.87
13Foot-14Foot	18.25	8.52	6.40
14Foot-15Foot	11.85	5.06	4.21
15Foot-16Foot	7.64	3.47	2.94
16Foot-17Foot	4.70	2.47	2.13
17Foot-18Foot	2.57	1.82	1.51
18Foot-19Foot	1.06	1.21	0.88
19Foot-20Foot	0.18	0.51	0.18

Figure 4-2: Bathymetry in Lake Jackson

The average depth of Lake Jackson is 6.6 ft, and much of the lake has depths less than 10 ft. The deepest points in the lake correspond with the sinkholes mapped in **Exhibit 4-1**, which are along the southern shoreline. Throughout the lake, narrow strips of deeper water are buttressed by shallower waters that encompass the majority of the lake, including its central locations. The northern lobe of the lake has the shallowest area. During a dry down period, waters pool in the westernmost, easternmost, and southeastern deeper areas of Lake Jackson. The lack of deep water allows for a more widespread presence of submerged aquatic vegetation (SAV), which necessitates more concentrated efforts by agencies such as FWC and FDEP to manage the waterbody for nutrients and hydrologic implications of biota in the water.

4.4.3.2 Land Use

Land use is the term used to describe the general purpose or function of a given area of land. It can represent economic and cultural activities, or it can depict the physical nature of the land (known as land cover). Land use categorization is used for planning and regulation purposes and assists agencies in keeping track of geographic areas for their respective organization purposes, such as zoning or environmental management. Impacts to waterbodies from watershed loading are evaluated, in part, as a function of land use. Event mean concentrations (EMCs) are utilized for simulating water quality concentrations in stormwater runoff. Pollutant loads are a function of pollutant concentration and volume of runoff. Land use types are used to determine appropriate EMCs when assessing water quality impacts from stormwater.

For the purpose of this study, the Level 2 Florida Land Use Cover Classification System (FLUCCS) codes were used to be consistent with classifications used to generate EMC values, which dictate pollutant loading with respect to precipitation and land use types. **Exhibit 4-3** presents a map of the Level 2 land uses within the Lake Jackson basin. A table is provided to show the overall acreages and percent cover for the various levels. Tables are provided for both the Level 2 and grouped Level 1 land uses. The largest land use types within the Lake Jackson drainage basin per the grouped Level 1 categories are Urban and Built Up (31 percent, **Exhibit 4-3**) and Upland Forest (25 percent, **Exhibit 4-3**). Within the Urban Built Up category, Low to Medium Density Residential takes up the largest portion. The anthropogenic land use categories are clustered around the southern and western sides of the basin directly adjacent to Lake Jackson. The northern areas of the basin are more dominated by forested areas with the exception of the Summerbrook Creek watershed. Wetland areas make up around 19 percent of the basin and water around 10 percent. All other land use classifications are less than 10 percent of the basin area. Approximately 34 percent of the basin is categorized as developed (combining level 1 FLUCCS for Urban and Built Up with Transportation, Communication, and Utilities), mainly located directly south and west of Lake Jackson. The basin is otherwise categorized as approximately 54 percent undeveloped (combining level 1 FLUCCS for Upland Forest with Water, and Wetlands) and nearly 12 percent Agricultural (combining level 1 FLUCCS for Agriculture with Rangeland and Barren Land).

4.4.3.3 Soils

Soil classifications for the study were determined from the area’s hydrological soil group category. Hydrologic soil groups are based on estimates of runoff and infiltration potential. The Natural Resource Conservation Service (NRCS), an agency of the U.S. Department of

Agriculture (USDA), delineates four primary soil groups (A, B, C, and D) as well as three dual classes (A/D, B/D, and C/D). Group A soils are characterized as having high infiltration rates with low runoff potential, and each subsequent group is characterized by an iteratively lower infiltration rate and higher runoff potential, ending with Group D soils being designated as having very low infiltration rates with high runoff potential. The dual classes represent conditions where infiltration rates under dry conditions would be per the primary soil type, but due to high groundwater levels in these areas, infiltration is low.

The most prevalent soil group in the Lake Jackson drainage basin is Group B (37.3 percent per **Exhibit 4-4**). Group B soils are considered to have a moderate rate of infiltration. Lake Jackson is predominantly surrounded by Group B soils, along with sparse, isolated areas of Group C soils, which are considered to have slow rates of infiltration (**Exhibit 4-4**). A cluster of group A/D soils is along the western and southern edge of the lake. These are considered to have high infiltration potential but due to elevated groundwater table conditions, will act more similarly to soils with low infiltration potential.

4.4.3.4 Septic Systems

An estimated 4,515 septic tank units are within the boundaries of the Lake Jackson drainage basin based on the Florida Department of Health (FDOH) septic tank layer (**Exhibit 4-5**). Effluent from septic tanks that are in good condition should be comparable to secondarily treated wastewater effluent from sewage treatment plants. However, septic systems can be a source of pollutants, pathogens, and nutrients and are identified by FDEP as a potential source of FIB and nutrients to waterbodies in its assessment processes.

For recent TMDL analyses, FDEP used a radius of 200 meters to analyze direct contribution of nutrient loads from septic systems to a waterbody. Within that buffer, Lake Jackson is in proximity to over 280 septic systems. Accounting for tributaries that directly drain into Lake Jackson, that number rises to more than 1,000 septic systems. Septic nutrient loads to a waterbody are a function of the number of septic units, the number of people per household, the soil conditions in the area, groundwater table conditions, and if the systems are working properly. As discussed in **Section 4.4.3.3**, the predominant soil types surrounding Lake Jackson are Type B and Type A/D, which have moderate to moderate-low infiltration potential, respectively. The lake has large clusters of septic systems on the southern and western sides, with many of the units within the 200-meter buffer (of the lake or directly draining tributaries) dwelling on A/D soils, which are poorly drained, depending on antecedent moisture conditions. On a basin-wide standpoint, there are more than 580 septic units in areas of A/D soils near the lake and tributaries that drain to the lake.

4.4.3.5 Point Sources

A search of permitted facilities within the Lake Jackson basin was conducted using information from FDEP's Oculus platform. No active permitted facilities were identified within the basin.

4.4.3.6 Hydrologic Data

Rainfall station locations and data were retrieved from NWFWMD. There are five stations within the boundaries of the Lake Jackson Drainage Basin **(Exhibit 4-6**) that were utilized for precipitation data from the NWFWMD database, with one location directly adjacent to the lake

(Station 011321). The station with the longest period of record is located upstream of Megginnis Arm (Station 011289). Data gaps exist within each of the precipitation stations, so gaps within the primary station located directly on the lake (011321) were filled with data from the other stations.

Figure 4-3 presents the annual precipitation from the combined dataset from 1987 through 2020. The data show that rainfall levels range from around 40 inches in various years up to a maximum of more than 80 inches in 1994. Examination of the annual average rainfall against the documented dry down periods (periods discussed previously where the lake dries out due to flow out the sinkholes greater than inflows) showed that the dry down periods did align with low rainfall years in all cases since 1987, but there were some relatively dry years when the lake did not drain.

Lake stage data were retrieved from NWFWMD and USGS with the locations shown on **Exhibit 4-6**. Only one station from NWFWMD within the waterbody boundary, Station 011321, records water elevation in the lake, whereas the other two stations are upstream of the lake within stormwater treatment facilities. An additional water level station monitored by USGS (2329200) was located on the western side of the lake and was in place from 1950 to 2002. This data set had some gaps in the 1950s and a significant gap from 1994 to 2002.

Figure 4-4 presents the measured water levels in the lake from 1950 to 2021 based on merging the two datasets. Examination of the plots shows that prior to 1970, the lake fluctuations ranged nearly 20 ft with the highest measured stage more than 95 ft-NAVD88 in 1966. From 1960 to around 1970, the lake stage was above 85 ft-NAVD88 and stayed high the entire time. After 1970, the overall lake level fluctuation range dropped to generally between 87 ft-NAVD88 to lows near 76 to 77 ft-NAVD88, which represented dry down periods. In more recent years (since 2010), compared to the long-term average (84 ft on **Figure 4-4**) lake levels have been lower, with the average from 2010 to 2020 at around 82 ft.

Two additional stage recorders are located within the Lake Jackson basin, specifically within stormwater treatment facilities upstream of Megginnis Arm. Station 011289 is within the MARS Facility upstream of I-10, and Station 011337 is within the Boone Boulevard treatment pond. These two stations provide information on fluctuations in water level within their respective facilities and would identify periods when the elevations of the weirs or discharge structures were overtopped.

The only continuous direct discharge data available on a tributary flowing into Lake Jackson are for Station 008454, which is on Lexington Creek (where it crosses Meridian Road) and drains to Fords Arm. **Figure 4-5** presents the measured flows along this tributary. The figure shows measured flows from 1987 through 2018. A number of aspects can be derived from examination of the flows. First, the system is highly flashy, with periods of near zero flow followed by high inflows in response to rain events. This type of flow was identified as typical of conditions within the Lake Jackson basin, especially within more developed areas. Second, there are some significant differences in the overall flow conditions. Prior to 1998, where there is a gap in the data, baseflow conditions are much higher, and overall, the flow magnitudes are larger. After 1998, while maximum measured flows are similar, overall magnitudes have decreased, with conditions after 2014 significantly decreased.

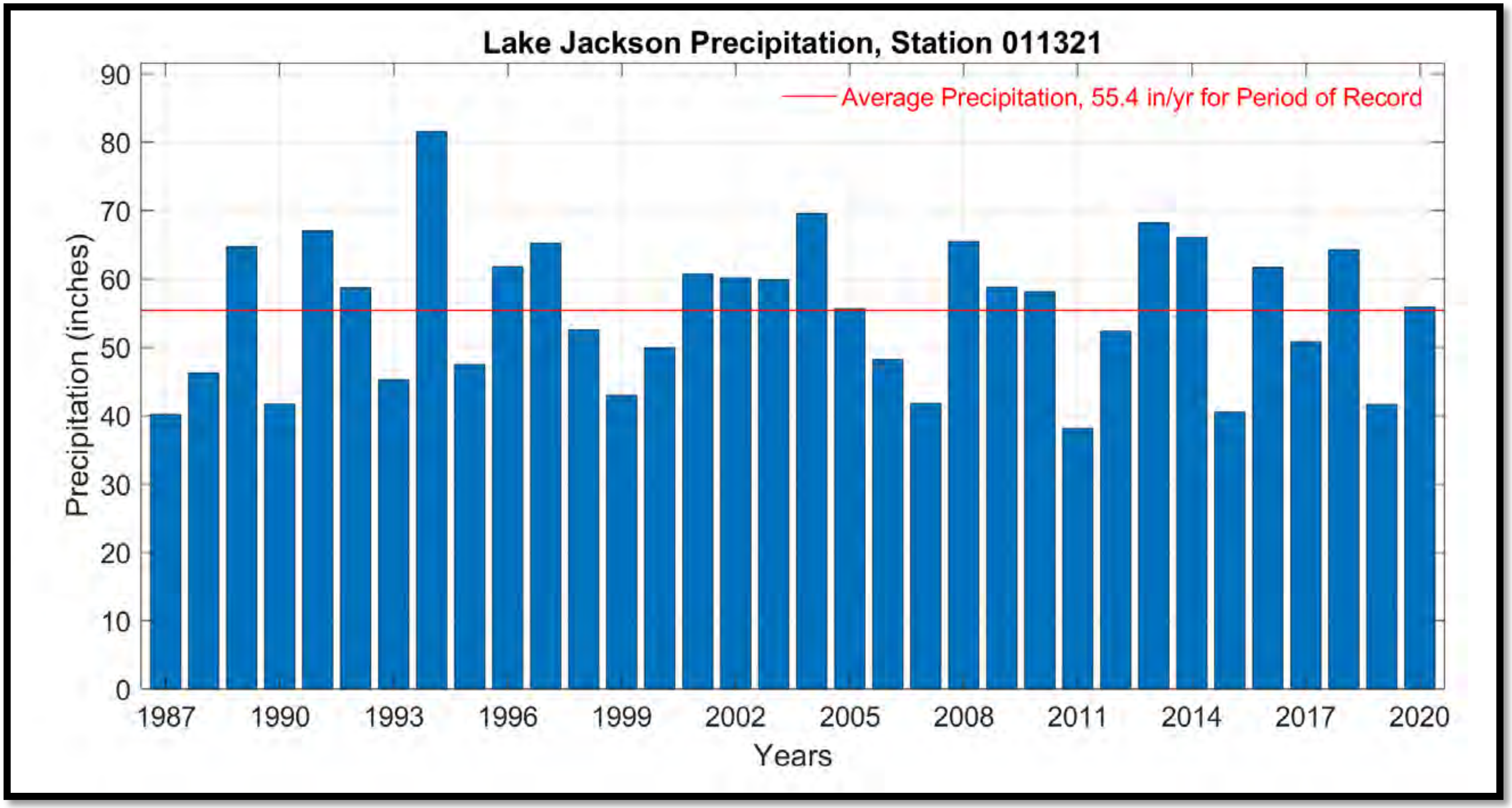


Figure 4-3: Annual Precipitation from Lake Jackson Stations (1987 to 2020)

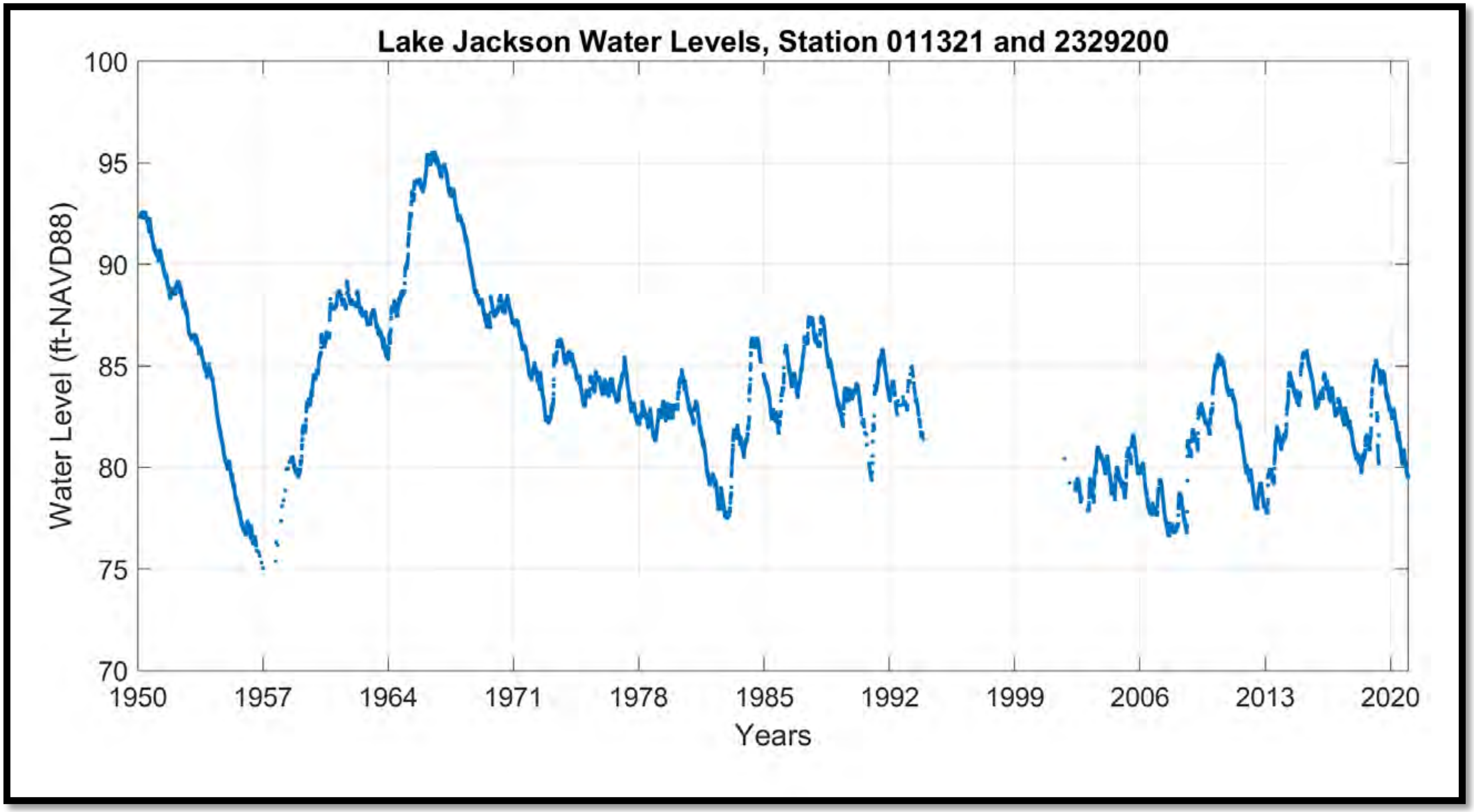


Figure 4-4: Measured Water Levels in Lake Jackson (1950 to 2020)

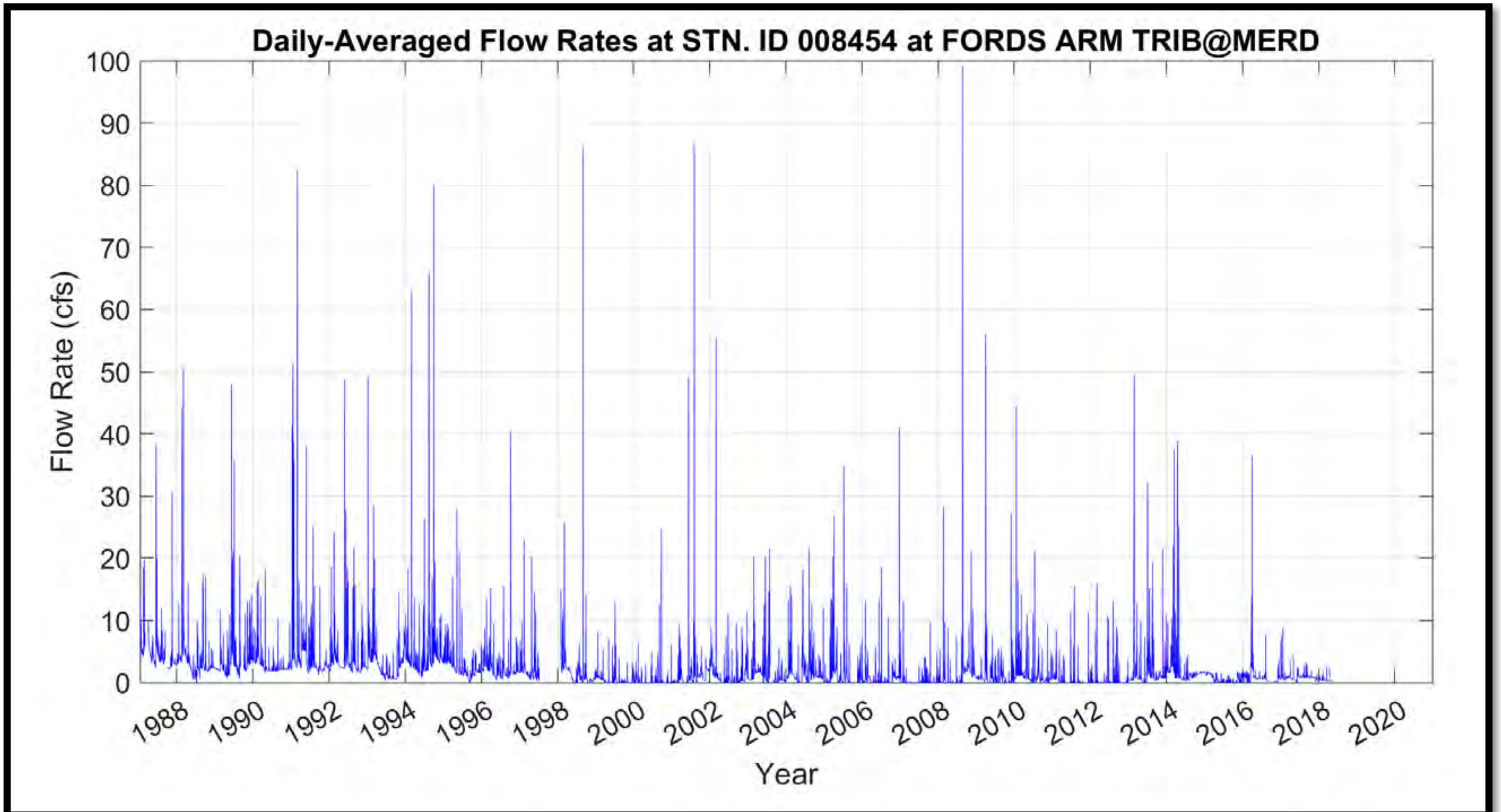


Figure 4-5: Measured Flows in Lexington Creek (Station 008454) (1987 to 2020)

The data after 2014 would indicate some significant alterations on the system or errors in the measurements. Some of the overall changes in the flows may be due to increased BMP-related stormwater storage and attenuation within the watershed draining to Fords Arm due to installation of stormwater treatment facilities and other stormwater infiltration and storage facilities.

The City measures flow at times of water quality data collection at Station LJB01 which is located on Megginnis Creek downstream of the MARS Facility. **Table 4-2** presents the measured flows from 2015 to 2020. Examination of the flow magnitudes identifies that the highest measured flow during sampling was around 18 cubic feet per second (cfs), with most of the flows around or below 1 cfs reflecting baseflow conditions.

The only other flow data identified were based on storm sampling conducted in September 1979. These data were utilized to calibrate a Stormwater Management Model (SWMM) as part of the Stormwater Management Plan (City and Leon County, 1991). Flow measurements were available at two stations flowing into Megginnis Arm and one Station flowing into Fords Arm. The data were for single storm events on July 24 and September 25 and 26, 1979. Examination of the measured flows on those days showed discharges of 387 and 133 cfs along Megginnis Creek and 62 cfs on Fords Arm. The 62 cfs measurement on Fords Arm is within the range of what was measured there pre-2010 (**Figure 4-5**), but above what was measured after 2010.

4.4.3.7 Surface Water Quality Data

The water quality data used for this study were retrieved from the FDEP Impaired Waters Rule (IWR) and City databases. The IWR outlines FDEP's methodology to identify waters that will be included in the 303(d) list. The IWR database is a collection of stations that are used to assess ambient water quality of surface waterbodies. The stations are not necessarily managed by FDEP, but any relevant data from various agencies are included for the purpose of collecting pertinent information for a given body of water.

The water quality dataset for Lake Jackson (WBID 582B) spans from 1961 to 2020 and includes contributions from local, state, and national agencies (City, Leon County, NWFWMD, FDEP, FWC, Florida LAKEWATCH, and USGS), as well as private sector firms (BRA, and McGlynn Lab). The IWR contains multiple parameters that are monitored. For these purposes, the primary parameters will be nutrients (and nutrient related parameters) and FIB. **Exhibit 4-7** presents the locations of in-lake water quality monitoring stations for Lake Jackson (yellow) along with stations that provide water quality data along tributaries that flow directly into Lake Jackson (red). A table is provided in **Exhibit 4-7** that shows the station identification (ID), station name, period of record, sample count, data source, and if the station represents in-lake or inflowing tributary data (upstream of the lake).

Based on the number of stations and the length of the station IDs, station IDs were not provided directly onto the station locations in the exhibit, rather each of the stations is given a number and the numbers correspond to stations in the table. Stations within or upstream of other waterbodies in the Lake Jackson basin are not shown in this exhibit. These stations will be presented along with the discussions for the individual waterbodies in the sections to follow.

Table 4-2: City Measured Flows at LJB01 During Water Quality Sampling (2015 to 2020)

Date	Result	Units	Qualifier
3/12/15 12:08	0.00	CFS	Insufficient volume & flow for sampling.
5/6/15 16:50	0.00	CFS	Insufficient volume & flow for sampling.
7/8/15 10:21	0.00	CFS	Insufficient volume & flow for sampling.
9/9/15 10:20	0.00	CFS	Insufficient volume & flow for sampling.
11/19/15 9:25	13.40	CFS	Swift flow, heavy exotic vegetation population in channel.
2/18/16 8:08	1.23	CFS	Station moved to North side of I-10 & new profile survey and elevation performed.
4/8/16 8:25	1.63	CFS	Clear with good flow. Heavy vegetation.
6/14/16 8:49	17.87	CFS	Green water with many riparian exotics water level is high.
8/2/16 10:30	0.66	CFS	Very shallow, low flow. Field blank performed.
10/5/16 12:40	0.24	CFS	Very shallow, moderate flow. Water clear and not tannic.
11/30/16 11:00	0.00	CFS	Dry Streambed
2/1/17 13:20	0.31	CFS	Water clear and slightly tannic
3/27/17 11:20	0.11	CFS	Very shallow, heavy algal growth with floating mats.
5/30/17 11:30	0.12	CFS	Shallow, green tint, thick algal mats near spillway.
7/24/17 11:20	3.25	CFS	Slightly turbid, heavy vegetation at station.
9/26/17 7:55	0.46	CFS	Clear flow in small channel.
11/27/17 12:20	0.04	CFS	Very shallow, very little flow, slight green tint, surface film in pooled area.
2/5/18 12:40	1.12	CFS	Good flow, clear, slight green tint, some vegetative debris in channel from recent maintenance.
4/11/18 12:50	0.63	CFS	DOT work in culvert and vegetation recently cleared on banks. Water very clear.
6/19/18 7:45	1.00	CFS	Stream morphology changing due to recent vegetation clearing.
8/6/18 13:00	9.05	CFS	Swift flow, heavy vegetation, channel much wider due to increased depth.
10/16/18 13:10	0.83	CFS	Shallow, swift flow, heavy vegetation. Lineman working upstream of station.
1/15/19 8:20	1.11	CFS	New channel configuration; vegetation completely cleared.
2/5/19 8:40	1.01	CFS	Clear water, recent maintenance at location changing flow channel.
4/9/19 9:00	1.74	CFS	Long strand green algae in flow, ~10% coverage.
6/11/19 8:05	0.98	CFS	Long strand green algae in flow, ~20% coverage.
8/5/19 9:30	0.37	CFS	Heavy vegetation, mainly invasive. Stream very narrow and shallow.
9/16/19 9:55	0.16	CFS	Heavy vegetation, mainly invasive. Stream very narrow and shallow. River otter present.
11/13/19 7:45	0.17	CFS	Heavy vegetation, mainly invasive. Stream very narrow and shallow. River otter present.
1/14/20 8:30	0.51	CFS	Very clear, average depth, floating algae in pooled area behind weir. Large tree cut and dropped in flow.
3/17/20 8:45	0.22	CFS	Shallow, clear, organic debris in channel.
6/16/20 10:20	[redacted]	CFS	No path for velocity meter readings due to split streams and heavy vegetation.
8/10/20 10:15	0.14	CFS	Highly vegetated with one 3-ft-wide discharge section.
10/12/20 10:45	0.74	CFS	Highly vegetated. Discharge section width 5.4 ft.
12/15/20 9:30	0.40	CFS	Discharge section width 5 ft.

Exhibit 4-7 shows that there are stations located throughout Lake Jackson, but the highest density of data exists in the southeastern portion of the lake in the area of Megginnis Arm and Fords Arm. Data exist for the vast majority of the main tributaries to Lake Jackson (Overstreet Drain, Meridian Creek, Sunset Creek, Butlers Mill Creek, Okeeheepkee Creek, and Megginnis Creek) but some of the data are sparse and old. The stations on Lexington Creek are not shown on the figure as they will be presented in **Section 4.7.3.6**, which discusses Lexington Creek. There are three tributaries flowing directly into Lake Jackson that currently have no data stations. These are the Blue Dog watershed, the unnamed watershed that flows into the upper lobe of the lake, and the unnamed watershed that flows into the northwest side of the lake (See **Exhibit 4-1**). The tributary data support the qualitative assessment of potential sources in **Section 4.4.4**.

Some initial plots of the available data in the lake are provided in this section. This includes plots of the data and analyses of annual geometric means (AGM) against numeric nutrient criteria (NNC). As nutrients are the primary constituent of interest relative to water quality conditions in Lake Jackson, plots are provided for the key parameters related to potential nutrient impairment. These include total nitrogen (TN), total phosphorus (TP), Chlorophyll *a* (Chl-a), and Trophic State Index (TSI). Additionally, based on interest relative to septic systems and other sources, FIB, specifically *Escherichia coli* (*E. coli*) is included. It is noted that additional data plots and analyses are provided as part of the qualitative assessment of sources in **Section 4.4.4**. For the data plots and analyses, only data after 2010 are presented or analyzed since the goal of this study is to assess present conditions. Some discussions of the historical measurements are provided in the text that follows where significant changes have occurred.

Through the analysis of the TN data for Lake Jackson and other waterbodies in the Lake Jackson basin, issues were identified relative to how certain total Kjeldahl nitrogen (TKN) data were used in the calculation of TN. **Appendix A** presents a short write up of the issues encountered and how they were rectified to get the TN levels utilized in the analyses below.

Figure 4-6 through **Figure 4-8** presents plots of the measured TN, TP, and Chl-a data from 2010 to 2020. Examination of the plots shows that from 2010 to 2020 TN concentrations went down slightly, while TP and Chl-a concentrations went up slightly. The data plots show missing data in 2012, which was likely due to the dry down that occurred that year.

Under FDEP’s NNC, Lake Jackson is defined as a low color, low alkalinity system. Based on this designation, the AGM threshold for Chl-a is 6 micrograms per liter (μg/L). For TN and TP, a range of concentrations are allowed, based on maintaining Chl-a concentrations below 6 μg/L. For TN, the range is 0.51 milligram per liter (mg/L) to 0.93 mg/L. For TP, the range is 0.01 mg/L to 0.03 mg/L. TN or TP levels below the minimum indicate the system is not impaired for either parameter. Levels above the maximum would indicate impairment. Measurements in between are allowed so long as the Chl-a levels that coincide with the nutrient concentrations are below the 6 μg/L threshold.

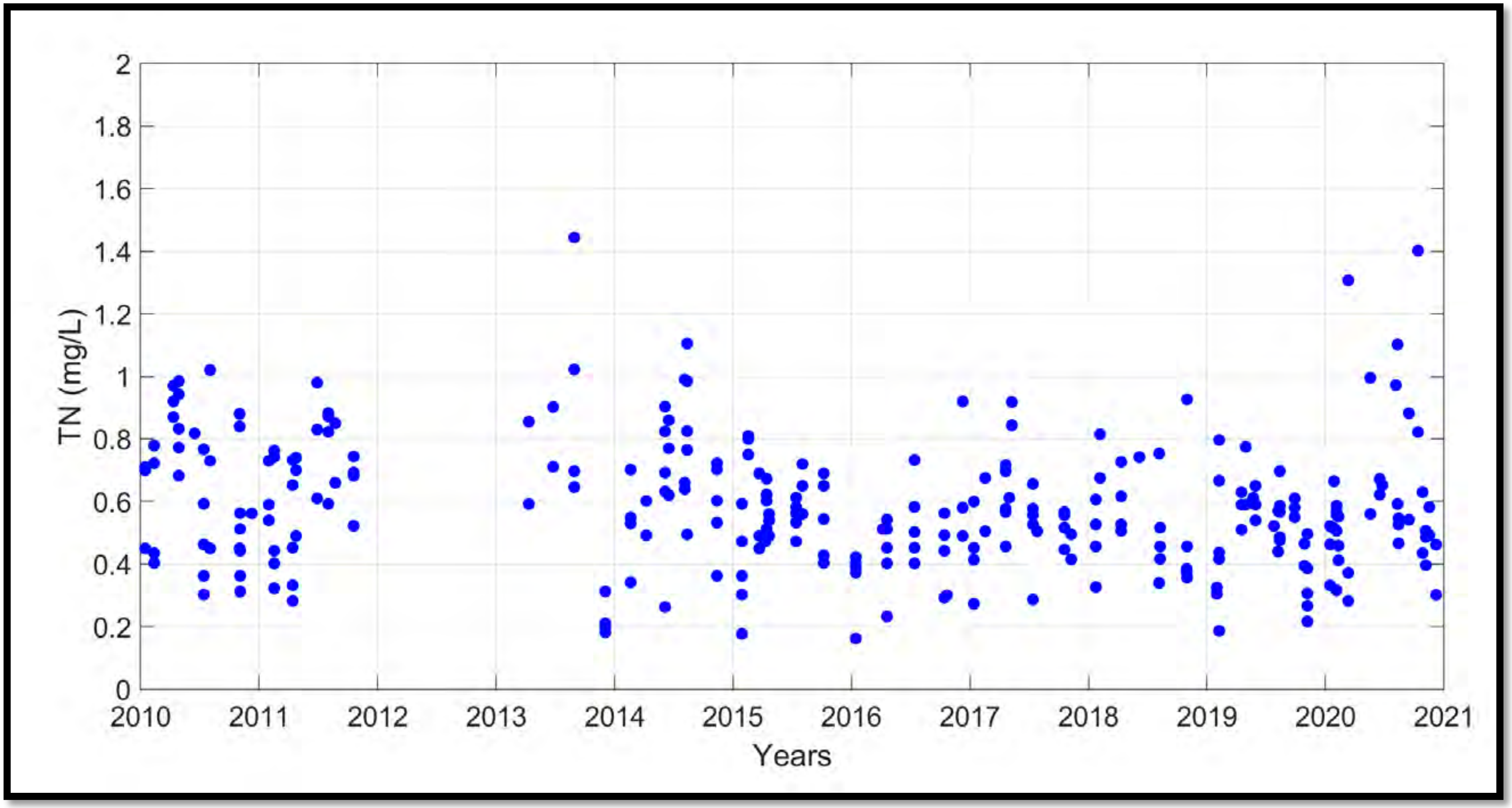


Figure 4-6: Plot of Measured TN

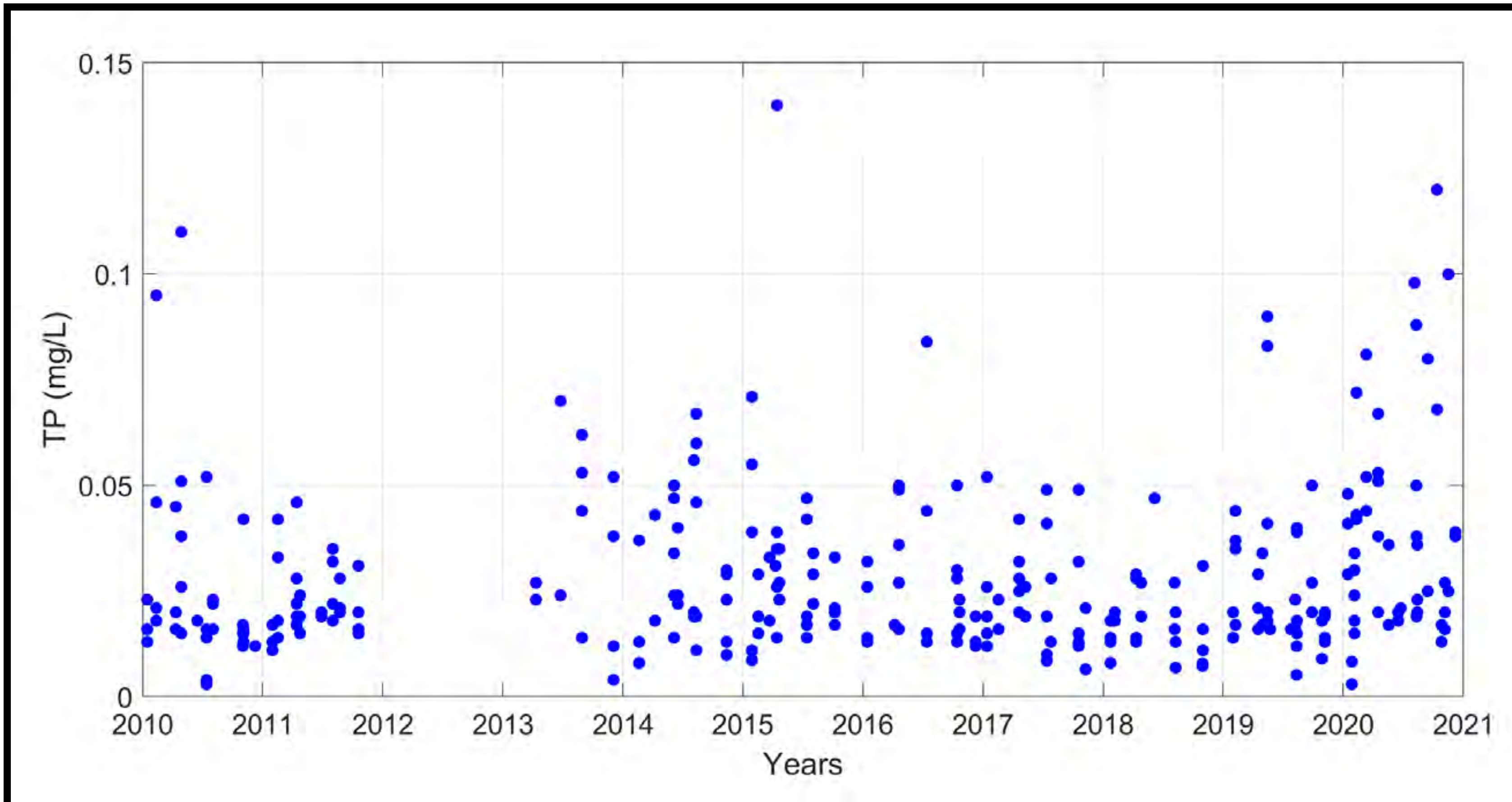


Figure 4-7: Plot of Measured TP

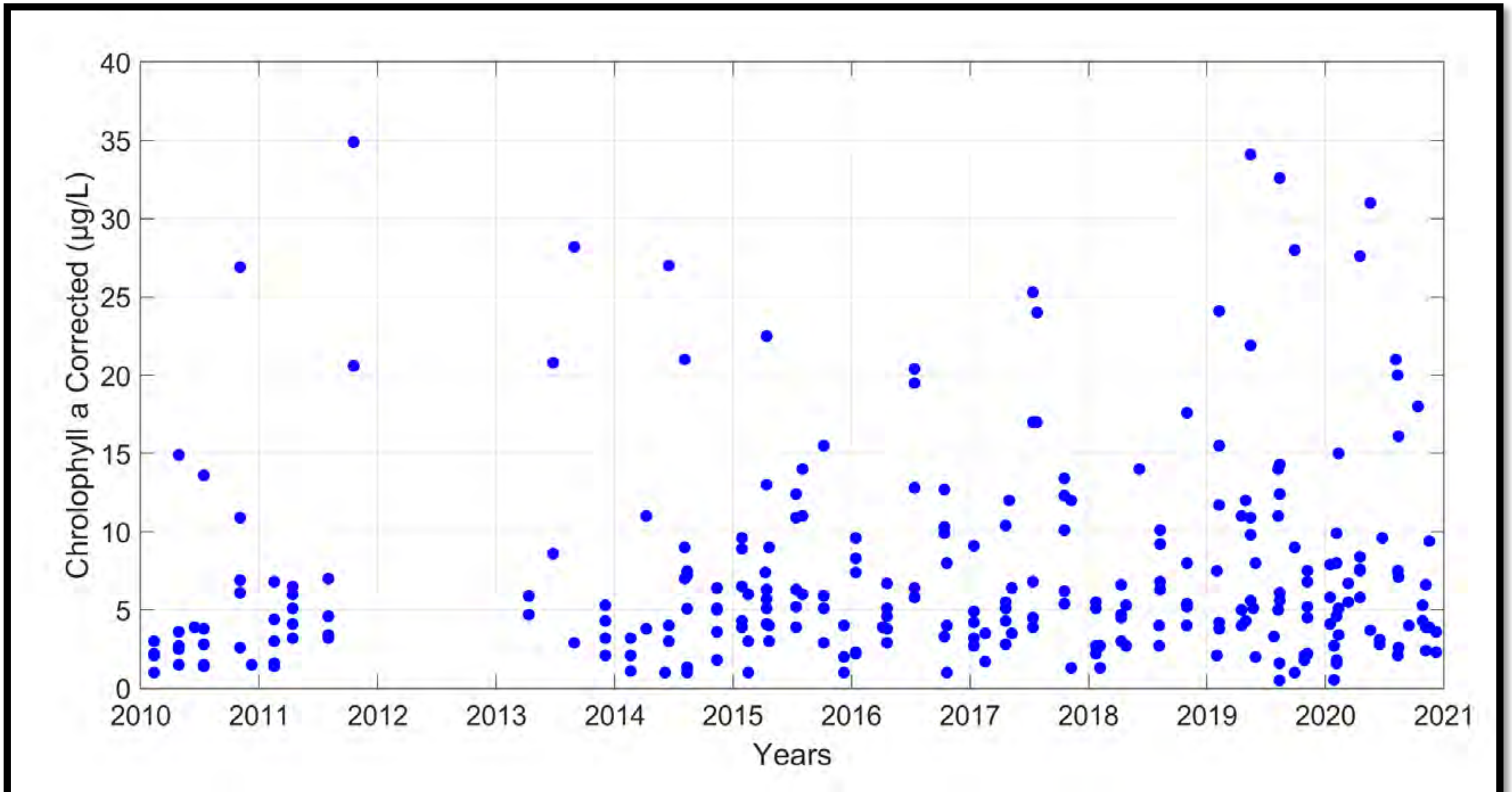


Figure 4-8: Plot of Measured Chl-a

Historically, FDEP utilized TSI as a metric for determination of surface waterbody impairment due to nutrients. TSI is a classification system designed to rate lakes based on the amount of biological productivity occurring in the waterbody, with higher TSI values indicative of more productive lakes. The calculations are based on a scale from 1 to 100. Lakes with TSI values less than 60 were considered good, lakes with values between 60 and 69 were considered fair, and lakes with values greater than 70 were considered poor. While no longer utilized for assessment of impairment, the TSI index remains a tool for evaluating potential nutrient enrichment and biological productivity. Therefore, data on TSI are presented against the thresholds listed above.

For *E. coli*, the criteria are monthly geometric means below 126 colonies per 100 milliliters (mL) of water and less than 10 percent of samples above 410 colonies per 100 mL of water in any 30-day period. Generally, insufficient samples are available to assess the monthly geometric means, therefore, the criteria most used for assessing *E. coli* is the 410 colonies per 100 mL. For the purposes of this report, the *E. coli* are presented against the 410 threshold to see if more than 10 percent of the available data are above it.

TN, TP, and Chl-a AGMs are plotted in **Figure 4-9** through **Figure 4-11.** Where sufficient data are available (based generally on the IWR rule requirements) to assess the AGMs, the levels are provided from 2010 through 2020. The Chl-a threshold and the minimum and maximum thresholds for TN and TP relative to the NNC are provided on each of the graphs as pink dashed lines. **Figure 4-12** presents a plot of calculated TSI values in the lake. **Figure 4-13** presents plots of *E. coli* data for the available period of record (2014 to 2020).

Examination of the TN plot **(Figure 4-9**) shows that between 2010 and 2020 the AGM values were just above or below the minimum criteria, with somewhat higher values in the earlier years (2010 to 2015). Historically, TN levels were generally higher but for the period of available data, the AGM levels were not above the maximum thresholds for TN. No AGM value is provided in 2012 due to the dry down discussed earlier.

In contrast, TP AGMs (**Figure 4-10**) have been higher relative to the NNC minimum and maximum. Since 2010, the TP values have ranged in the upper range between the minimum and maximum values, with the level in 2020 just above the maximum value. Historically, TP values were much higher, with historical levels prior to 2000 almost always above the maximum threshold, with some years well above.

Examination of the corrected Chl-a plot (**Figure 4-11**) shows that since 2010 the Chl-a AGMs have generally been around or near the threshold 6 μg/L with values above the threshold in 2011, 2013, 2017, 2019, and 2020. Lower Chl-a AGMs were calculated in 2010, 2014, and 2018.

Examination of the TSI plot **(Figure 4-12**) shows that since 2010, most of the calculated values fall within the good range (below 60). This is consistent with what was seen with the Chl-a, TN, and TP concentrations relative to the NNC, where later years showed Chl-a levels just above the threshold, and TN and TP levels were generally within acceptable ranges. For the calculated TSI values, the nutrient limitations are presented by color based on the method for calculation of TSI. In more recent years, the higher TSI levels occurred under nutrient balanced or nitrogen limited conditions, indicating that nitrogen does (at times) play an important role in the level of productivity in Lake Jackson.

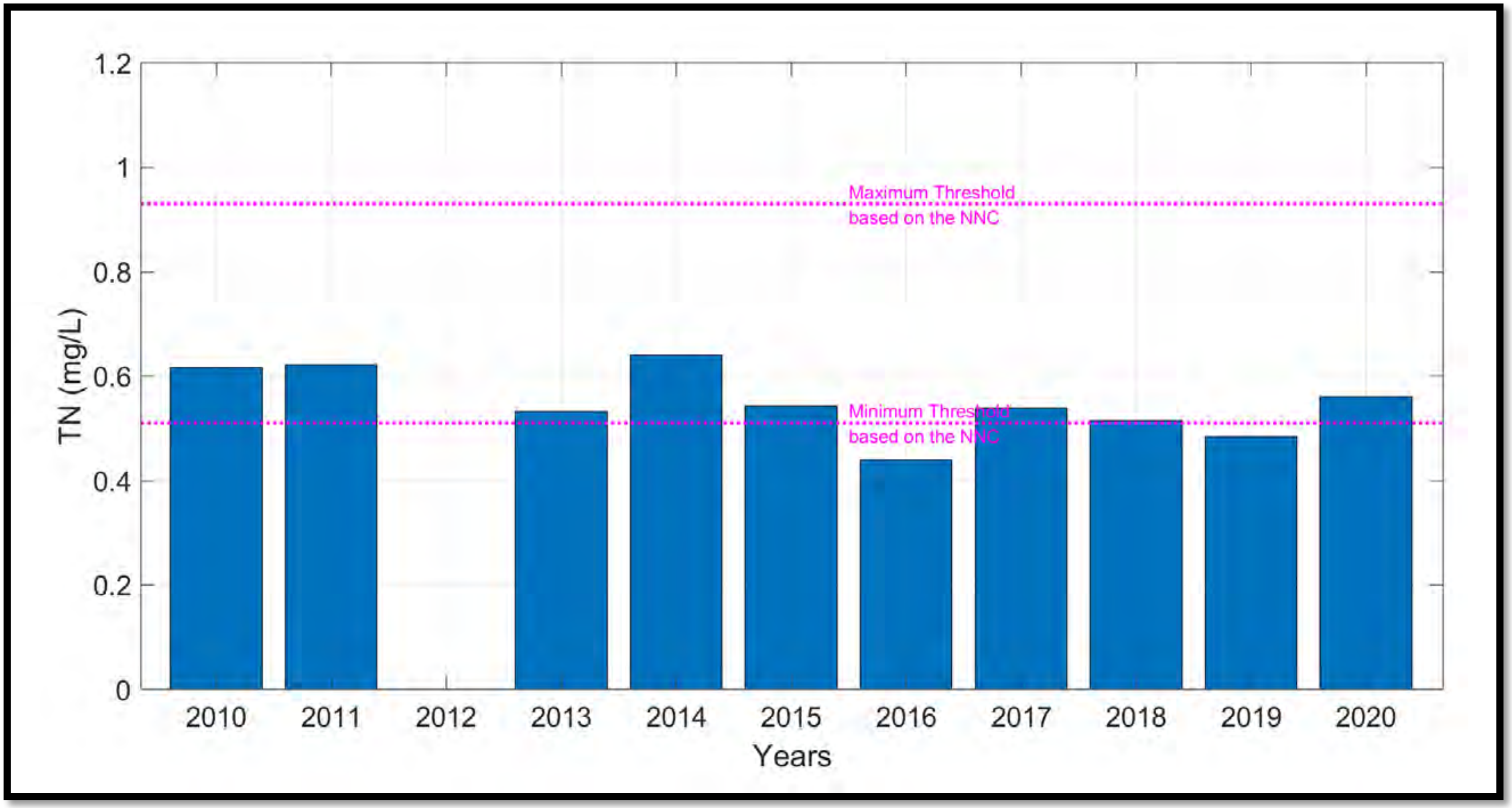


Figure 4-9: Plot of Annual Geometric Means for TN with NNC Criteria for Lake Jackson

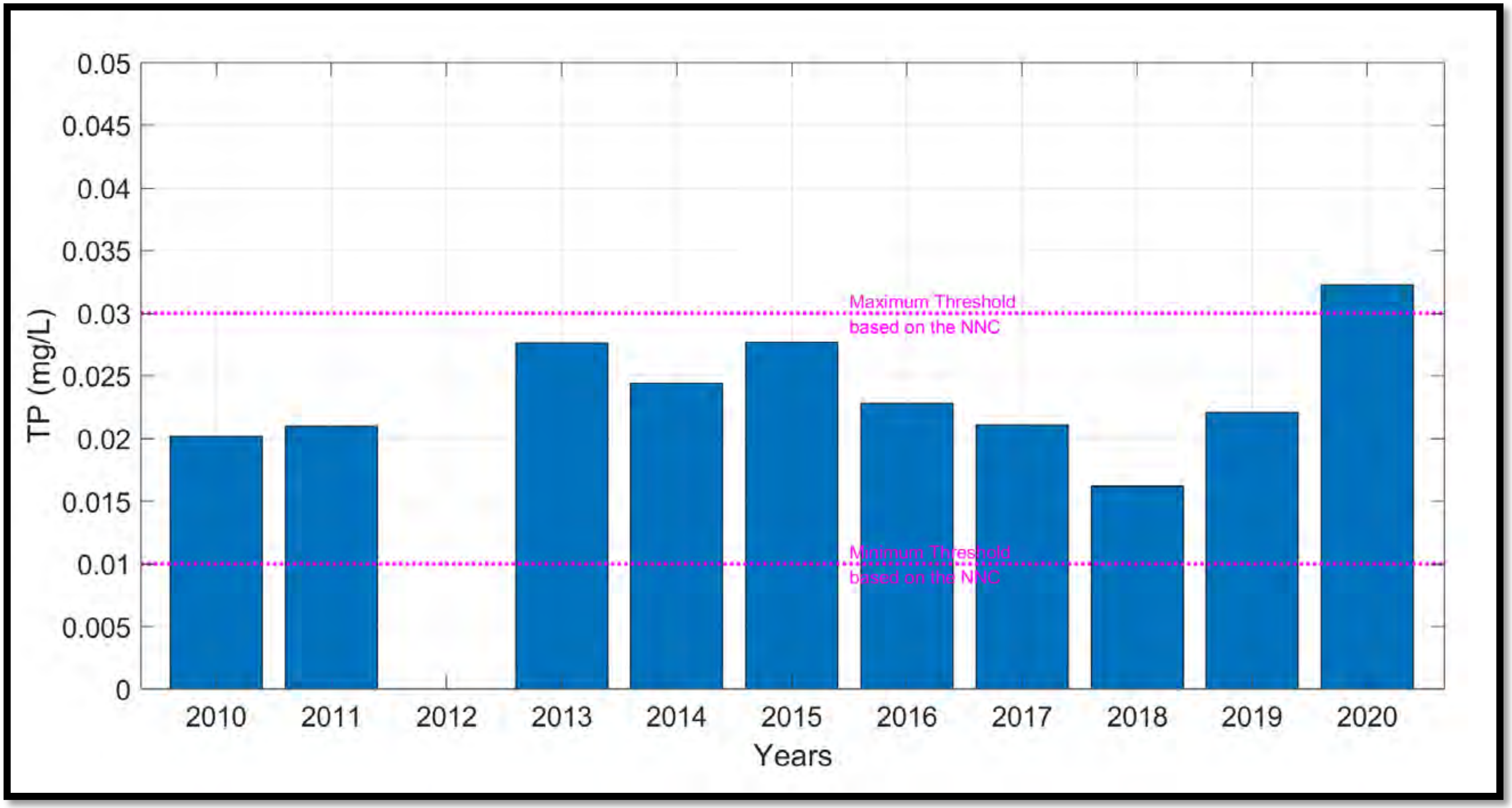


Figure 4-10: Plot of Annual Geometric Means for TP with NNC Criteria for Lake Jackson

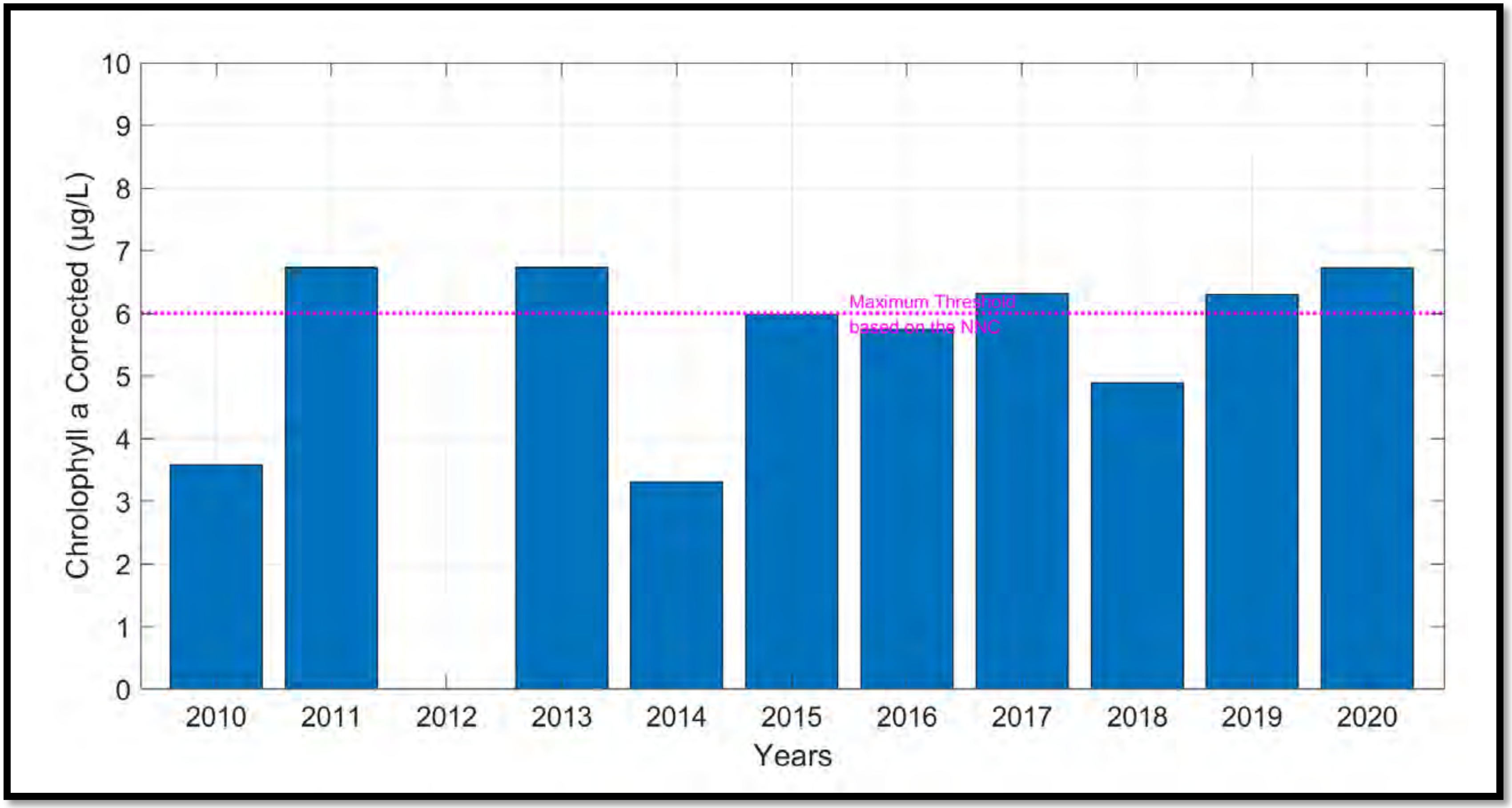


Figure 4-11: Plot of Annual Geometric Means for Chl-a with NNC Criteria for Lake Jackson

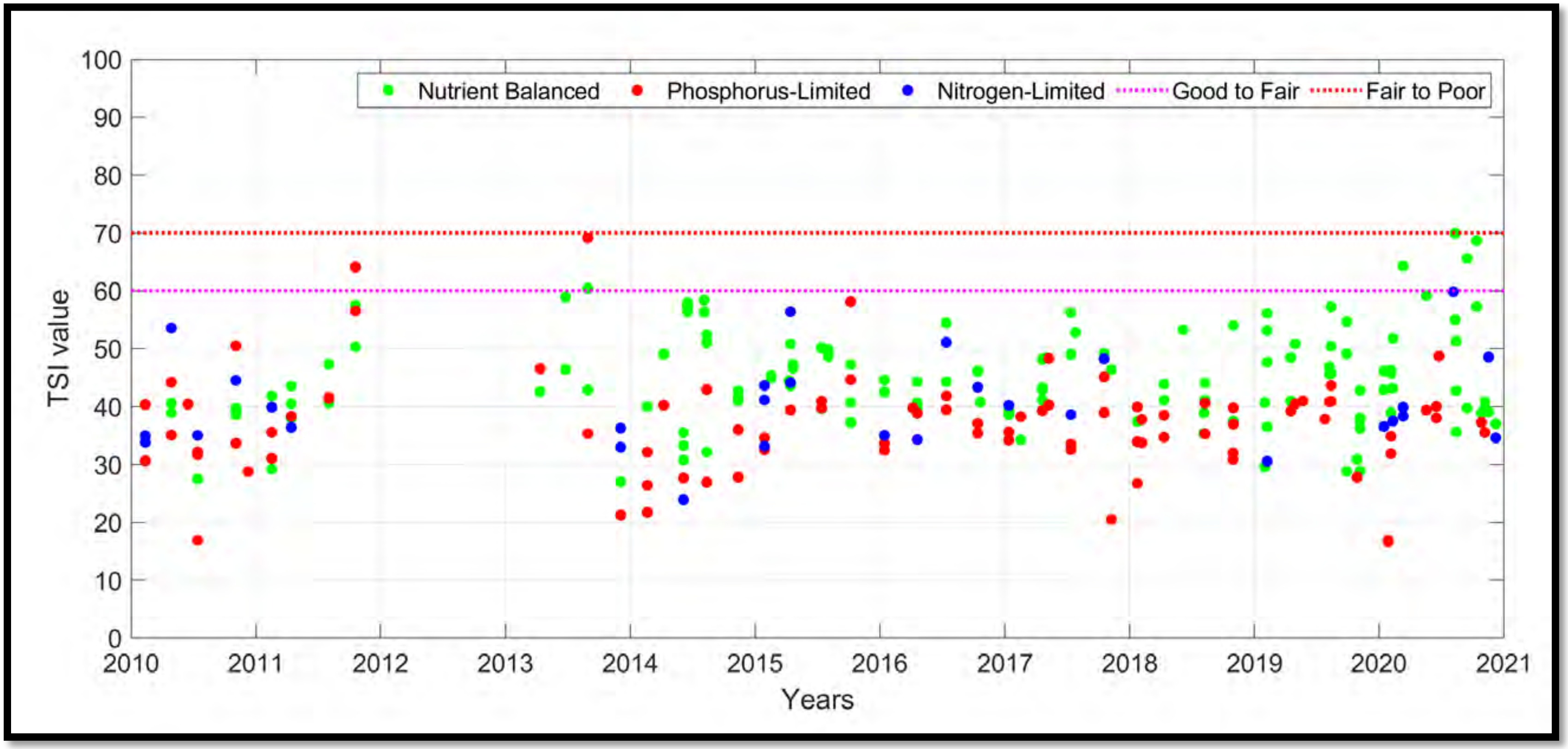


Figure 4-12: Trophic State Index for Lake Jackson

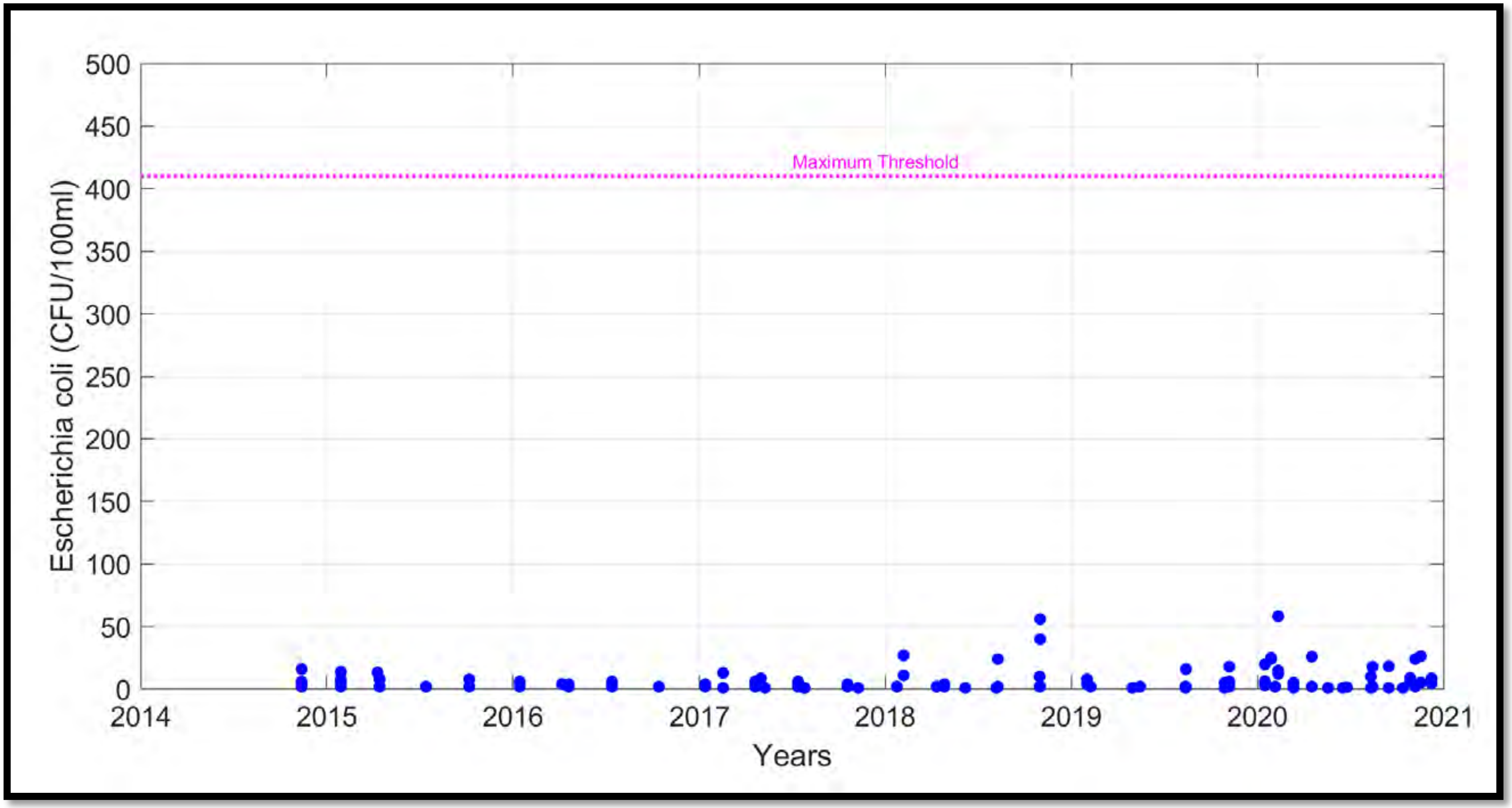


Figure 4-13: Plot of *E. coli* for Lake Jackson

Examination of the *E. coli* plot (**Figure 4-13**) shows that no measurements exceeded the less than 10 percent of samples above 410 colonies per 100 mL criteria for Class III freshwaters and values within the lake are very low.

4.4.3.8 Groundwater Data

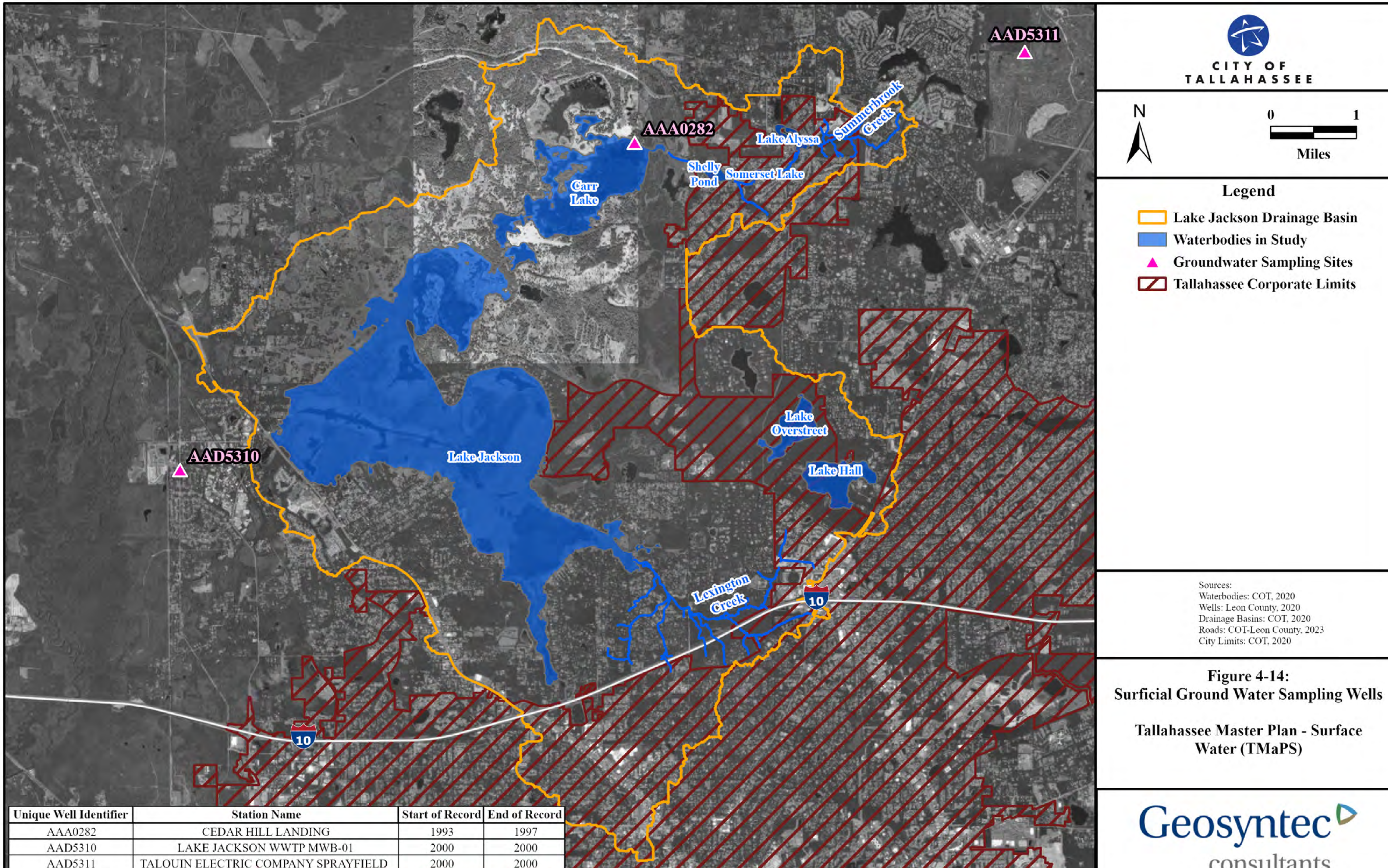
Groundwater is water that has infiltrated to fill spaces between sediments and cracks in rock. Groundwater is fed by precipitation and eventually resurfaces to replenish surface water, including lakes through seepage from the surficial aquifer and, at times, from inputs from the Floridan Aquifer. For Lake Jackson, flows to the Floridan Aquifer are through the Lime and Porter Sinks and are out of the lake and, therefore, not a source of water or nutrients. The surficial aquifer, on the other hand, could be a source of water and/or nutrients through direct seepage into the lake. Surficial groundwater flow into waterbodies may bring with it any contaminants or pollutants that it contacts on its way to a lake or surface water. Therefore, analysis of surficial groundwater data can be beneficial in evaluating potential seepage into the lake and its impacts on water quality.

Only one surficial aquifer groundwater sampling well is within the boundaries of the Lake Jackson Drainage Basin, Station AAA0282 (**Figure 4-14**). This well is more than 3,000 meters from the edge of Lake Jackson at the northern end of Carr Lake. Another well is located just outside of the Lake Jackson basin boundary along the western side (AAD5310) and is closer to Lake Jackson, but this station is associated with a wastewater treatment facility and is likely not representative of surficial seepage into Lake Jackson. The available groundwater quality data in the area limits the assessment of potential seepage issues into Lake Jackson and, therefore, is not analyzed directly in this report.

4.4.3.9 Biological Data

The Lake Vegetation Index (LVI) is a bioassessment procedure that analyzes the health of the plant community in lakes. FDEP performs sampling and calculations for waterbodies to interpret LVI values with respect to how closely they resemble the levels of a lake under conditions of minimal human disturbance. The LVI methodology was developed in 2005 in the pursuit of relating plant metrics to human disturbance. The LVI assesses factors such as the presence of exotic species and their ratio to native plant species, lakeshore alterations, and chemical disturbances such as excessive nutrients from surrounding land uses.

For lakes in Florida, an LVI range of 79 to 100 is considered Exceptional, a range of 43 to 78 is considered Healthy, and any values below 42 are deemed Impaired. **Table 4-3** presents LVI data for Lake Jackson. Between 2010 to 2019, there has been one instance in which the LVI measurements were below the 42 threshold. Most sampling events in the lake have yielded an LVI in the healthy range above 42, which denotes that while there are invasive plant taxa present in the lake, the vast majority are native plant taxa, and the invasive taxa have declined to a minimal amount.



Unique Well Identifier	Station Name	Start of Record	End of Record
AAA0282	CEDAR HILL LANDING	1993	1997
AAD5310	LAKE JACKSON WWTP MWB-01	2000	2000
AAD5311	TALQUIN ELECTRIC COMPANY SPRAYFIELD	2000	2000

Sources:
Waterbodies: COT, 2020
Wells: Leon County, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
City Limits: COT, 2020

Figure 4-14:
Surficial Ground Water Sampling Wells

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Table 4-3: Summary of LVI Results from Lake Jackson

Date	Station ID	LVI	Aquatic Life Use Category
7/9/2010	21FLPNS 99LAKES09	79	Exceptional
9/7/2010	21FLLEONLEONLVI006	48	Healthy
7/19/2013	21FLGW 43541	59	Healthy
7/31/2014	21FLLEONLEONLVI006	52	Healthy
9/30/2014	21FLWQSPLEO09JAC01	40	Impaired
9/30/2014	21FLPNS 99LAKES09	70	Healthy
9/18/2015	21FLLEONLEONLVI006	61	Healthy
9/15/2016	21FLLEONLEONLVI006	52	Healthy
6/29/2017	21FLGW 43541	53	Healthy
7/25/2018	21FLLEONLEONLVI006	54	Healthy
7/26/2019	21FLWQSPLEO19JAC1	44	Healthy

4.4.3.10 Stormwater Treatment Facilities

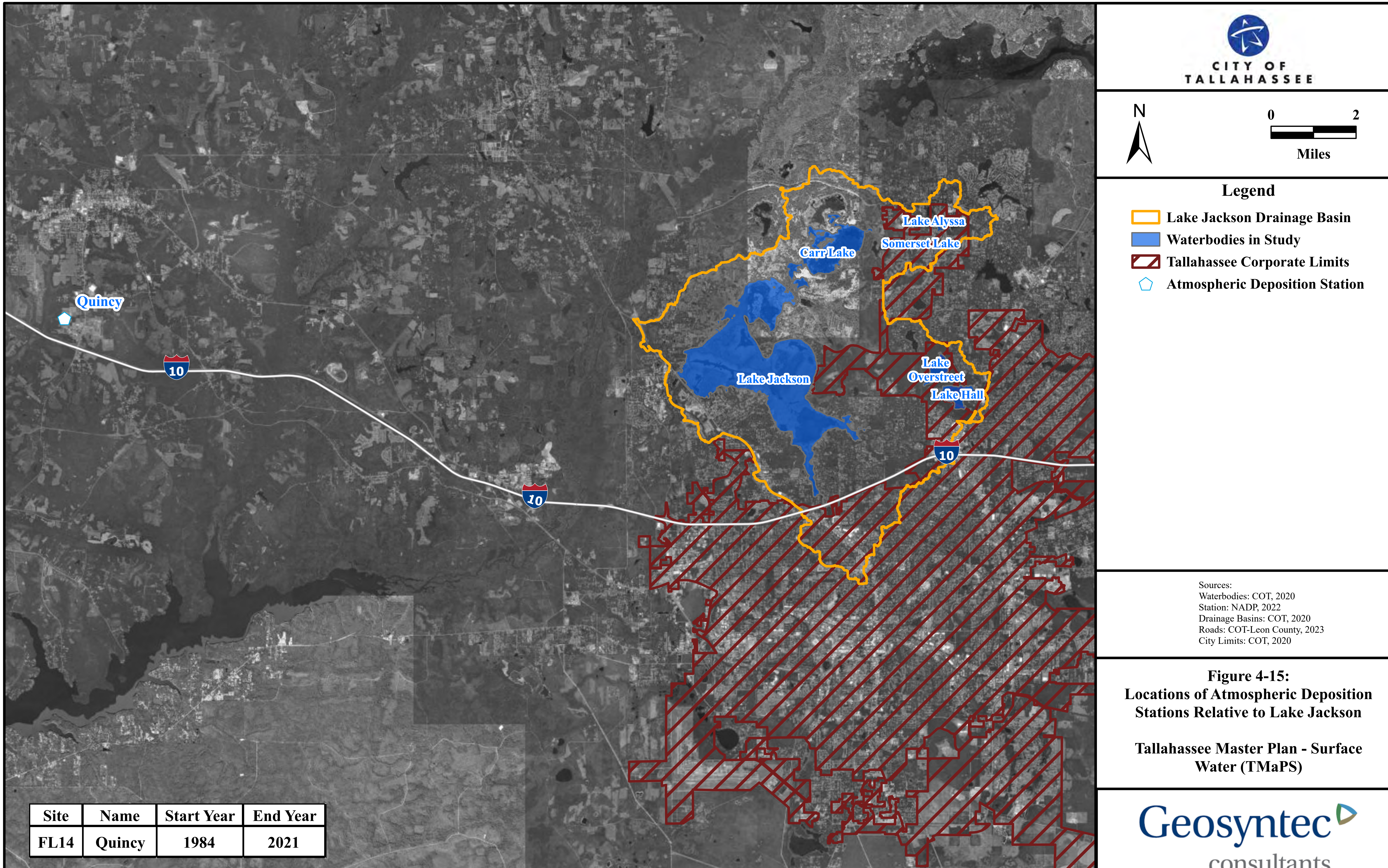
In assessing potential sources of pollutants to Lake Jackson, and ultimately for targeting nutrient reduction projects, it is important to identify existing treatment facilities adjacent to and along tributaries flowing into the downstream waterbodies. In **Section 4.4.1**, discussions were provided on stormwater treatment facilities that were constructed to deal with specific inputs to Megginnis Arm, Fords Arm and areas along the western side of the lake. **Exhibit 4-8** presents a map of stormwater treatment facilities (ponds) within the Lake Jackson basin boundaries based on available data from the City, Leon County and the Florida Department of Transportation (FDOT). As the exhibit shows, there are extensive treatment facilities located along the southern and western side of Lake Jackson, especially within Megginnis Creek and Lexington Creek watersheds. Additionally, there are numerous facilities within Summerbrook Chain of Lakes watershed.

4.4.3.11 Atmospheric Deposition Data

Atmospheric deposition is the loading contained in rainfall that falls directly onto the open water lake surface or that falls onto the surface as dry deposition. Stations are maintained throughout Florida that collect atmospheric deposition data. **Figure 4-15** shows the location of the nearest atmospheric deposition station to Lake Jackson. The station is in Quincy (FL14) and has been collecting data since 1984.

4.4.3.12 Data Summary

For the purposes of the qualitative analysis of sources of pollutants to Lake Jackson (**Section 4.4.4),** the available data are reasonable. There are sufficient active surface water quality stations within the lake and within key tributaries entering the lake to support the qualitative assessment. The following outlines limitations in the available data. Specific recommendations on additional data collection efforts are provided in **Section 4.11**.



Site	Name	Start Year	End Year
FL14	Quincy	1984	2021

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Sources:
Waterbodies: COT, 2020
Station: NADP, 2022
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
City Limits: COT, 2020

Figure 4-15:
Locations of Atmospheric Deposition Stations Relative to Lake Jackson

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- There is limited flow data along key tributaries entering the lake. There was only one continuous gauge identified and that was in Lexington Creek. The gauge was discontinued in 2018.
- For some of the tributary inflows to the lake (especially in less developed watersheds), the available water quality data are sparse and older than 2005.
- There are limited data to evaluate the potential for seepage of pollutants to the lake from the surficial aquifer, i.e., surficial groundwater sampling stations around the lake.

4.4.4 Qualitative Assessment of Sources

Prior to performing loading calculations and other analyses to quantify existing pollutant sources to Lake Jackson, it is important to analyze available data and summarize findings from historical studies to support identification of the pathway and magnitude of potential sources. This aids in the determination of sources by providing a more complete understanding of the lake's water quality response and (where data and historical studies are available) highlights those tributaries and other inputs that are potential sources. Additionally, the determination of potential sources must take into account existing water quality treatment infrastructure and how their location and function mitigate conditions prior to discharge to Lake Jackson.

For Lake Jackson, the sources that were evaluated include the following:

- Stormwater runoff
- Septic systems
- Internal recycling and seepage
- Wastewater
- Atmospheric deposition
- Interconnected flows

An overview of the analyses and findings for each source listed above is provided in the following sections. Prior to the discussions of each of the potential sources, in-lake analyses examining the spatial variation of the parameters of interest are provided to support determination of key focus areas around Lake Jackson. Following the discussions for each source type, a summary of findings for the qualitative assessment is provided.

4.4.4.1 In-Lake Water Quality

In-lake spatial variation was evaluated for the following parameters:

- Color
- Alkalinity
- Total Phosphorus

- Total Nitrogen
- Chl-a
- Trophic State Index
- *E. coli*

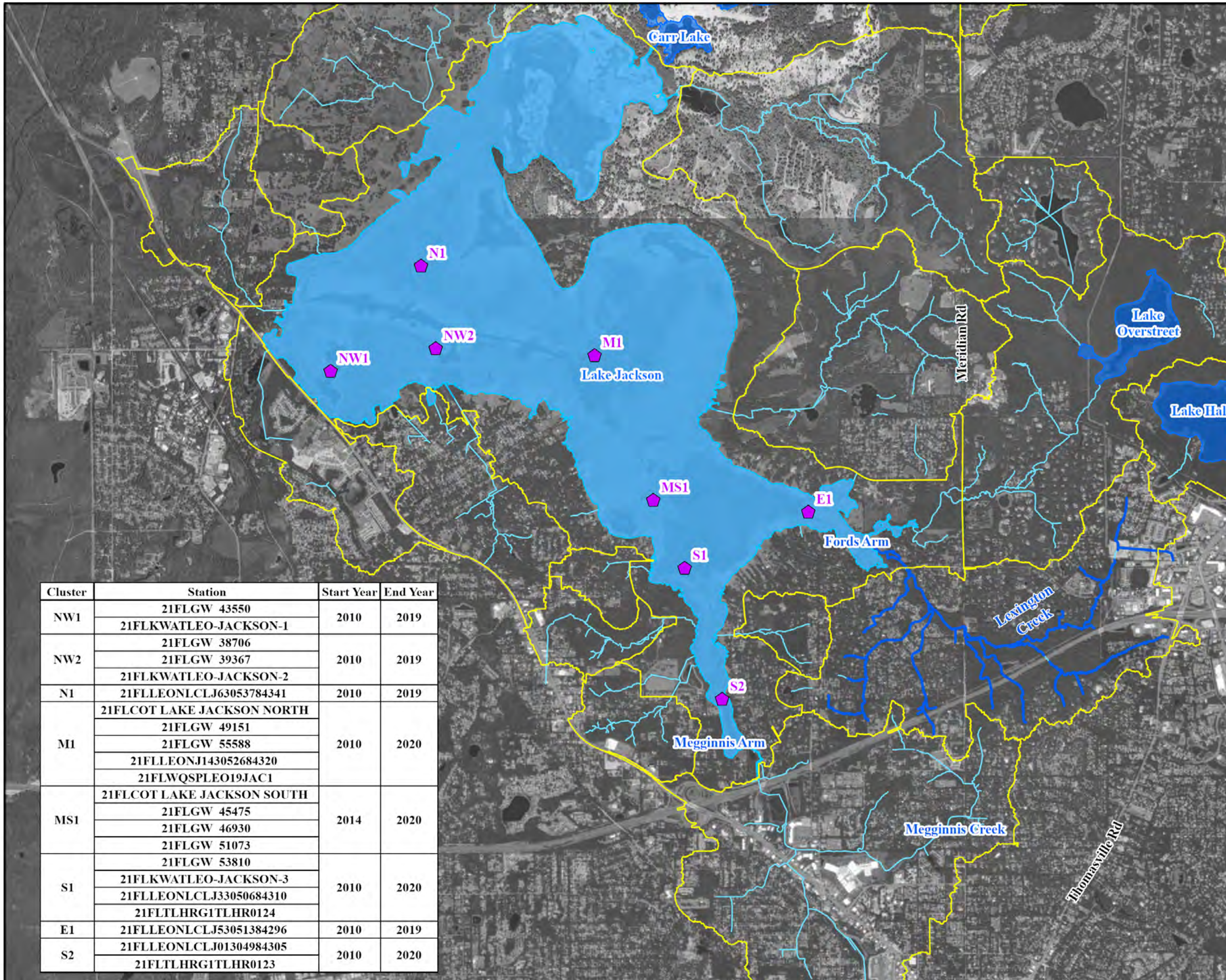
To maximize available data for use in the spatial analyses, data stations were clustered to represent general areas of the lake, such as stations in the south portion of the lake, north portion, etc. Analyses were then performed on the collective data for that general location. **Figure 4-16** presents the data clustering locations and the specific water quality stations where data were pulled for that specific cluster.

For Lake Jackson, a total of eight clusters were identified. The locations included S2 in Megginnis Arm, S1 near the mouth of Megginnis Arm, E1 near the mouth of Fords Arm, MS1 in the general open water area at the northwest side where Megginnis and Fords Arm drain, M1 in the lake center, N1 on the north side of the main lake area, and NW1 and NW2 in open water areas along the northwest edge of the lake. The spatial analyses were only performed using data after 2010 to represent recent conditions. Any station that had data after 2010 was assigned one of the cluster locations and a collective data set developed for that cluster. As such, all data available within the lake after 2010 was utilized in the spatial analyses. Clusters NW1 and NW2 had limited data compared to other clusters (as can be seen on the tables in the spatial figures) but a determination was made to include the analyses. No data were available after 2010 in the northern lobe that connects to Carr Lake.

Figure 4-17 through **Figure 4-23** present the spatial analyses. For all parameters (other than *E. coli*), the annual geomeans for the period of record from 2010 to 2020 were averaged to calculate the cluster values. For *E. coli* the 90th percentile of the data was calculated. Some cluster areas had more data than others and, as such, the period of record analyzed is not always the same between locations. The goal was to utilize as much data as available for each site. Where no symbol is shown on a map for a specific parameter at a cluster location, it indicates that a determination was made that insufficient or no data were available to assess the averages of the geometric means or the 90th percentile for *E. coli*.

The results at each cluster of stations are presented as colored symbols representing ranges of calculated values. FDEP or other criteria/thresholds were used to define breakpoints for the color transitions. For the in-lake TN and TP criteria, where maximum and minimum thresholds are defined through NNC, the transition from blue to green was at the minimum value and the transition from orange to red was at the maximum value. The levels between the minimum and maximum were evenly divided into the range for the transition from green to yellow and yellow to orange. For all other parameters with only a maximum criteria/threshold, the transition from orange to red was set at the criteria/threshold. The other four levels were then evenly divided down from the maximum to 0.

- For alkalinity and color, the cutoff from orange into red was set to 20 mg/L and 40 platinum-cobalt units (PCUs), respectively.



Cluster	Station	Start Year	End Year
NW1	21FLGW 43550	2010	2019
	21FLKWATLEO-JACKSON-1		
NW2	21FLGW 38706	2010	2019
	21FLGW 39367		
	21FLKWATLEO-JACKSON-2		
N1	21FLLEONLCLJ63053784341	2010	2019
M1	21FLCOT LAKE JACKSON NORTH	2010	2020
	21FLGW 49151		
	21FLGW 55588		
	21FLLEONJ143052684320		
	21FLWQSPLEO19JAC1		
MS1	21FLCOT LAKE JACKSON SOUTH	2014	2020
	21FLGW 45475		
	21FLGW 46930		
	21FLGW 51073		
S1	21FLGW 53810	2010	2020
	21FLKWATLEO-JACKSON-3		
	21FLLEONLCLJ33050684310		
	21FLTLHRG1TLHR0124		
E1	21FLLEONLCLJ53051384296	2010	2019
S2	21FLLEONLCLJ01304984305	2010	2020
	21FLTLHRG1TLHR0123		

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023

Figure 4-16: Station Clustering for In-Lake Spatial Analyses for Lake Jackson

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- For TN and TP, cutoffs were set for orange to red at the maximum of the allowable range for Lake Jackson (0.93 mg/L TN and 0.03 mg/L TP) and blue to green at the minimum (0.51 mg/L TN and 0.01 mg/L TP).
- For Chl-a, the cutoff from orange to red was set at the criteria for Lake Jackson (6 µg/L).
- For TSI, the cutoff was set to 60 from orange to red, based on the transition from mesotrophic to eutrophic conditions.
- For *E. coli*, the transition from orange to red was set at 410 most probable number (MPN)/100 mL.

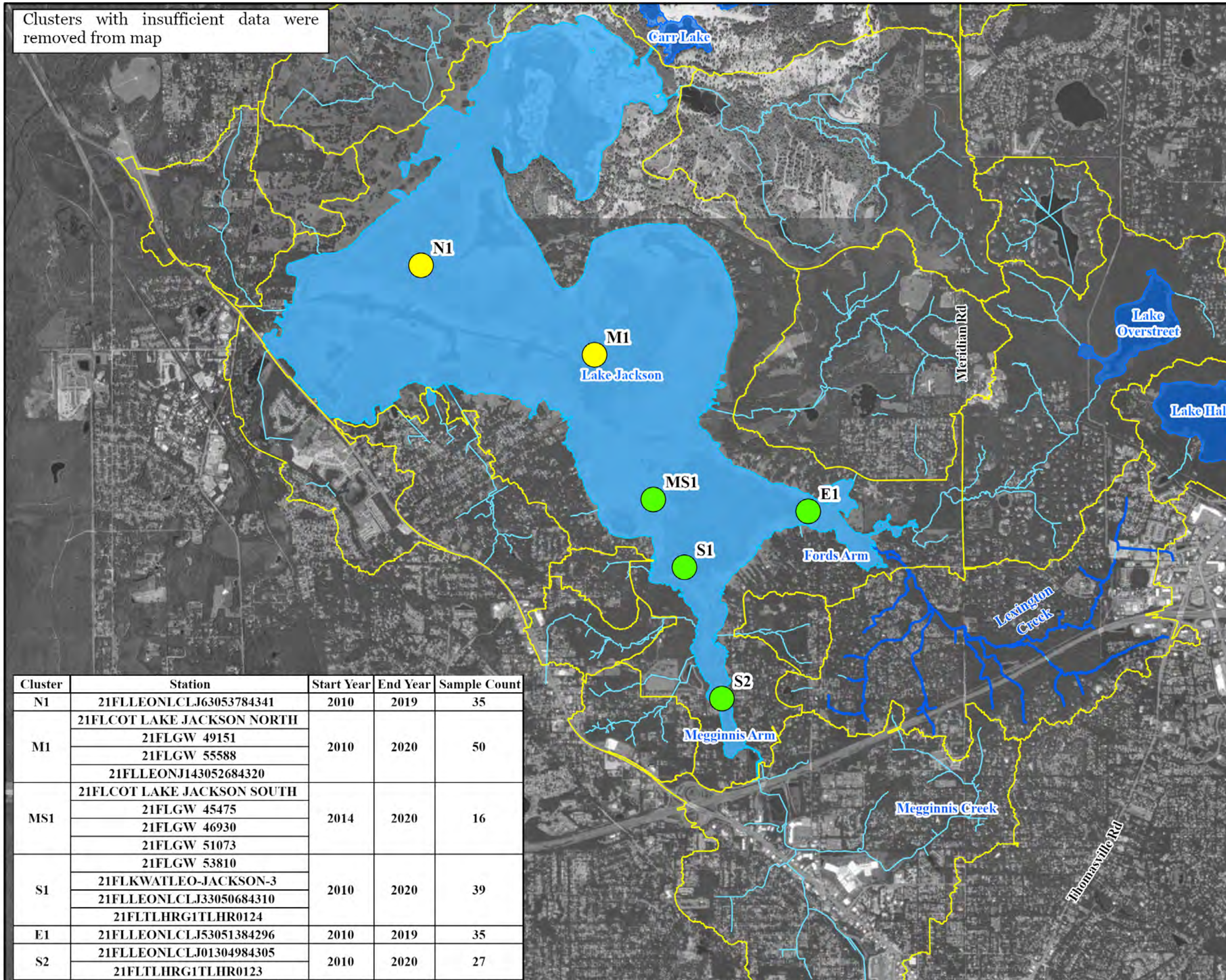
The analyses presented herein are not meant to indicate conditions of impairment or non-impairment per FDEP rules and criteria. The criteria/thresholds are to aid in assessing general conditions in the lake and spatial variation, and the thresholds provide baselines to evaluate against and to aid in defining potential target areas for water quality improvement projects.

Figure 4-17 and **Figure 4-18** present the variations in color and alkalinity. Examination of the color map shows that there does not appear to be a significant variation between clusters (S1=14.9 PCU, S2=15.5 PCU, E1=16.1 PCU, MS1=15.7 PCU, M1=22.9 PCU, N1=25.4 PCU). One aspect that can be seen is that at the Megginnis Arm cluster, the levels are somewhat lower. In no case do the color values for any of the clusters go above 40 PCU, which would indicate transition to high color lake conditions. The alkalinity map does show some significant variation, with higher alkalinity in the clusters in the southern end of the system and lower values moving north and west (S1=22.1 mg/L, S2=53.3 mg/L, E1=19.9 mg/L, MS1=19.1 mg/L, M1=10.1 mg/L, N1=5.2 mg/L). In two of the clusters (S1 and S2), the values are above the 20 mg/L cutoff from low alkalinity to high alkalinity lake conditions as defined by the NNC.

Figure 4-19 and **Figure 4-20** present the spatial variation of TN and TP. TN cluster values are highest in the northwest side of the lake near where the Harbinwood neighborhood drains in (S1=0.43 mg/L, S2=0.21 mg/L, E1=0.36 mg/L, MS1=0.54 mg/L, M1=0.54 mg/L, N1=0.50 mg/L, NW1=0.66 mg/L, NW2=0.72 mg/L). The next highest levels are at the middle stations (M1, MS1). The lowest cluster values are at the northern cluster (N) and in the areas of Megginnis Arm and Fords Arm.

All of the values are below the maximum threshold. Examination of the TP map shows a distinct spatial pattern, with higher concentrations along the southern and southwestern side of the lake, decreasing moving further north (S1=0.025 mg/L, S2=0.046 mg/L, E1=0.037 mg/L, MS1=0.024 mg/L, M1= 0.017 mg/L, N1=0.014 mg/L, NW1=0.027 mg/L, NW2=0.019 mg/L).

The highest concentrations are seen in Megginnis Arm and the mouth of Fords Arm. The values at those two locations are above the maximum threshold range for TP. Overall, the TP levels were more elevated than TN in relation to the NNC thresholds. This is particularly evident in the southern portion of the lake and in the two arms where the TN clusters showed some of the lowest levels while the TP clusters showed values above the NNC maximum.



Cluster	Station	Start Year	End Year	Sample Count
N1	21FLLEONLCLJ63053784341	2010	2019	35
M1	21FLCOT LAKE JACKSON NORTH	2010	2020	50
	21FLGW 49151			
	21FLGW 55588			
	21FLLEONJ143052684320			
MS1	21FLCOT LAKE JACKSON SOUTH	2014	2020	16
	21FLGW 45475			
	21FLGW 46930			
	21FLGW 51073			
S1	21FLGW 53810	2010	2020	39
	21FLKWATLEO-JACKSON-3			
	21FLLEONLCLJ33050684310			
	21FLTLHRG1TLHR0124			
E1	21FLLEONLCLJ53051384296	2010	2019	35
S2	21FLLEONLCLJ01304984305	2010	2020	27
	21FLTLHRG1TLHR0123			

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

Figure 4-17:
Spatial Assessment of Color in Lake Jackson

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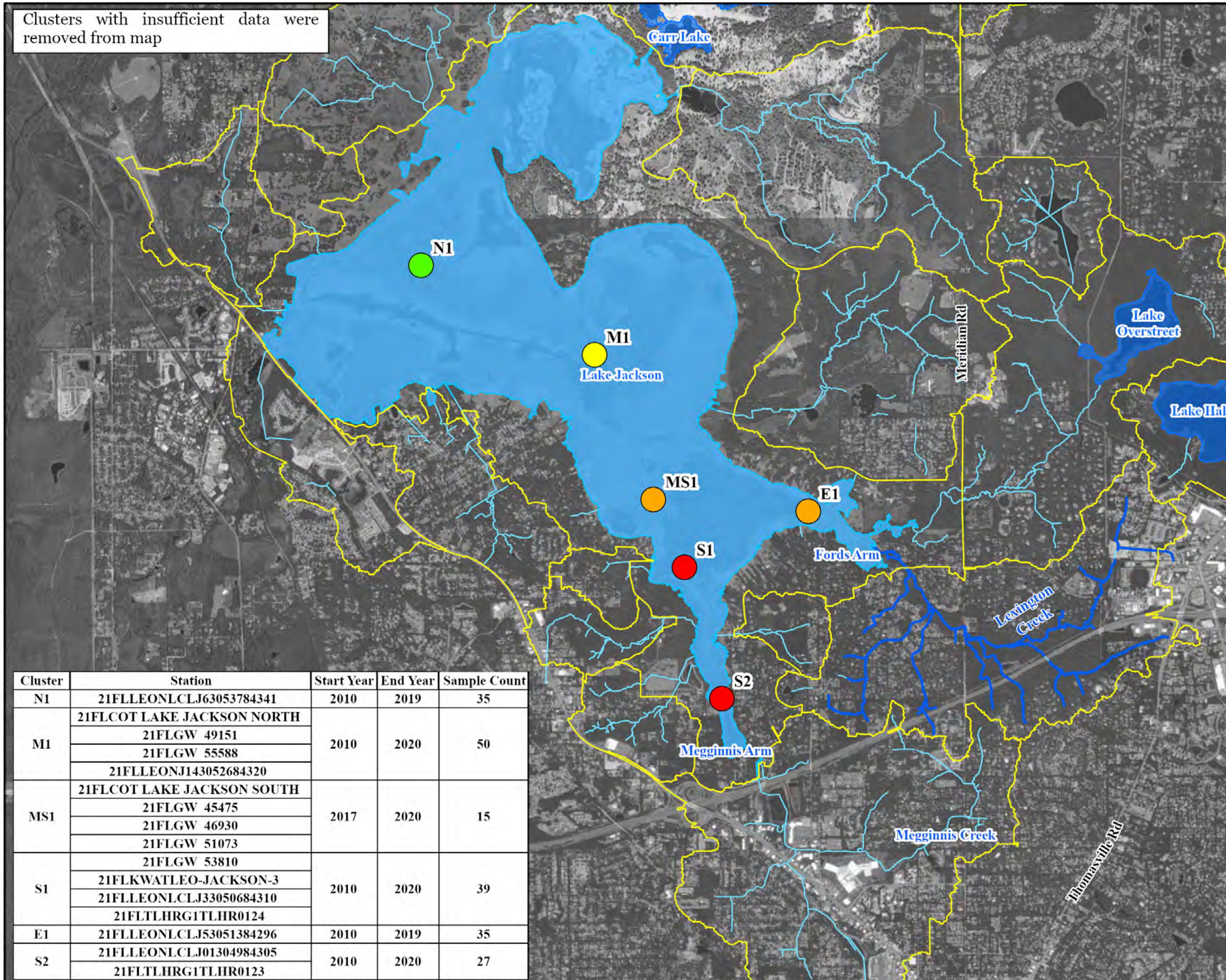

Cluster	Station	Start Year	End Year	Sample Count
N1	21FLLEONLCLJ63053784341	2010	2019	35
M1	21FLCOT LAKE JACKSON NORTH	2010	2020	50
	21FLGW 49151			
	21FLGW 55588			
	21FLLEONJ143052684320			
MS1	21FLCOT LAKE JACKSON SOUTH	2017	2020	15
	21FLGW 45475			
	21FLGW 46930			
	21FLGW 51073			
S1	21FLGW 53810	2010	2020	39
	21FLKWATLEO-JACKSON-3			
	21FLLEONLCLJ33050684310			
	21FLTLHRG1TLHR0124			
E1	21FLLEONLCLJ53051384296	2010	2019	35
S2	21FLLEONLCLJ01304984305	2010	2020	27
	21FLTLHRG1TLHR0123			

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Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

Figure 4-18: Spatial Assessment of Alkalinity in Lake Jackson

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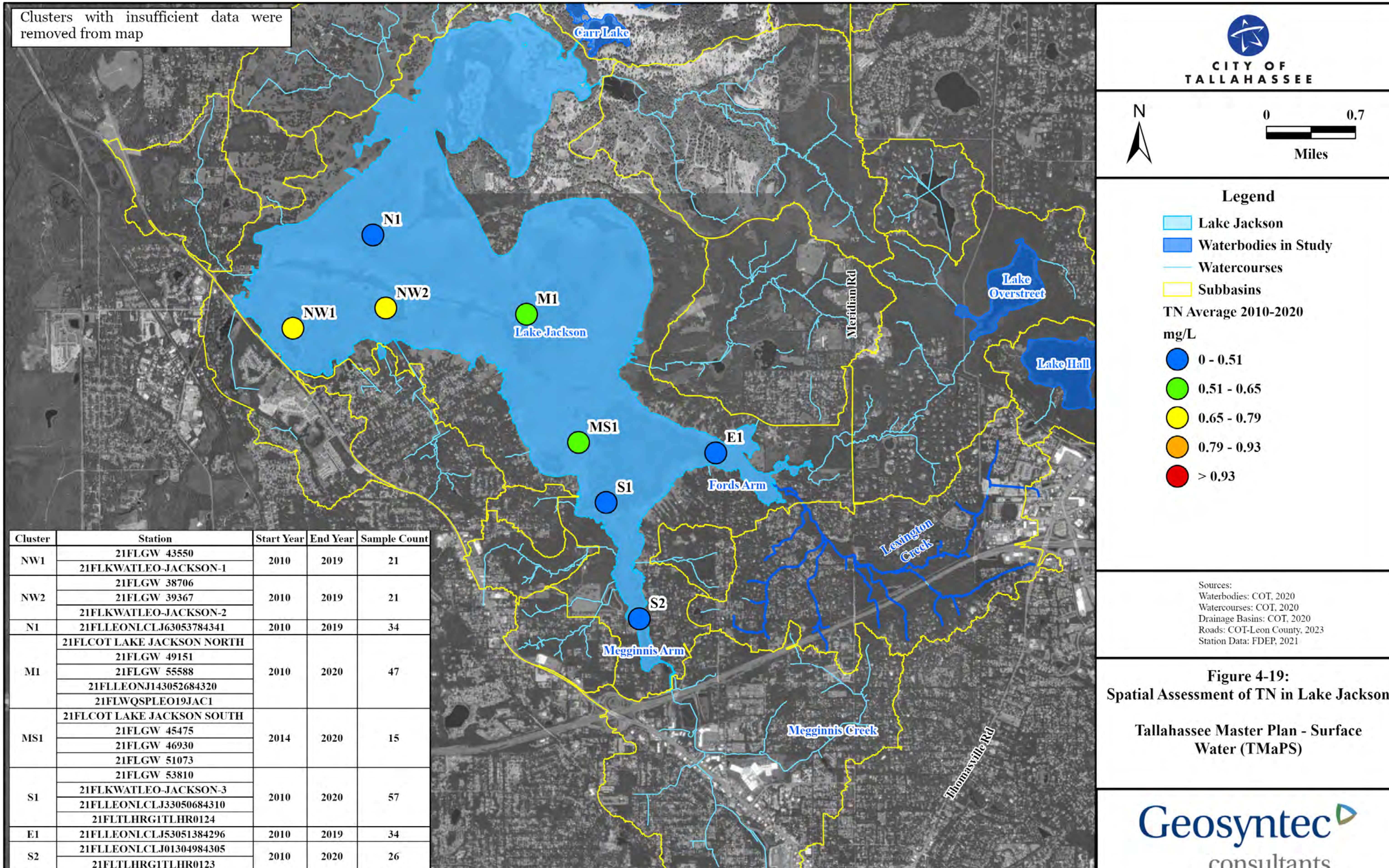

Cluster	Station	Start Year	End Year	Sample Count
NW1	21FLGW 43550	2010	2019	21
	21FLKWATLEO-JACKSON-1			
NW2	21FLGW 38706	2010	2019	21
	21FLGW 39367			
	21FLKWATLEO-JACKSON-2			
N1	21FLLEONLCLJ63053784341	2010	2019	34
M1	21FLCOT LAKE JACKSON NORTH	2010	2020	47
	21FLGW 49151			
	21FLGW 55588			
	21FLLEONJ143052684320			
	21FLWQSPLEO19JAC1			
MS1	21FLCOT LAKE JACKSON SOUTH	2014	2020	15
	21FLGW 45475			
	21FLGW 46930			
	21FLGW 51073			
S1	21FLGW 53810	2010	2020	57
	21FLKWATLEO-JACKSON-3			
	21FLLEONLCLJ33050684310			
	21FLTLHRG1TLHR0124			
E1	21FLLEONLCLJ53051384296	2010	2019	34
S2	21FLLEONLCLJ01304984305	2010	2020	26
	21FLTLHRG1TLHR0123			

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Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

Figure 4-19:
Spatial Assessment of TN in Lake Jackson

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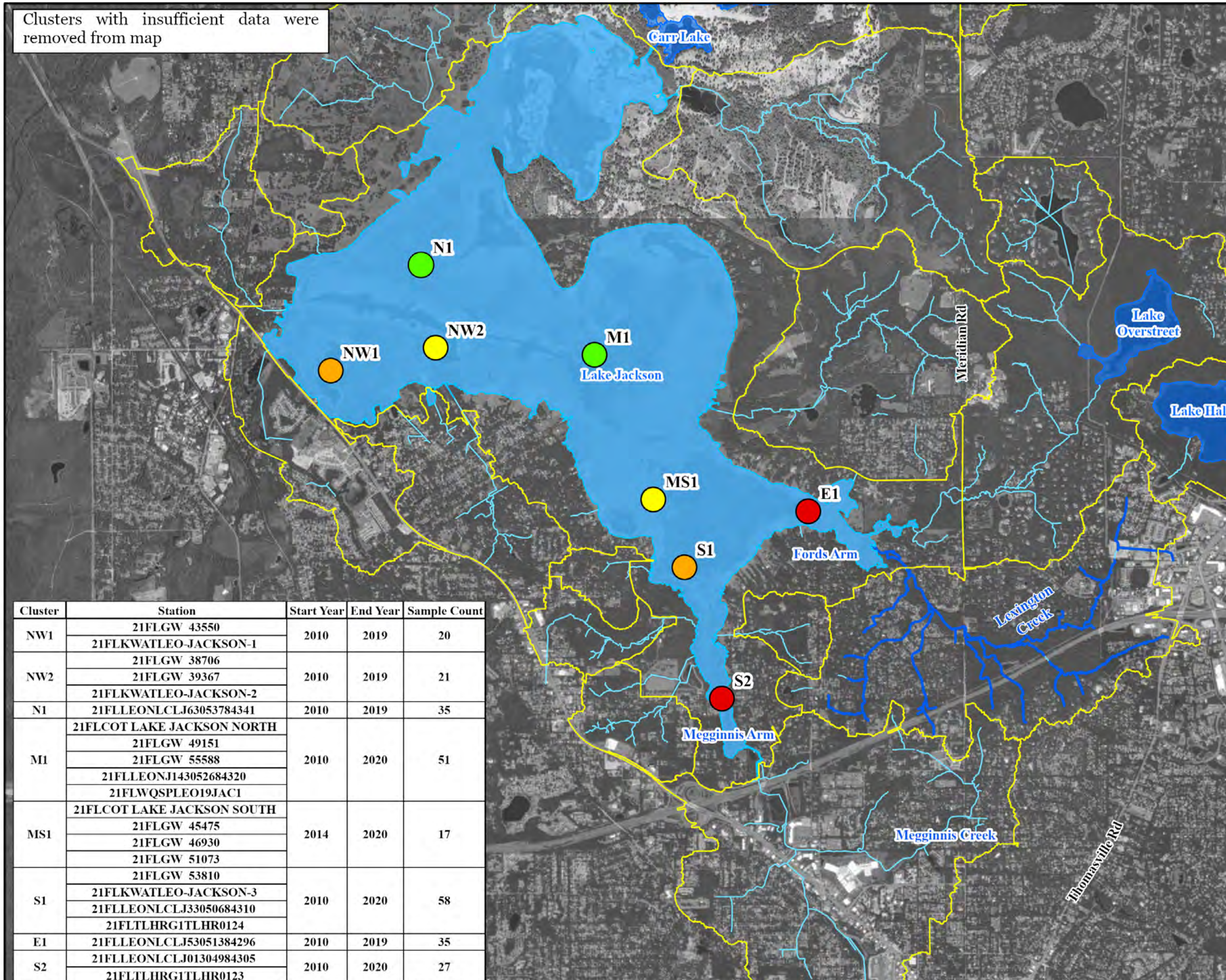

Cluster	Station	Start Year	End Year	Sample Count
NW1	21FLGW 43550	2010	2019	20
	21FLKWATLEO-JACKSON-1			
NW2	21FLGW 38706	2010	2019	21
	21FLGW 39367			
	21FLKWATLEO-JACKSON-2			
N1	21FLLEONLCLJ63053784341	2010	2019	35
M1	21FLCOT LAKE JACKSON NORTH	2010	2020	51
	21FLGW 49151			
	21FLGW 55588			
	21FLLEONJ143052684320			
	21FLWQSPLEO19JAC1			
MS1	21FLCOT LAKE JACKSON SOUTH	2014	2020	17
	21FLGW 45475			
	21FLGW 46930			
	21FLGW 51073			
S1	21FLGW 53810	2010	2020	58
	21FLKWATLEO-JACKSON-3			
	21FLLEONLCLJ33050684310			
	21FLTLHRG1TLHR0124			
E1	21FLLEONLCLJ53051384296	2010	2019	35
S2	21FLLEONLCLJ01304984305	2010	2020	27
	21FLTLHRG1TLHR0123			

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N

0 0.7

Miles

Legend

- Lake Jackson
- Waterbodies in Study
- Watercourses
- Subbasins

TP Average 2010-2020

mg/L

- 0 - 0.010
- 0.010 - 0.017
- 0.017 - 0.024
- 0.024 - 0.030
- > 0.03

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

Figure 4-20:
Spatial Assessment of TP in Lake Jackson

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Figure 4-21 and **Figure 4-22** present maps of the spatial variation in Chl-a and TSI. These parameters represent the biological response of the system to nutrient loading. For Chl-a, there is a distinct pattern of higher values in the southern portion of the lake and along the western shoreline (S1=7.5 µg/L, S2=7.2 µg/L, E1=8.8 µg/L, MS1=7.1 µg/L, M1=3.6 µg/L, N1=5.0 µg/L, NW1=11.0 µg/L, NW2=3.9 µg/L). Values at five of the eight clusters showed levels above the 6.0 µg/L threshold. Moving away from the shorelines and north, the values generally decrease. TSI shows a similar but less distinct pattern relative to Chl-a (S1=28, S2=31, E1=32, MS1=29, M1=26, N1=23, NW1=32, NW2=29). It is important to note that based on studies outlined earlier, vegetation represents the largest store of nutrients in the system. As such, the uptake by vegetation is a key driver of in-lake concentrations. Examination of historical aerials identified that the dredging of sediments within the Megginnis and Fords Arm area created a somewhat larger open water area than historically existed, resulting in reduced natural vegetation in this area. This area of the lake has experienced overgrowth of hyacinth at times, which may drive some of the algal response.

Looking at the spatial comparisons of water quality overall, it does appear that the southern and western sides of the lake continue to exhibit more productive algal growth in comparison to other parts of the lake. This is demonstrated by elevated phosphorus and Chl-a. Due to elevated nutrients and Chl-a, the southern end of the lake, where Megginnis Arm and Fords Arm discharge, remains a target area for load reduction and potential restoration of the macrophyte community.

Figure 4-23 presents the map for *E. coli*. Examination of the map shows that the in-lake levels are low and present no distinct or discernable spatial patterns (S1=3.5 MPN/100 mL, S2=3.5 MPN/100 mL, E1=3.0 MPN/100 mL, MS1=5.5 MPN/100 mL, M1=4.9 MPN/100 mL, N1=4.5 MPN/100 mL).

4.4.4.2 Stormwater Runoff

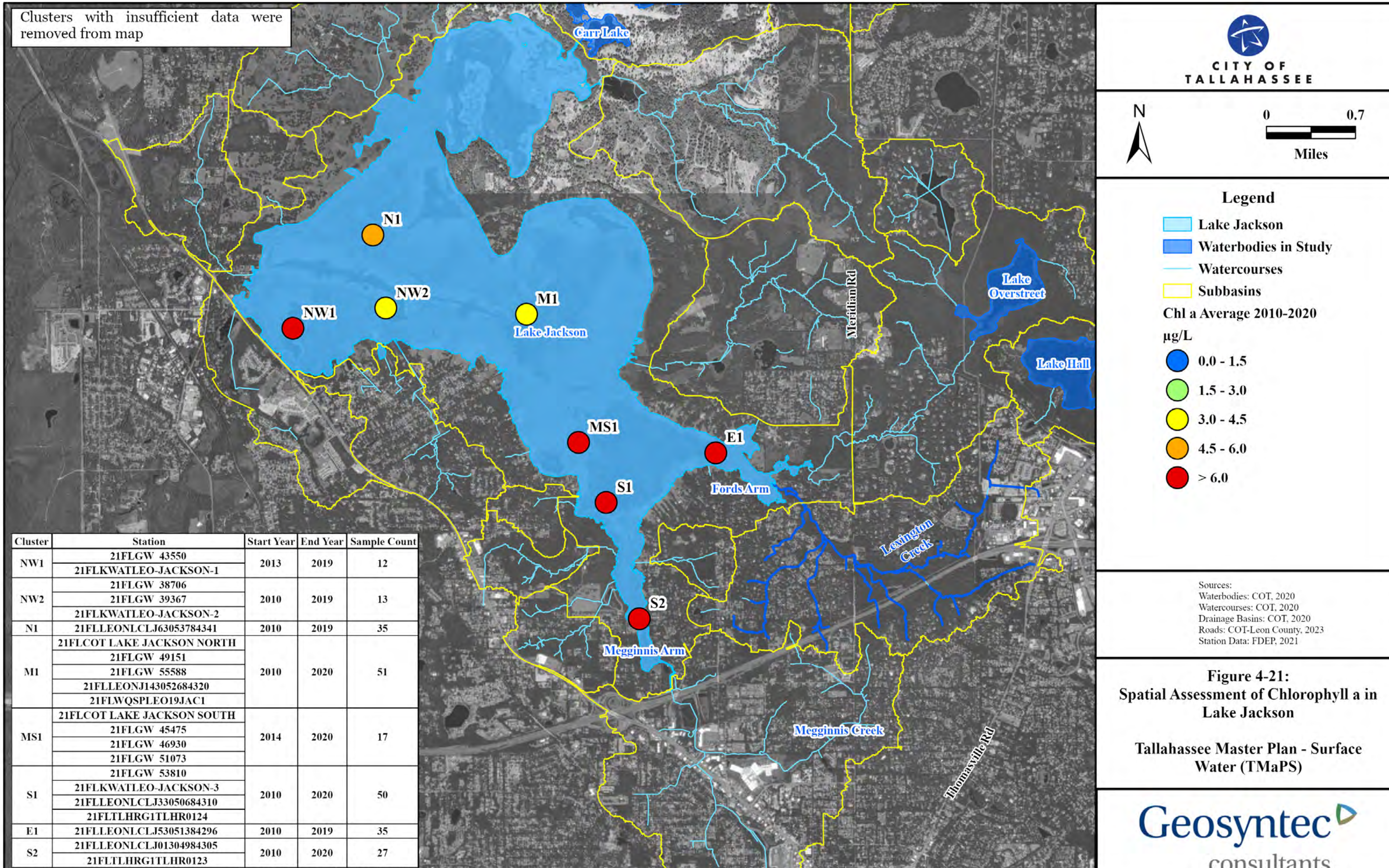
To assess stormwater runoff as a potential source of pollutant loads to Lake Jackson, a number of analyses were conducted. First, calculations of Landscape Development Intensity (LDI) Index by sub-watershed were performed. LDI is an estimate of the intensity of human land use based on nonrenewable energy flow (Brown and Vivas, 2005). The LDI is calculated as the percentage area within a catchment of particular types of land use, multiplied by the coefficient of energy associated with that land use, summed over all land use types in the catchment.

$$LDI = \sum(LDI_i * \%LU_i)$$

Where:

LDI_i = the nonrenewable energy land use for land use i, and
$\%LU_i$ = the percentage of land area in the catchment with land use i.

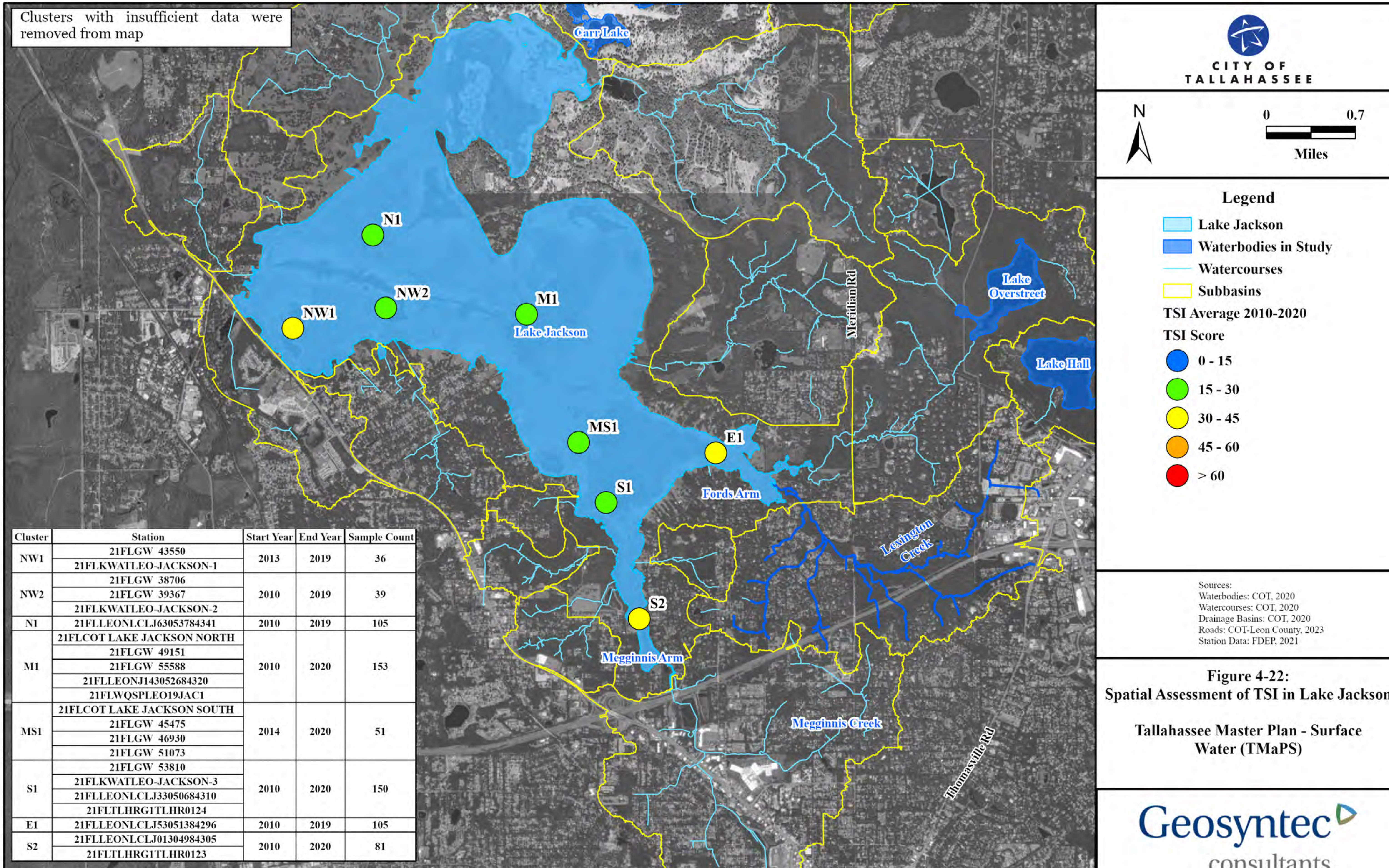
The LDI coefficients are provided in **Table 4-4**.



Cluster	Station	Start Year	End Year	Sample Count
NW1	21FLGW 43550	2013	2019	12
	21FLKWATLEO-JACKSON-1			
NW2	21FLGW 38706	2010	2019	13
	21FLGW 39367			
	21FLKWATLEO-JACKSON-2			
N1	21FLLEONLCLJ63053784341	2010	2019	35
M1	21FLCOT LAKE JACKSON NORTH	2010	2020	51
	21FLGW 49151			
	21FLGW 55588			
	21FLLEONJ143052684320			
	21FLWQSPLEO19JAC1			
MS1	21FLCOT LAKE JACKSON SOUTH	2014	2020	17
	21FLGW 45475			
	21FLGW 46930			
	21FLGW 51073			
S1	21FLGW 53810	2010	2020	50
	21FLKWATLEO-JACKSON-3			
	21FLLEONLCLJ33050684310			
	21FLTLHRG1TLHR0124			
E1	21FLLEONLCLJ53051384296	2010	2019	35
S2	21FLLEONLCLJ01304984305	2010	2020	27
	21FLTLHRG1TLHR0123			

Figure 4-21: Spatial Assessment of Chlorophyll a in Lake Jackson

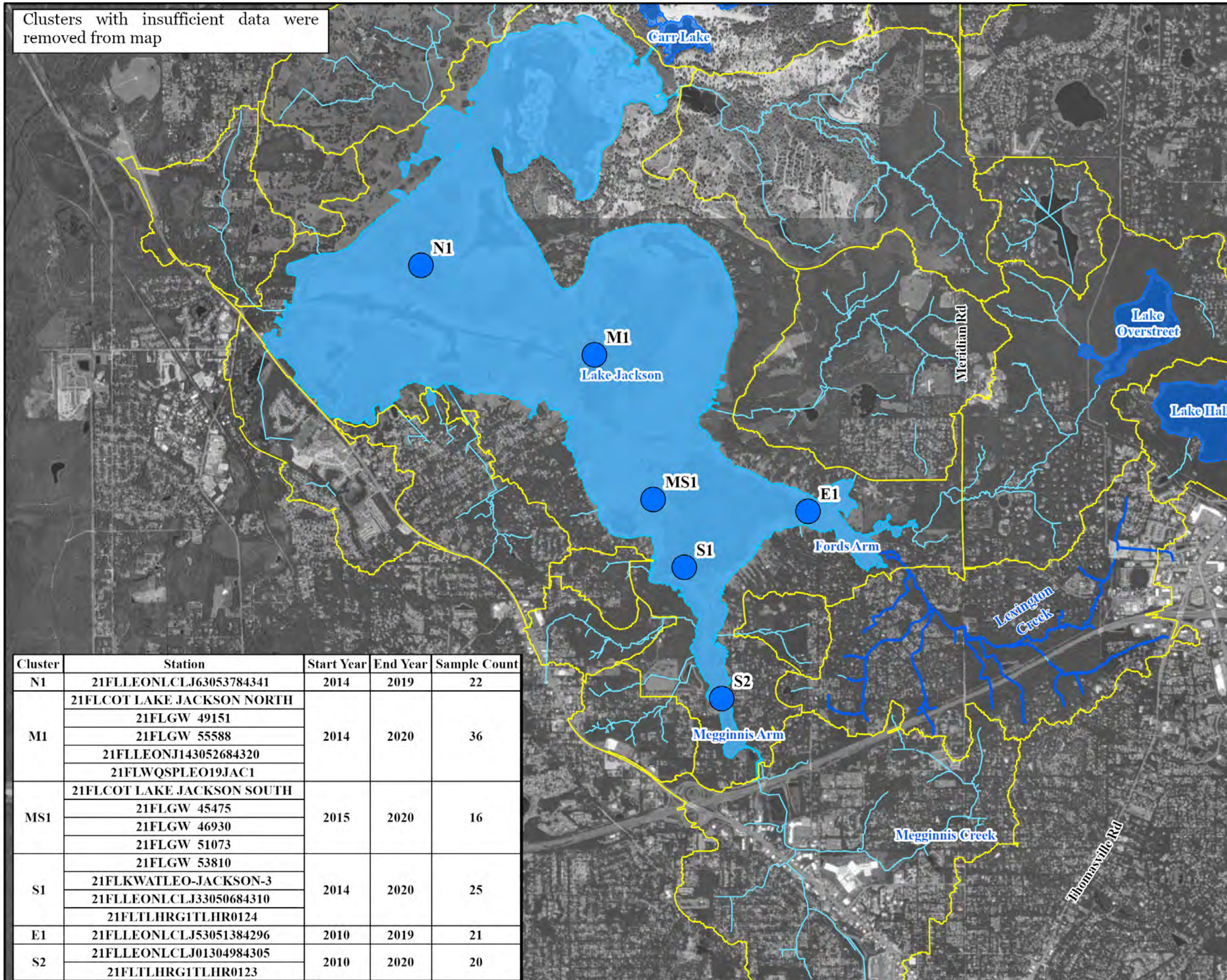
Tallahassee Master Plan - Surface Water (TMaPS)



Cluster	Station	Start Year	End Year	Sample Count
NW1	21FLGW 43550	2013	2019	36
	21FLKWATLEO-JACKSON-1			
NW2	21FLGW 38706	2010	2019	39
	21FLGW 39367			
	21FLKWATLEO-JACKSON-2			
N1	21FLLEONLCLJ63053784341	2010	2019	105
M1	21FLCOT LAKE JACKSON NORTH	2010	2020	153
	21FLGW 49151			
	21FLGW 55588			
	21FLLEONJ143052684320			
	21FLWQSPLEO19JAC1			
MS1	21FLCOT LAKE JACKSON SOUTH	2014	2020	51
	21FLGW 45475			
	21FLGW 46930			
	21FLGW 51073			
S1	21FLGW 53810	2010	2020	150
	21FLKWATLEO-JACKSON-3			
	21FLLEONLCLJ33050684310			
	21FLTLHRGITLHR0124			
E1	21FLLEONLCLJ53051384296	2010	2019	105
S2	21FLLEONLCLJ01304984305	2010	2020	81
	21FLTLHRGITLHR0123			

Figure 4-22:
Spatial Assessment of TSI in Lake Jackson

Tallahassee Master Plan - Surface Water (TMaPS)



Cluster	Station	Start Year	End Year	Sample Count
N1	21FLLEONLCLJ63053784341	2014	2019	22
M1	21FLCOT LAKE JACKSON NORTH	2014	2020	36
	21FLGW 49151			
	21FLGW 55588			
	21FLLEONJ143052684320			
	21FLWQSPLEO19JAC1			
MS1	21FLCOT LAKE JACKSON SOUTH	2015	2020	16
	21FLGW 45475			
	21FLGW 46930			
	21FLGW 51073			
S1	21FLGW 53810	2014	2020	25
	21FLKWATLEO-JACKSON-3			
	21FLLEONLCLJ33050684310			
	21FLTLHRG1TLHR0124			
E1	21FLLEONLCLJ53051384296	2010	2019	21
S2	21FLLEONLCLJ01304984305	2010	2020	20
	21FLTLHRG1TLHR0123			

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Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

Figure 4-23:
Spatial Assessment of E. coli in Lake Jackson

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Table 4-4: Landscape Development Intensity Index Coefficients

Category	Coefficient
Natural System	1
Pine Plantation	1.6
Pasture	3.4
Row Crops	4.5
Residential (low)	6.8
Residential (high)	7.6
Commercial	8.0
Industrial	8.3
Commercial (high)	9.2
Business District	10.0

FDEP uses the LDI as a tool to estimate potential adverse human effects from various land uses on adjacent waterbodies, such as streams, lakes, and wetlands. Based on the LDI score, the catchment area is rated as excellent (1 to 2), good (3 to 4), moderate (5 to 6), poor (7 to 8), or very poor (9 to 10) in relation to its potential for adverse impacts or loadings to waterbodies that receive runoff (FDEP, 2020).

Figure 4-24 presents the calculated LDIs by sub-watershed throughout the Lake Jackson basin. Examination of the map shows that much of the basin has excellent LDI values, indicating low potential for adverse runoff impacts. Only one subbasin in the northern area has a moderate LDI score and that is the Summerbrook Creek area. That area does not drain directly into Lake Jackson but flows into Carr Lake. The subbasins along the southern end that drain directly to Lake Jackson range from excellent to poor. The moderate subbasins include Harbinwood, Bellwood, and Lexington Creek. The land uses in those watersheds are primarily residential. The subbasin that drains to Megginnis Arm is rated as poor. This watershed has both residential and urban land uses. It is important to note that the calculated LDI does not account for any existing level of treatment within individual subbasins.

The second analysis utilized available data within the tributaries flowing into Lake Jackson to define average conditions in a manner similar to the analyses for the in-lake spatial variation. Where any limitation or absence of data exist, the figures are annotated to denote the limitation in data for the parameter assessed. The parameters analyzed included the following:

- Total Phosphorus
- Total Nitrogen
- Total Suspended Solids
- *E. coli*

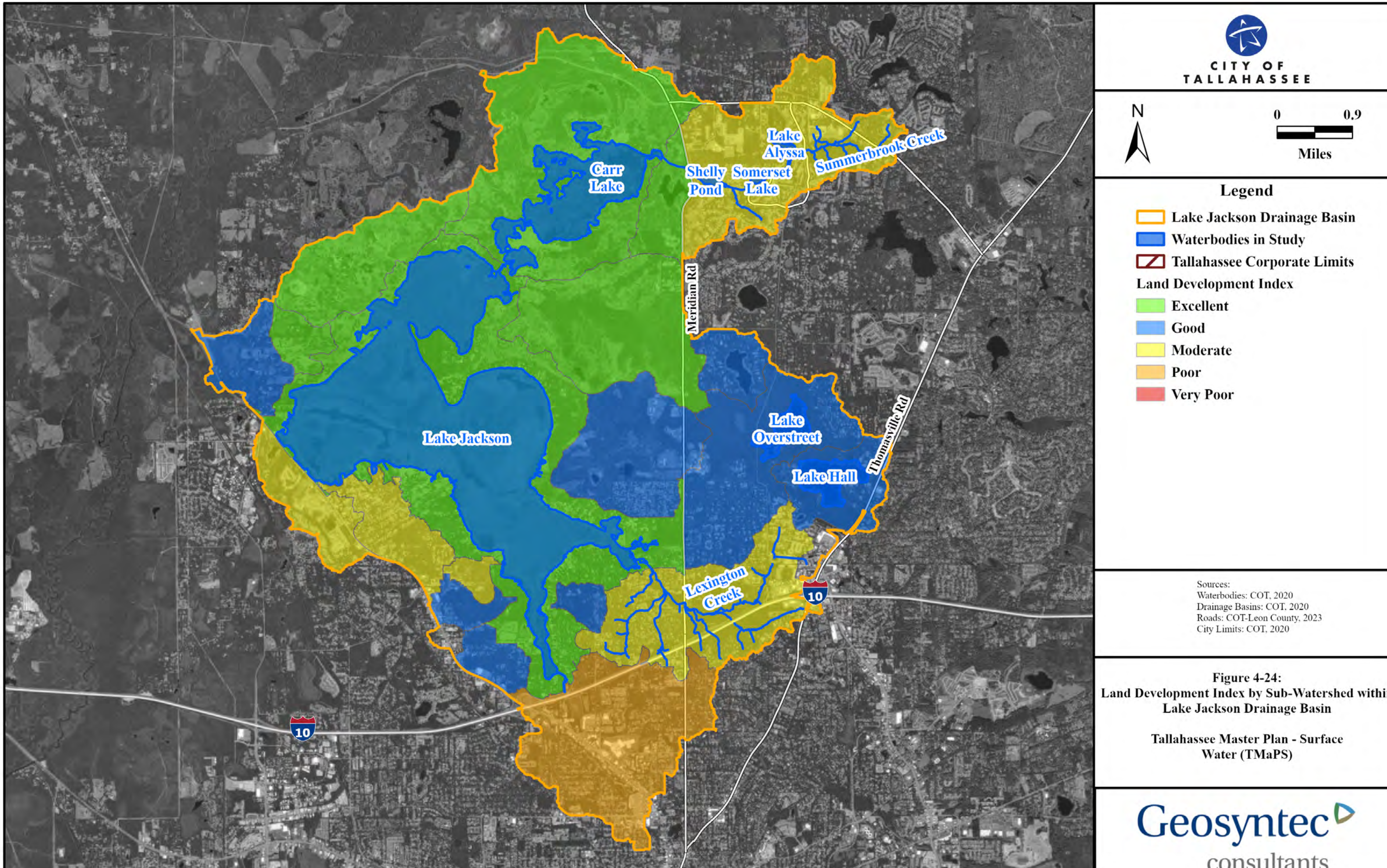

Figure 4-24:
Land Development Index by Sub-Watershed within Lake Jackson Drainage Basin

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As with the in-lake analyses, stations that were near each other or along the same drainageway were clustered to provide more data for the analyses and to represent general sub-watershed conditions. **Figure 4-25** presents the data clustering used. Where stations were located upstream and downstream of in-line treatment facilities, the stations were separated. This is the case for the Megginnis Creek clusters. The only stations with sufficient amounts of recent data were located in the Megginnis Creek, Lexington Creek, Overstreet Drain, Okeeheepkee, Lake Jackson Mounds, and Harbinwood watersheds. The other primary tributaries flowing directly into Lake Jackson have good LDI scores, in general, indicating that relative to surface runoff, they would have limited potential as anthropogenic sources to the lake. As with the in-lake analyses, the periods of record for the various clustered stations were not always the same. For each cluster, the available data after 2010 were utilized in the analyses and all stations that had data after 2010 were assigned to a cluster.

Similar to the in-lake analysis, where criteria/thresholds were available, those thresholds were utilized to define the breaks in the color scale.

- For TP and TN, the Panhandle East nutrient thresholds for streams were defined as the cutoff from yellow to red (0.18 mg/L and 1.03 mg/L, respectively).
- For *E. coli*, the freshwater criterion was defined as the cutoff between yellow and red (410 MPN/100 mL).

For the other parameters, the ranges were set to support the evaluation of spatial differences. As with the in-lake maps, the analyses presented herein are not meant to provide information on impairment or non-impairment per FDEP rules and criteria. They are utilized to aid in the evaluation of spatial differences and to help identify potential target areas.

Figure 4-26 and **Figure 4-27** present the TN and TP results. TN values did show some significant variations around the system (Trib 1=1.07 mg/L, Trib 2=0.83 mg/L, Trib 3=1.06 mg/L, Trib 4=0.36 mg/L, Trib 5=0.22 mg/L, Trib 6=0.29 mg/L, Trib 7=0.28 mg/L). The highest values were found along Megginnis Creek upstream of the MARS Facility and within the tributary draining the Lake Jackson Mound area. These values were above the stream threshold. Downstream of the MARS Facility along Megginnis Creek, the levels were lower.

As previously discussed, the MARS Facility is one of the most significant stormwater improvement projects in the basin. It provides stormwater treatment for Megginnis Creek, which is a significant portion of Lake Jackson inflow from the City, which is mostly characterized by residential and urban land use. However, limited preventative maintenance activities for the facility's treatment filter and marshes are currently performed and parts of the facility have known maintenance issues.

Given the investment made in the facility's treatment areas and their significance to the basin, appropriate maintenance activities are needed to ensure the facility operates in a design condition, and adequate treatment is being provided long-term to best protect Lake Jackson. The City, in coordination with FDEP and NWFWMD, recently initiated a monitoring project to assess the current removal efficiency of the MARS Facility. The preliminary results from that project and the data analyses completed for this study suggest that the facility is currently providing reasonable levels of nutrient load removal even with the known maintenance issues.

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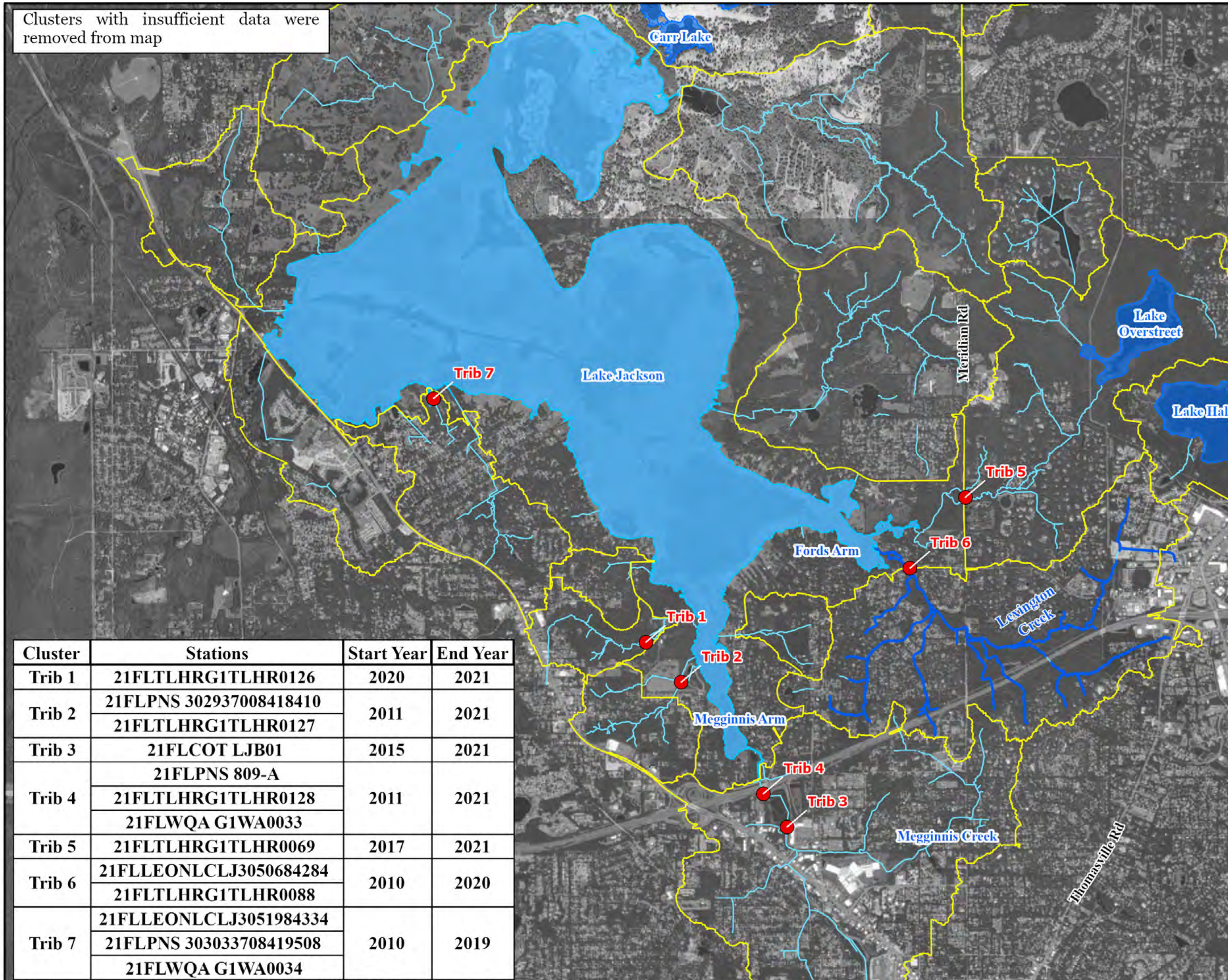

Cluster	Stations	Start Year	End Year
Trib 1	21FLTLHRG1TLHR0126	2020	2021
Trib 2	21FLPNS 302937008418410	2011	2021
	21FLTLHRG1TLHR0127		
Trib 3	21FLCOT LJB01	2015	2021
Trib 4	21FLPNS 809-A	2011	2021
	21FLTLHRG1TLHR0128		
	21FLWQA G1WA0033		
Trib 5	21FLTLHRG1TLHR0069	2017	2021
Trib 6	21FLLEONLCLJ3050684284	2010	2020
	21FLTLHRG1TLHR0088		
Trib 7	21FLLEONLCLJ3051984334	2010	2019
	21FLPNS 303033708419508		
	21FLWQA G1WA0034		

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

Figure 4-25:
Station Clustering for Analyses of Tributary Inflows to Lake Jackson

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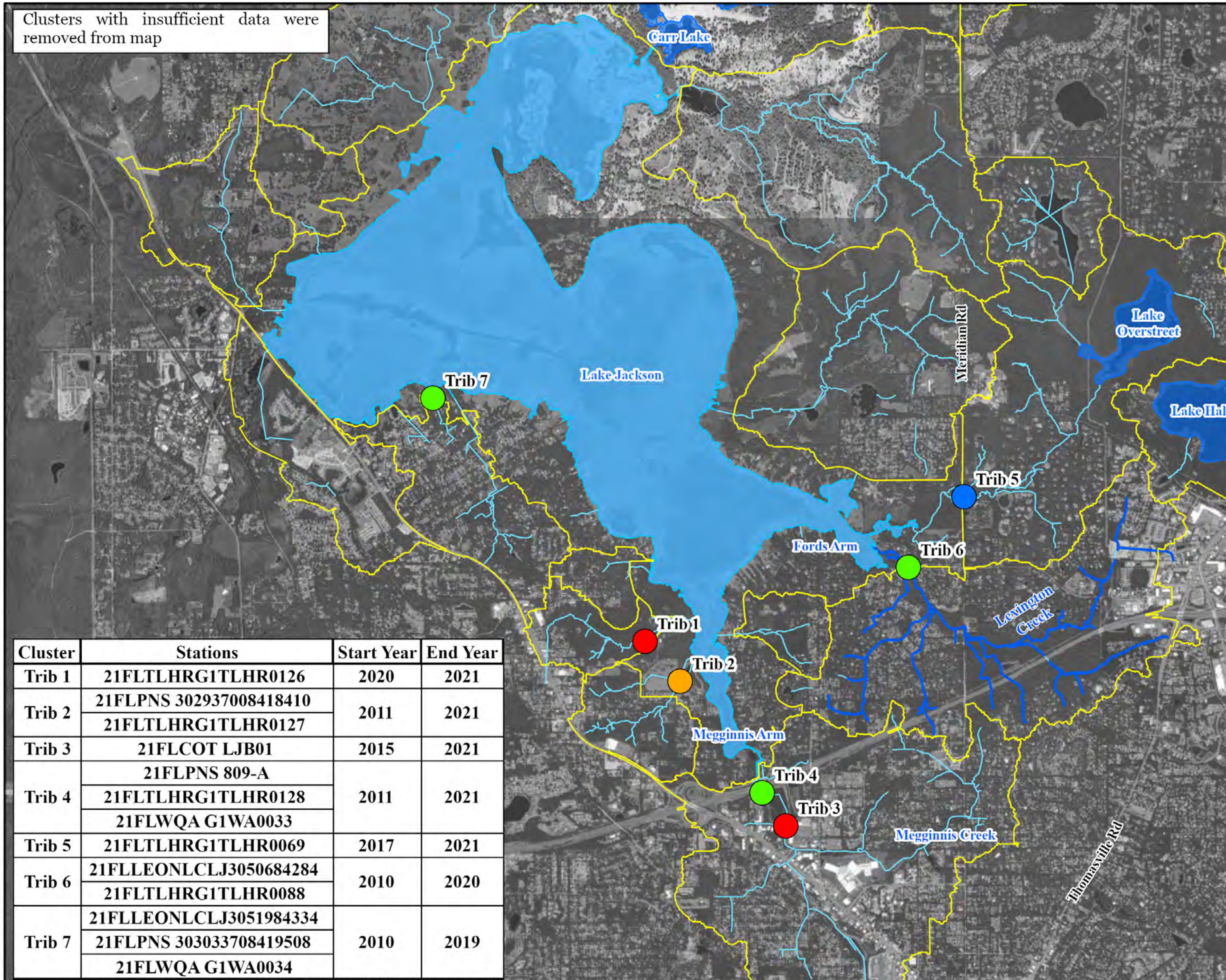

Cluster	Stations	Start Year	End Year
Trib 1	21FLTLHRG1TLHR0126	2020	2021
Trib 2	21FLPNS 302937008418410 21FLTLHRG1TLHR0127	2011	2021
Trib 3	21FLCOT LJB01	2015	2021
Trib 4	21FLPNS 809-A 21FLTLHRG1TLHR0128 21FLWQA G1WA0033	2011	2021
Trib 5	21FLTLHRG1TLHR0069	2017	2021
Trib 6	21FLLEONLCLJ3050684284 21FLTLHRG1TLHR0088	2010	2020
Trib 7	21FLLEONLCLJ3051984334 21FLPNS 303033708419508 21FLWQA G1WA0034	2010	2019

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N

0 0.7

Miles

Legend

- Lake Jackson
- Waterbodies in Study
- Watercourses
- Subbasins

TN Average 2010-2020 mg/L

- 0- 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.03
- > 1.03

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

Figure 4-26: Spatial Assessment of TN in Tributaries to Lake Jackson

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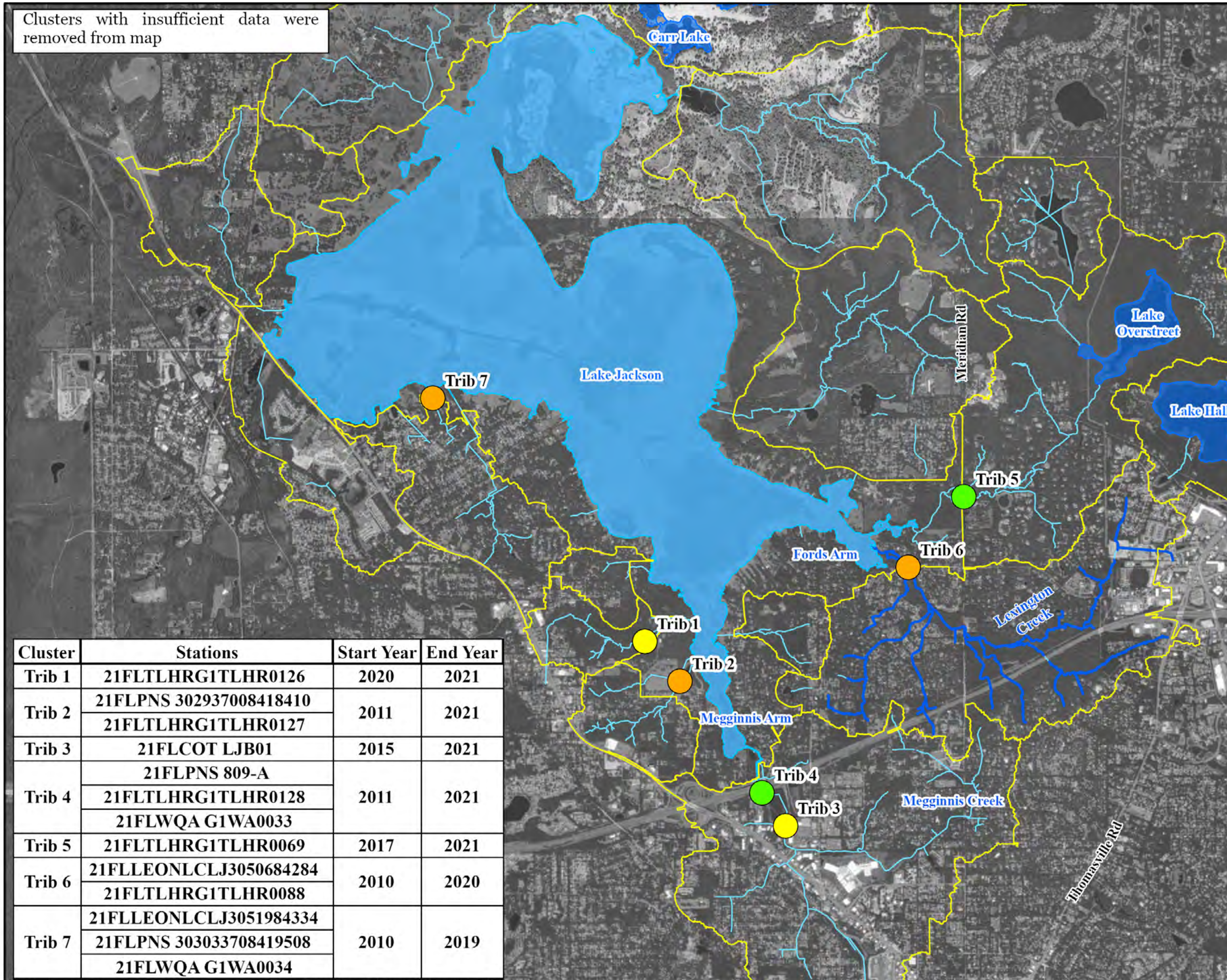

Cluster	Stations	Start Year	End Year
Trib 1	21FLTLHRG1TLHR0126	2020	2021
Trib 2	21FLPNS 302937008418410 21FLTLHRG1TLHR0127	2011	2021
Trib 3	21FLCOT LJB01	2015	2021
Trib 4	21FLPNS 809-A 21FLTLHRG1TLHR0128 21FLWQA G1WA0033	2011	2021
Trib 5	21FLTLHRG1TLHR0069	2017	2021
Trib 6	21FLLEONLCLJ3050684284 21FLTLHRG1TLHR0088	2010	2020
Trib 7	21FLLEONLCLJ3051984334 21FLPNS 303033708419508 21FLWQA G1WA0034	2010	2019

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Figure 4-27: Spatial Assessment of TP in Tributaries to Lake Jackson

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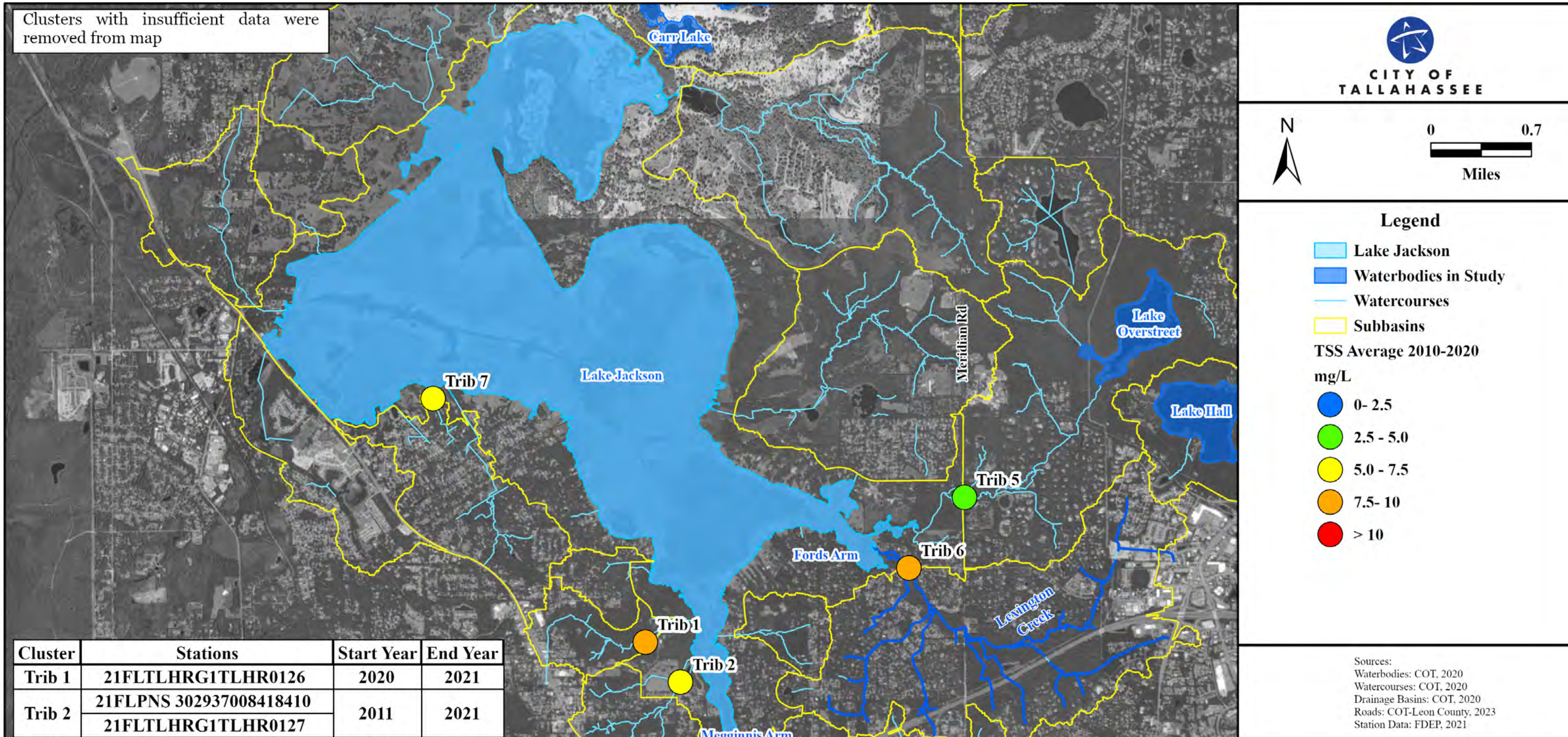
However, as is discussed in **Section 4.4.4**, spatial analyses within the lake continue to indicate elevated nutrient levels in the southern portions downstream of the MARS Facility and Megginnis Arm. Based on in-lake nutrient levels, maintenance of the MARS Facility to return treatment areas to the design condition and/or further improvements to the facility may be warranted to improve Megginnis Arm and the southern portion of Lake Jackson.

A point of note is that the TN concentrations for the Trib 1 cluster in the Lake Jackson Mound watershed were predominantly inorganic nitrogen, indicating the potential for anthropogenic sources. Higher TN concentrations were also seen in the tributary draining the Okeeheepkee watershed. Examination of the TP map shows some spatial differences between the locations (Trib 1=0.119 mg/L, Trib 2=0.126 mg/L, Trib 3=0.091 mg/L, Trib 4=0.078 mg/L, Trib 5=0.080 mg/L, Trib 6=0.176 mg/L, Trib 7=0.122 mg/L). The lowest values were found along Megginnis Creek downstream of the MARS Facility and along the Overstreet Drain. The highest concentrations were found along Lexington Creek just below the stream criteria threshold of 0.18 mg/L. The other tributaries showed similar concentration levels to each other.

Figure 4-28 presents the total suspended solids (TSS) map (Trib 1=9.4 mg/L, Trib 2=6.6 mg/L, Trib 3=2.8 mg/L, Trib 4=3.0 mg/L, Trib 5=3.3 mg/L, Trib 6=8.1 mg/L, Trib 7=5.4 mg/L). As seen in the in-lake data, the TSS concentrations in the tributaries are generally low, with somewhat higher values along Lexington Creek and the Lake Jackson Mounds tributary.

Figure 4-29 presents the analyses for *E. coli* (Trib 1=898 MPN/100 mL, Trib 2=830 MPN/100 mL, Trib 3=242 MPN/100 mL, Trib 4=115 MPN/100 mL, Trib 5=204 MPN/100 mL, Trib 6=871 MPN/100 mL, Trib 7=222 MPN/100 mL). The measurements in the Lexington Creek, Okeeheepkee, and Lake Jackson Mounds watersheds were above the 410 MPN/100 mL threshold. The levels within the remaining tributaries were at similar ranges to each other, with the lowest levels downstream of the MARS Facility. **Section 4.4.2** identified concerns on the methodology utilized for collecting some of the *E. coli* data within Lexington Creek and potentially other stations. The potential issues with the data have not been resolved to date.

Figure 4-30 presents the tributaries where data analyses were performed, with the cluster locations and stormwater BMPs identified. As was stated previously, the tributary analyses and resulting conclusions must account for existing treatment in the system that would further mitigate direct discharges to Lake Jackson. For Megginnis Creek, the data clusters are located immediately upstream (Trib 3) and downstream (Trib 4) of the MARS Facility. The most downstream data cluster along Megginnis Creek is upstream of the polishing wetlands, which would provide additional treatment to the already low values. For the Okeeheepkee watershed, the data cluster (Trib 2) is upstream of the Okeeheepkee Prairie Pond facility, which would provide treatment prior to discharge to Megginnis Arm. In Lexington Creek, there are presently no treatment facilities downstream of the cluster (Trib 6) prior to discharge to Fords Arm. In the Harbinwood sub-watershed, one of the stations in the cluster is upstream of potential treatment facilities, but the bulk of the data are from stations downstream.



Cluster	Stations	Start Year	End Year
Trib 1	21FLTLHRG1TLHR0126	2020	2021
Trib 2	21FLPNS 302937008418410 21FLTLHRG1TLHR0127	2011	2021
Trib 3	21FLCOT LJB01	2015	2021
Trib 4	21FLPNS 809-A 21FLTLHRG1TLHR0128 21FLWQA G1WA0033	2011	2021
Trib 5	21FLTLHRG1TLHR0069	2017	2021
Trib 6	21FLLEONLCLJ3050684284 21FLTLHRG1TLHR0088	2010	2020
Trib 7	21FLLEONLCLJ3051984334 21FLPNS 303033708419508 21FLWQA G1WA0034	2010	2019

Figure 4-28: Spatial Assessment of TSS in Tributaries to Lake Jackson

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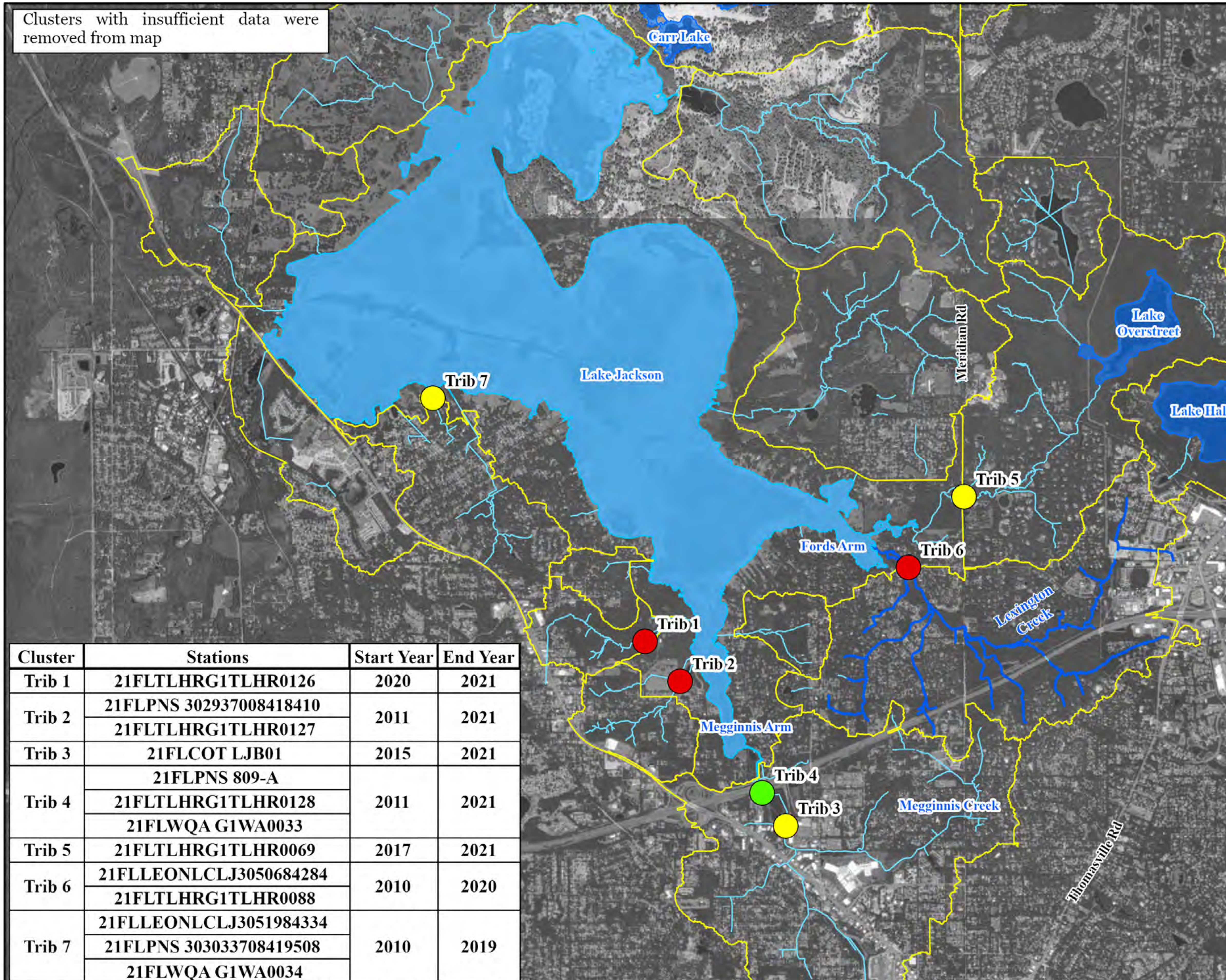

Cluster	Stations	Start Year	End Year
Trib 1	21FLTLHRG1TLHR0126	2020	2021
Trib 2	21FLPNS 302937008418410	2011	2021
	21FLTLHRG1TLHR0127		
Trib 3	21FLCOT LJB01	2015	2021
Trib 4	21FLPNS 809-A	2011	2021
	21FLTLHRG1TLHR0128		
	21FLWQA G1WA0033		
Trib 5	21FLTLHRG1TLHR0069	2017	2021
Trib 6	21FLLEONLCLJ3050684284	2010	2020
	21FLTLHRG1TLHR0088		
Trib 7	21FLLEONLCLJ3051984334	2010	2019
	21FLPNS 303033708419508		
	21FLWQA G1WA0034		

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Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

Figure 4-29:
Spatial Assessment of E. coli in Tributaries to Lake Jackson

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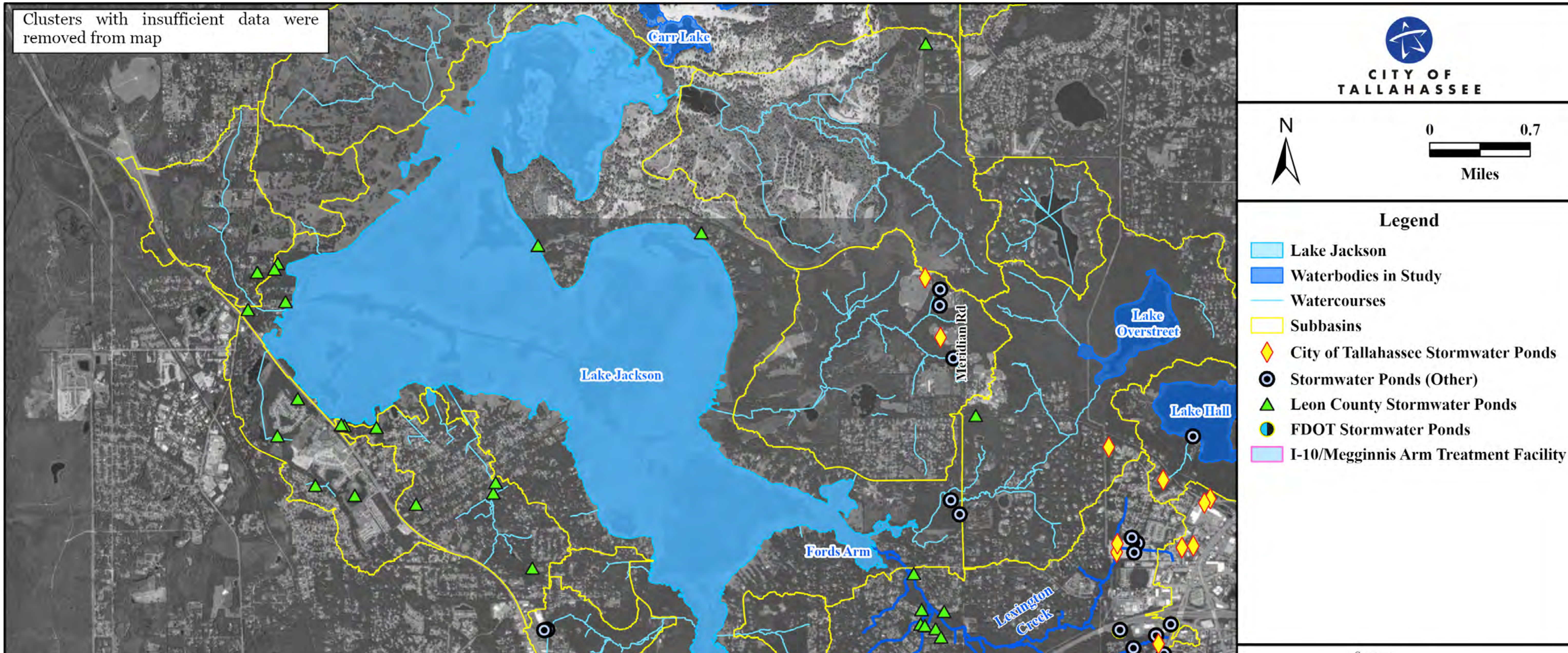


Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021
BMPs: COT, 2020

Figure 4-30: BMPs near Tributary Inflows to Lake Jackson

Tallahassee Master Plan - Surface Water (TMaPS)

4.4.4.3 Septic Systems

Figure 4-31 presents a map showing the septic tank densities by watershed to aid in identifying the areas more likely to be sources of loading to the lake. Examination of the figure shows that the highest density watersheds are in the areas along the southern and southwestern side of the lake, with densities ranging from 0.64 to 0.96 units per acre, including the following:

- Harbinwood
- Bellwood
- Okeeheepkee
- An unnamed watershed in the Lakeshore area.

The next level of density can be found in numerous watershed areas surrounding the lake, including the direct discharge areas, i.e., those areas immediately adjacent to the lake. For the calculation of the densities in this area, the lake area was removed. The densities in these watersheds range from 0.31 to 0.59 unit per acre. The densities in the Lake Overstreet Drain and within Lake Hall are somewhat lower, ranging from 0.13 to 0.17. Finally, areas to the north (other than Summerbrooke) and the Megginnis Arm subbasin (which is within the incorporated area of the city and generally sewered) have the lowest densities.

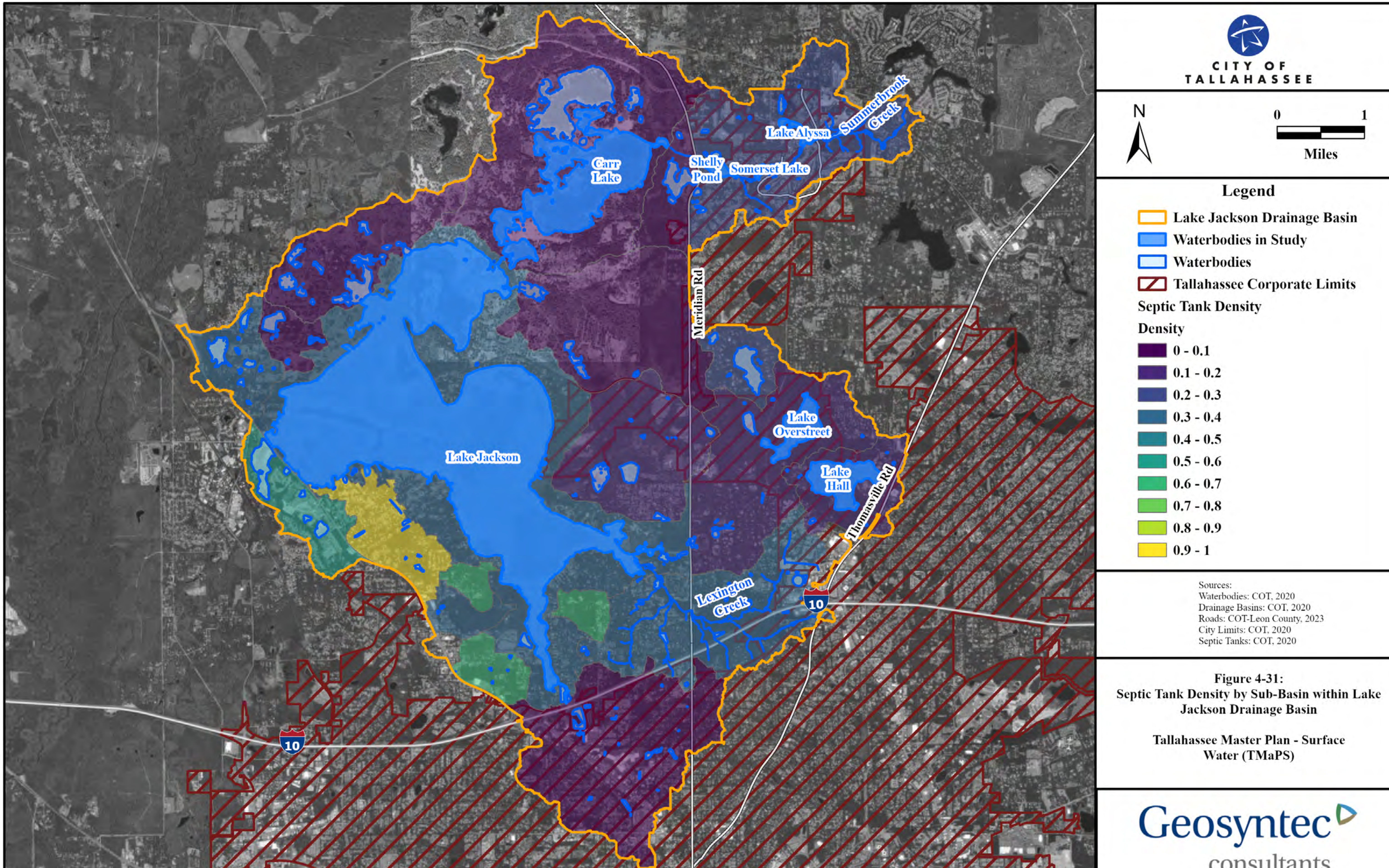
As outlined earlier, historical studies have not provided a definitive quantification of the impacts of septic system loading on the lake, but numerous studies have named them as a potential source. Based on the densities shown, and issues identified earlier on soil conditions in some of the higher density areas, septics are a potential source and should be further evaluated to determine potential loading.

4.4.4.4 Internal Recycling and Seepage

Internal Recycling

Lake Jackson's unique hydrology and restoration project history has direct impacts upon the potential for internal lake sediment/recycling as a source of loading. The natural dry-out of the lake bottom creates conditions where a significant portion of the bottom sediments are periodically desiccated. Additionally, in the late 1990s, a large volume of sediments (nearly 3 million cubic yards) was removed from the southern lobe of the lake where Megginnis and Fords Arm drain. This was to mitigate historical sediment loading prior to the installation of treatment in this highly developed area and the build up of organic muck. Finally, Lake Jackson is a closed basin. Therefore, the nutrients either accumulate in the sediments or are taken up by plants. These aspects impact the potential for sediment recycling as a potential source.

Historical studies (LaRock, 1991) determined that sediment flux was on the same order of magnitude as stormwater as a source of nutrient loads. While this study accounted for the periodic dry-out of the lake sediments, it did not account for the sediment removal that occurred in the late 1990s. This removal targeted much of the anthropogenic organic soils that would account for areas where nutrient flux was significant. As such, it is expected that the overall levels of nutrient sediment flux have been reduced and play a lesser role today.



Sources:
Waterbodies: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
City Limits: COT, 2020
Septic Tanks: COT, 2020

Figure 4-31: Septic Tank Density by Sub-Basin within Lake Jackson Drainage Basin

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One aspect of the sediment removal that has been identified in past reports is that the total volume removed was larger than needed to get back to historical conditions. Examination of aerial photography presented earlier shows that the depths in the southern lobe have increased from historical conditions (pre circa 2000). This reduces the potential for aquatic vegetative growth in this area, the largest store of nutrients in the system. Additionally, the sediment removal can result in lake bottom substrate that is susceptible to propagation of undesirable exotic species such as hydrilla. As a result, these areas of the lake require herbicide treatment that may limit the re-establishment of native vegetation. As communicated by City personnel, recent evaluations of the southern lobe have not identified any areas of significant build up of organic material and, therefore, are not suggestive of significant potential internal recycling nutrient loads within the excavated area.

Seepage

As outlined in the data summary (**Section 4.4.3.11**), there are very few surficial sampling wells in the area that might provide direct data on the potential for seepage as a source.

Figure 4-14 presented three surficial sampling wells in or near the Lake Jackson basin. Two of the wells are located outside of the Lake Jackson basin boundaries. These wells are associated with sprayfields for Talquin Electric and, therefore, would not be suitable for general surficial aquifer conditions. The third site is north of Carr Lake and would provide data more appropriate to seepage to Carr Lake.

The primary potential source of pollutants to the surficial aquifer in the areas surrounding Lake Jackson are septic systems. **Section 4.4.4.3** provides an assessment of septic systems as a source and, therefore, addresses their source potential.

4.4.4.5 Wastewater

Within the Lake Jackson basin, there currently are no direct wastewater discharges. Additionally, no areas in the Lake Jackson basin presently have reuse discharges. Two sprayfields operated by Talquin are located in areas adjacent to the basin. These locations are shown in **Figure 4-14** as two groundwater wells that monitor the sites. Based on the lack of direct wastewater discharge, the primary potential for wastewater loading to Lake Jackson comes from leakage or the potential of spills from existing wastewater infrastructure.

Figure 4-32 presents a map of the Lake Jackson basin boundaries in relation to sewer service areas. Sewer infrastructure within the basin is located along the southern end in the Megginnis and Fords Arm drainageways. Additionally, there is infrastructure in the Lake Overstreet Drain and Summerbrook watersheds.

Within the Megginnis Creek watershed, the available data from the tributaries did not show elevated nutrient or FIB levels in relation to other sub-watersheds. Relative to *E. coli* (**Figure 4-29**), the levels upstream and downstream of the MARS Facility were lower than in other tributaries. This indicates that there is not a persistent source associated with wastewater leakage in this area.

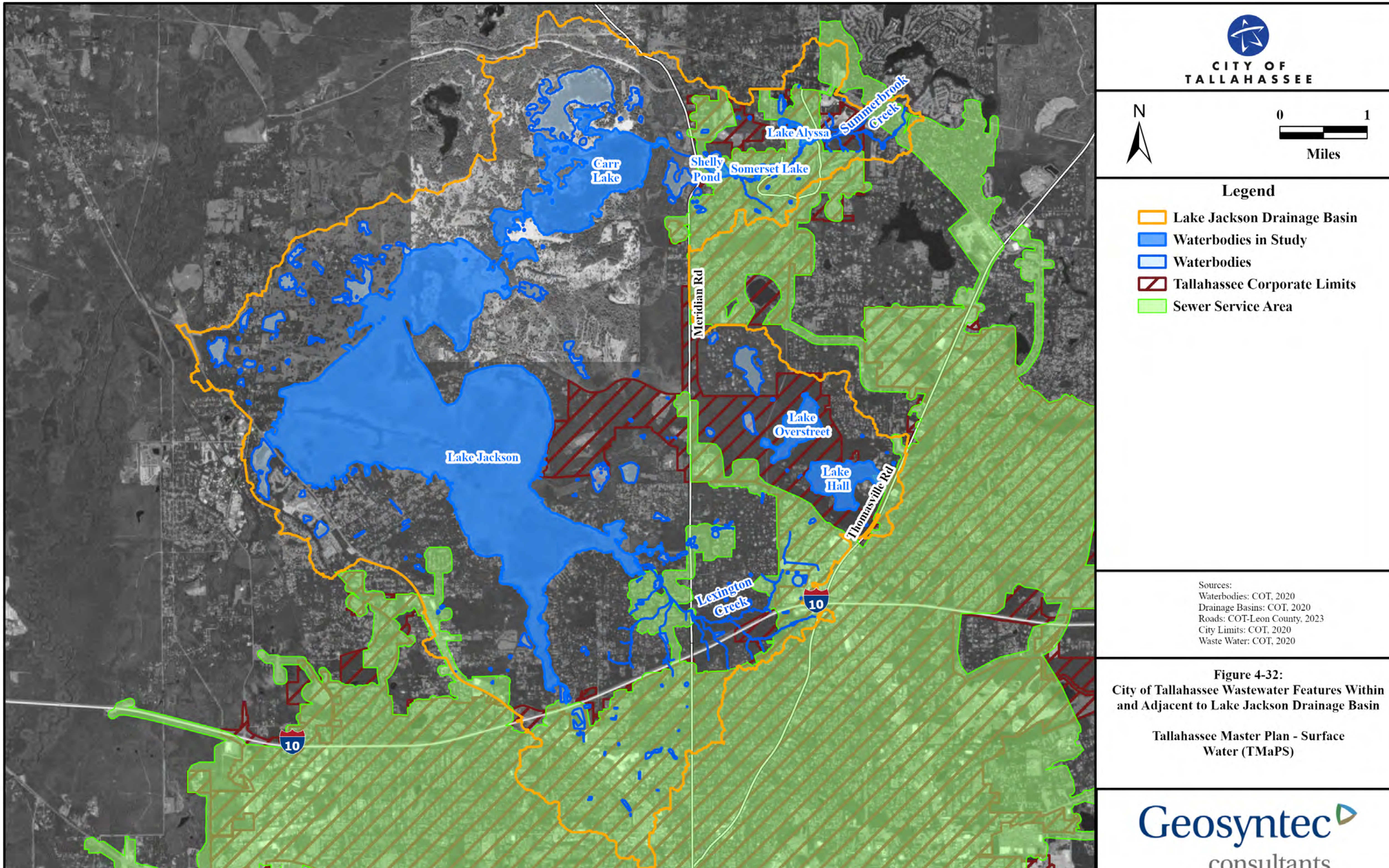


Figure 4-32:
City of Tallahassee Wastewater Features Within and Adjacent to Lake Jackson Drainage Basin

Tallahassee Master Plan - Surface Water (TMaPS)

While sanitary sewer overflows (SSOs) occur from time to time, SSOs are acute events with impacts lasting for relatively short periods of time (hours to several days), depending on magnitude and environmental conditions. The mechanism for abatement would not be treatment projects but rather any needed maintenance to sewer infrastructure. The City presently tracks, reports, and addresses these issues as they arise.

4.4.4.6 Atmospheric Deposition

Atmospheric deposition is the load that falls directly onto the earth's surface. For this and future analyses, atmospheric deposition is accounted for both indirectly within stormwater runoff and directly as a load to the lake surface. In watersheds with a smaller watershed-to-lake area ratio (such as Lake Jackson), atmospheric deposition can play significant role in overall loading. As such, it should be considered in the assessment of loads to the lake. It is important to note that project-specific recommendations made within this report will not address direct deposition on the lake surface as a source, but its quantification relative to other sources is important.

As outlined in **Section 4.4.3.11**, there is an atmospheric deposition station in the vicinity of Tallahassee. This station is the Quincy station (FL14) (**Figure 4-15**). Data from this station is utilized to calculate the atmospheric deposition to Lake Jackson and other lakes within the basin.

Atmospheric deposition is a function of air quality that is able to be improved through regulation and public outreach. Analysis of atmospheric deposition and impacts from it was outside of the project scope and, therefore, will not be assessed in this report.

4.4.4.7 Interconnected Flows

There are four lakes identified with surface connections and the potential to flow into Lake Jackson. These are Little Lake Jackson, Carr Lake, Pints Pond, and Lake Overstreet. The individual waterbodies, the connections, and their potential to contribute load to Lake Jackson are discussed below.

Little Lake Jackson has a surface area of about 59 acres and is mainly surrounded by residential land use as well as some forested area. Little Lake Jackson connects to Lake Jackson through a crossing under Monroe Street, which acts as a buffer between the two lakes. There is no current water quality data for Little Lake Jackson so potential impacts from the connection cannot be assessed. The dynamics of the connection between waterbodies and whether it is unidirectional is also not known. Based on the size differences between the two lakes and land use surrounding the connection to Little Lake Jackson, it is not a significant source of anthropogenic loads to Lake Jackson.

Carr Lake discharges out of the southwestern end of the lake and into a flow path that travels approximately 2,500 ft into the northeastern portion of Lake Jackson. Carr Lake's surface area is about 692 acres and is predominantly surrounded by forest, wetland, and urban land use. Carr lake has no listed impairments. This connection is not a concern for anthropogenic nutrient loading based on water quality conditions in Carr Lake. **Section 4.5.3.6** shows that the concentrations in Carr Lake are lower than Lake Jackson and Carr Lake is not impaired for nutrients or any other parameters.

Pints Pond is a small waterbody that is approximately 24 acres in size and mostly surrounded by coniferous forests with a small portion of residential housing to the south. Pints Pond discharges out of the western portion of the waterbody and the flow path length to Lake Jackson is around 7,500 ft. There is presently no data to assess Pints Pond or its potential impacts. FDEP does not have any water quality data on record for the waterbody and there is no calculated flow data available for the connection. Based on the nature of the land use surrounding Pint's Pond and its small size relative to Lake Jackson, it is not a significant potential anthropogenic nutrient load.

Lake Overstreet discharges out of its southwestern end. The flow path is the longest of all the inflows to Lake Jackson and stretches almost 20,000 ft before entering the eastern portion of Lake Jackson through Fords Arm. Lake Overstreet's 144-acre surface area is wholly surrounded by upland forest. This connection is not a concern for anthropogenic nutrient loading based on the water quality in Lake Overstreet. **Section 4.5.3.6** shows that the concentrations in Lake Overstreet are generally lower than Lake Jackson, and Lake Overstreet is not impaired for nutrients or any other parameters.

4.4.4.8 Summary of Findings

Based on the discussions above and data and information presented in **Section 4.6.3**, there are various potential sources of pollutant loads to Lake Jackson that should be targeted for further evaluation. As described earlier, the lake as a whole is not presently impaired for nutrients or Chl-a, but the AGM data show the system is close to being impaired and may become impaired in subsequent assessment cycles. The spatial analyses show levels above the NNC thresholds for Chl-a and TP within the southern (Fords Arm and Megginnis Arm area) and western sides of the lake. The analyses of tributary data identify that there are elevated nutrient and FIB levels within tributaries draining to the southern and western parts of the lake. This is especially true where there is less direct (in-line) treatment and higher LDI levels (Lexington Creek, Lake Jackson Mounds, and others). The following outlines the findings for each of the potential pollutant sources discussed above.

- Stormwater Runoff – Stormwater runoff, contributing to tributary inflow loads, is identified as a potential source of pollutants to Lake Jackson, with a focus on the southern and western sides.
- Septic Systems – Loads from septic system are identified as a potential source of pollutants to Lake Jackson, with a focus on areas with the highest septic densities and proximity of units to the lake and tributaries flowing into the lake.
- Interconnected Flows – Loading from adjacent lakes that drain to Lake Jackson is not deemed a significant source due to the generally pristine nature of the source lakes.
- Internal Recycling – Internal recycling is not identified as a potential significant load to Lake Jackson based upon historical dredging of organic rich sediments and recent evaluations showing limited muck build up subsequent to the sediment removal.
- Seepage – While no data on seepage into the lake is available, it is assumed that the primary source of seepage loads would be septic systems, which are assessed separately.

- Wastewater – No permitted point sources presently discharge within the Lake Jackson basin so direct wastewater discharge is not identified as a potential pollutant load. SSOs can contribute to loading but are short-term events that are typically addressed fairly quickly. Based on the available data and locations of sewer infrastructure, only the Lexington Creek area was identified for further evaluation of SSOs as a source. These are evaluated in **Section 4.9**, which focuses specifically on the Lexington Creek watershed.

- Atmospheric Deposition – Based on the relatively low ratio of the direct watershed discharge to Lake Jackson area, atmospheric deposition is identified as a potentially significant load. While this load is quantified for comparison to other loads, no recommendations will be made relative to potential reductions.

4.4.5 Calculation of Potential Nutrient Loads

This section presents calculations of potential nutrient (TN and TP) loads to Lake Jackson for the sources identified for calculation in **Section 4.4.4.8**. These include stormwater runoff, septic systems, interconnected flow and atmospheric deposition. Where loads were not calculated, the sections below provide brief discussions. The load calculations are for the purpose of comparing the potential magnitudes of each source relative to one another.

4.4.5.1 Stormwater Pollutant Load

To assess the potential stormwater TN and TP loads to Lake Jackson and other waterbodies within the Lake Jackson basin, average annual pollutant load modeling was performed. The goal was to identify areas that are contributing higher TN and TP loads relative to others within the drainage area to the waterbody and estimate a potential total load for comparison to other loading sources. TN and TP loads were calculated using the Spatially Integrated Model for Pollutant Loading Estimates (SIMPLE-Seasonal) model. The approach described below was used for all project waterbodies within the Lake Jackson basin. Pollutant load models, such as the SIMPLE model, calculate loads by determining a volume of runoff from a specified area and then multiplying the runoff volume by EMCs. EMCs are concentrations of constituents (TN and TP in this case) that are found in runoff based on specified land uses.

<u>SIMPLE-Seasonal Model Methodology</u>

Pollutant loads from direct runoff for each subbasin are calculated using the SIMPLE-Seasonal model, originally developed by Jones Edmunds and Associates (Jones Edmunds) for Sarasota County and the Southwest Florida Water Management District (SWFWMD). The complete model development is documented in *Sarasota County County-Wide Non-Point Source Pollutant Loading Model* prepared by Jones Edmunds in August 2005. The model operates within a geographic information system (GIS) framework and is able to calculate pollutant loading over large areas with spatially variable characteristics, leveraging the runoff excess estimation methods described by Harper and Baker, 2007.

For the purposes of this project, the model was set up following the procedure outlined in the Hernando County guidance document developed by Jones Edmunds (Hernando County, 2013). It should be noted that when running the SIMPLE-Seasonal model, Geosyntec utilized default model values to account for seasonal variability of rainfall. The model includes BMP, EMC, runoff, basins, septic, and point source feature classes. For the purposes of this project, the septic and point source feature classes were not utilized because those loads are quantified separately. TN and TP reductions due to the different types of BMPs are assigned in the BMP shapefile. The EMC shapefile includes the TN and TP EMCs based on the land use types. The runoff shapefile includes the land use, hydrologic soil group (HSG), and the average annual runoff coefficient, defined as the fraction of average annual rainfall volume converted to runoff. Finally, the basin shapefile includes the total acreages of each subbasin. No base flow was assigned for this analysis. The calculation of the pollutant load associated with the runoff was based on the Harper and Baker (2007) method of rainfall excess determination and pollutant loading. This method uses an average annual rainfall volume, which is multiplied by an average annual runoff coefficient to determine the average annual runoff volume. The average annual runoff coefficient is based on the percent directly connected impervious area (DCIA) and the non-DCIA curve number (CN), which are determined based on the land use and soil conditions. The average annual loading is determined by multiplying the average annual volume of runoff and the pollutant EMC.

The average annual rainfall depth for this watershed was estimated to be 59 inches using the Florida State University – Office of Institutional Research Tallahassee/Leon County, Florida.

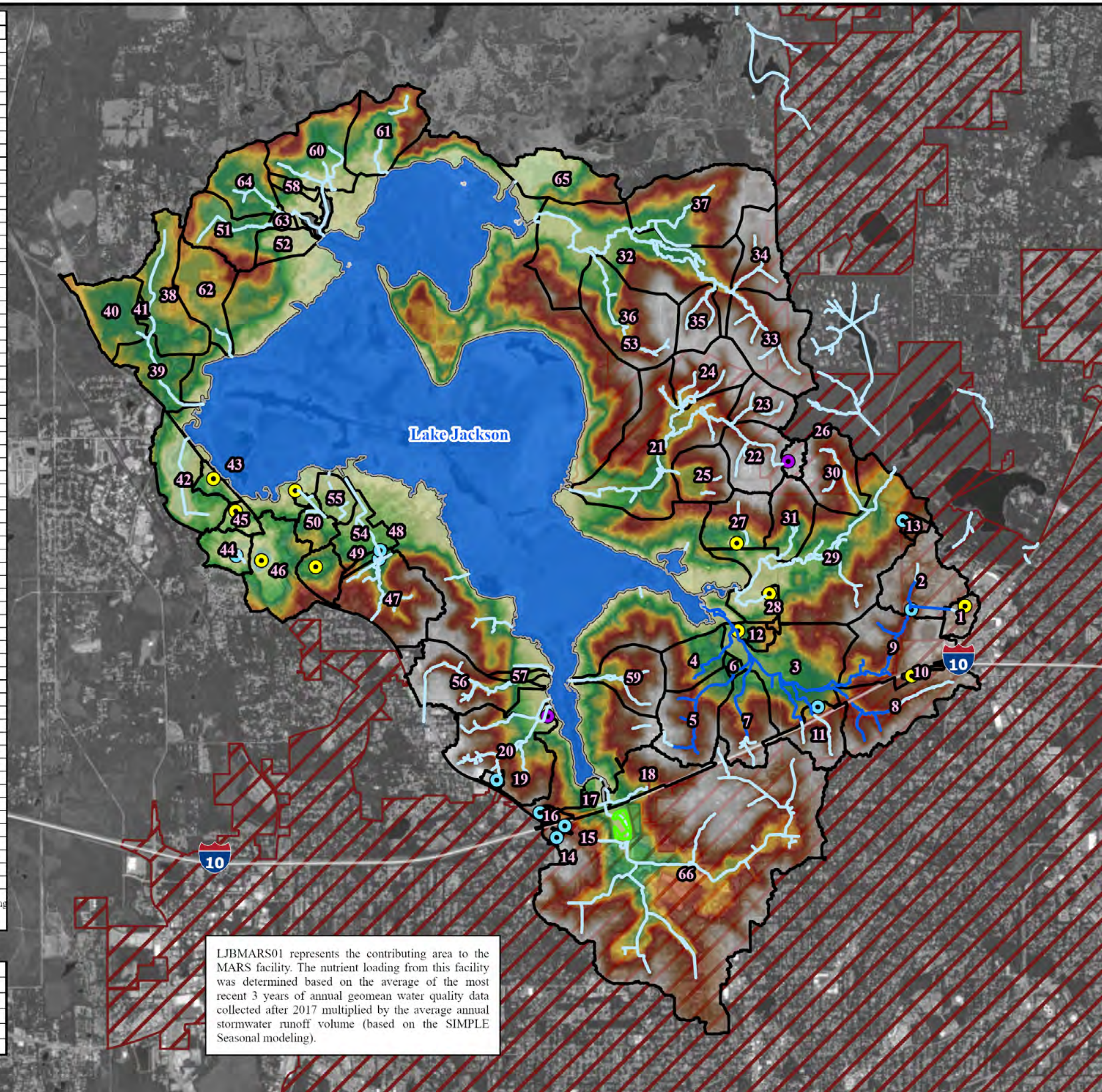
The topography for the study area was analyzed via a Digital Elevation Model (DEM) from Leon County (2018). The elevations within the watershed range from approximately 255 ft down to approximately 64 ft, NAVD88 (**Figure 4-33**). The highest elevations appear in Elinor Klapp-Phipps Park and surrounding south portions of Lake Jackson. The lowest elevation is Lake Jackson.

Subbasins were initially provided by the City within the Lake Jackson basin. For modeling purposes, subbasins were delineated to the BMP and the outfall level (**Figure 4-33**) to define where stormwater is generated and where it accumulates. The runoff volumes are estimated along with the associated pollutant loads. A total of 66 subbasins were delineated using the 2018 Leon County DEM and the flowlines from the USGS National Hydrological Data (NHD) (2020). The NHD represents the water drainage network within the study area, such as conduits, inlets, and junctions, and is used to delineate the watershed in a manner appropriate for the level of detail required for this study. The distribution of the subbasins, the subbasin sizes, and the BMP types for each are presented in **Figure 4-33.** Additionally, the treatment percentages utilized for each BMP type are presented.

The land use data used for this modeling effort referenced the 2019 NWFWMD feature class presented in **Section 0**. The data were manipulated for the purposes of this analysis as described below. First the NWFWMD land use data was aggregated into simplified land use categories as presented in the SIMPLE guidance document (Hernando County, 2013). This was done to generalize the watershed's land uses into 12 land use categories (**Figure 4-34**) which corresponded to available EMC data. A summary of how the land uses were aggregated is presented in **Table 4-5**.

Lake Jackson Subbasin Summary			
Number	Subbasin ID	Acreage	BMP Type
1	LJBLC0010	49.2	None
2	LJBLC0020	210.4	Wet Detention
3	LJBLC0030	347.7	None
4	LJBLC0031	117.2	None
5	LJBLC0032	209.2	None
6	LJBLC0033	13.8	None
7	LJBLC0034	169.9	None
8	LJBLC0035	269.6	None
9	LJBLC0036	274.6	None
10	LJBLC0040	8.8	Wet Detention
11	LJBLC0050	120.9	Wet Detention
12	LJBLC0060	35.4	Dry Detention
13	LJBLJ0010	22.2	Dry Detention
14	LJBLJ0110	4.2	Dry Detention
15	LJBLJ0120	14.5	Dry Detention
16	LJBLJ0130	19.3	Dry Detention
17	LJBLJ0140	39.1	None
18	LJBLJ0150	123.7	None
19	LJBLJ0160	11.4	Dry Detention
20	LJBLJ0170	315.0	Wet Retention
21	LJBLJ0180	491.7	None
22	LJBLJ0181	164.1	None
23	LJBLJ0182	99.7	None
24	LJBLJ0183	157.7	None
25	LJBLJ0184	124.2	None
26	LJBLJ0190	30.7	Wet Retention
27	LJBLJ0200	147.3	Wet Detention
28	LJBLJ0210	14.2	Wet Detention
29	LJBLJ0220	708.9	None
30	LJBLJ0221	170.3	None
31	LJBLJ0222	128.4	None
32	LJBLJ0230	584.7	None
33	LJBLJ0231	269.7	None
34	LJBLJ0232	156.6	None
35	LJBLJ0233	99.5	None
36	LJBLJ0234	303.6	None
37	LJBLJ0235	371.1	None
38	LJBLJ0240	234.5	None
39	LJBLJ0241	135.2	None
40	LJBLJ0242	166.2	None
41	LJBLJ0243	8.3	None
42	LJBLJ0250	204.8	None
43	LJBLJ0260	36.3	Wet Detention
44	LJBLJ0270	78.9	Dry Detention
45	LJBLJ0280	40.5	Wet Detention
46	LJBLJ0290	226.8	Wet Detention
47	LJBLJ0300	271.7	Dry Detention
48	LJBLJ0310	17.2	Dey Detention
49	LJBLJ0320	79.8	Wet Detention
50	LJBLJ0330	69.8	Wet Detention
51	LJBLJ0340	170.6	None
52	LJBLJ0341	70.8	None
53	LJBLJ0350	3,261.1	None
54	LJBLJ0351	102.8	None
55	LJBLJ0352	62.8	None
56	LJBLJ0353	220.8	None
57	LJBLJ0354	19.1	None
58	LJBLJ0355	22.0	None
59	LJBLJ0356	156.2	None
60	LJBLJ0360	233.5	None
61	LJBLJ0365	218.7	None
62	LJBLJ0370	182.1	None
63	LJBLJ0380	18.7	None
64	LJBLJ0385	157.5	None
65	LJBLJ0390	181.8	None
66	LJBMARS01	2,033.9	Impoundment with Settling Basin and Filtration

BMP Type	Reduction Percentages	
	TN (%)	TP (%)
Wet Detention	30	65
Dry Retention	99	99
Wet Retention	80	80
Dry Detention	30	40



LJBMARS01 represents the contributing area to the MARS facility. The nutrient loading from this facility was determined based on the average of the most recent 3 years of annual geomean water quality data collected after 2017 multiplied by the average annual stormwater runoff volume (based on the SIMPLE Seasonal modeling).

CITY OF TALLAHASSEE

N

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Miles

Legend

- Subbasins
- Lake Jackson
- Lexington Creek
- Watercourses
- Tallahassee Corporate Limits
- MARS Impoundment with Settling Basin and Filtration

BMP Type

- Dry Detention
- Wet Detention
- Wet Retention

Topographic Elevations

ft NAVD88

255

64

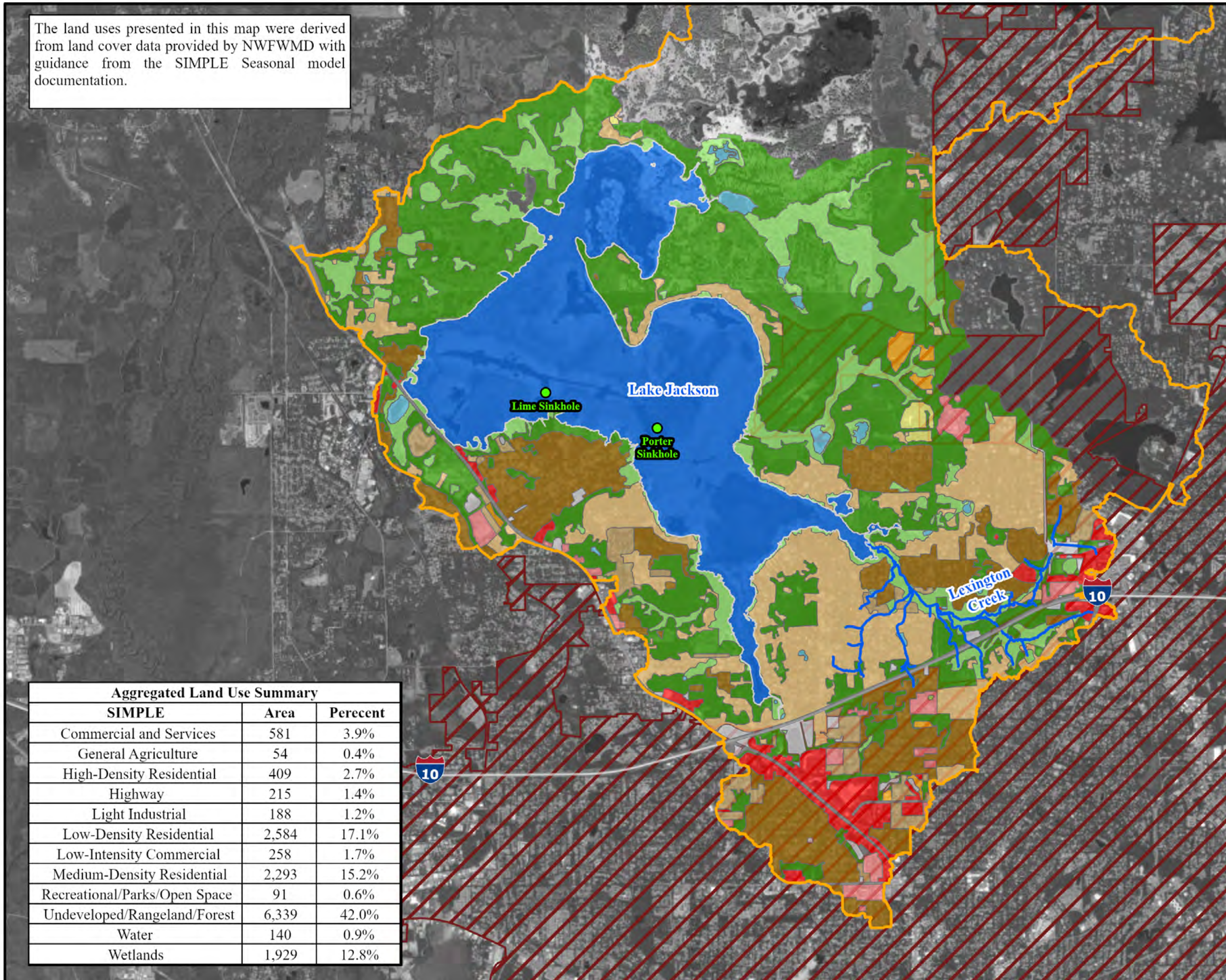
Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Subbasins: Geosyntec, 2023
Roads: COT-Leon County, 2023
City Limits: COT, 2020
BMPs: Geosyntec 2023
Sing Holes: Geosyntec, 2021
Elevation: COT-Leon County, 2018
City Limits: COT, 2020

Figure 4-33:
Lake Jackson Subbasin Delineation and BMPs

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

The land uses presented in this map were derived from land cover data provided by NWFWMD with guidance from the SIMPLE Seasonal model documentation.



Aggregated Land Use Summary		
SIMPLE	**Area**	**Percent**
Commercial and Services	581	3.9%
General Agriculture	54	0.4%
High-Density Residential	409	2.7%
Highway	215	1.4%
Light Industrial	188	1.2%
Low-Density Residential	2,584	17.1%
Low-Intensity Commercial	258	1.7%
Medium-Density Residential	2,293	15.2%
Recreational/Parks/Open Space	91	0.6%
Undeveloped/Rangeland/Forest	6,339	42.0%
Water	140	0.9%
Wetlands	1,929	12.8%

CITY OF TALLAHASSEE

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Land Use: Geosyntec, 2023
Roads: COT-Leon County, 2023
City Limits: COT, 2020
Sing Holes: Geosyntec, 2021
Elevation: COT-Leon County, 2018
City Limits: COT, 2020

Figure 4-34:
Lake Jackson Aggregated Land Use

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

Table 4-5: Aggregated Land Use

FLUCCS Code	FLUCCS Description	SIMPLE-Seasonal Aggregated Description
1100	Low Density Residential	Low Density Residential
1200	Medium Density Residential	Medium Density Residential
1300	High Density Residential	High Density Residential
1400	Commercial and Services	Commercial and Services
1700	Institutional	Low Intensity Commercial
1800	Community Recreational Facilities	Recreational/Parks/Open Space
1900	Open Land	Recreational/Parks/Open Space
2100	Cropland and Pastureland	Undeveloped/Rangeland/Forest
2200	Tree Crops	General Agriculture
2500	Specialty Farms	General Agriculture
3100	Range Land, Herbaceous (Dry Prairie)	Undeveloped/Rangeland/Forest
3200	Shrub and Brushland	Undeveloped/Rangeland/Forest
3300	Mixed Rangeland	Undeveloped/Rangeland/Forest
4100	Upland Coniferous Forests	Undeveloped/Rangeland/Forest
4200	Upland Hardwood Forests	Undeveloped/Rangeland/Forest
4300	Hardwood Coniferous - Mixed	Undeveloped/Rangeland/Forest
4400	Forest Regeneration Areas	Undeveloped/Rangeland/Forest
5200	Lakes	Water
5300	Reservoirs	Water
6100	Wetland Hardwood Forests	Wetlands
6200	Wetland Coniferous Forests	Wetlands
6300	Wetland Forested Mixed	Wetlands
6400	Vegetated Non-Forested Wetlands	Wetlands
6500	Non-Vegetated Wetlands	Wetlands
7400	Disturbed Lands	Undeveloped/Rangeland/Forest
8100	Transportation	Highway
8200	Communications	Light Industrial
8300	Utilities	Light Industrial

Note:

1. The aggregated descriptions are based on guidance from the SIMPLE-Seasonal Model guidance document.

As previously mentioned, the SIMPLE-Seasonal model uses the Harper and Baker (2007) method to determine stormwater pollutant loads. Specifically, a mean annual runoff coefficient (MARC) and the average annual rainfall depth are used to estimate average annual runoff volumes. The MARCs for all land use categories were developed based on the annual runoff coefficients for Meteorological Zone 1 in the draft *Florida Stormwater Quality Applicants Handbook* (FSQAH) (FDEP, 2010). The MARCs are assigned based on the percent DCIA and the non-DCIA CN. Impervious areas within representative areas for each simplified land use type were digitized to estimate representative DCIA and impervious percentages. The representative DCIA and impervious percentages were used for each land use with the values used provided in **Table 4-6**.

Table 4-6: Land Use DCIA and Non-DCIA Percentages

FLUCCS Code	FLUCCS Description	% Impervious	% DCIA	% Pervious
1100	Low Density Residential	11	3	89
1200	Medium Density Residential	37	12	63
1300	High Density Residential	38	18	62
1400	Commercial and Services	58	58	42
1700	Institutional	44	38	56
1800	Community Recreational Facilities	29	18	71
1900	Open Land	0	0	100
2100	Cropland and Pastureland	0	0	100
2200	Tree Crops	0	0	100
2500	Specialty Farms	0	0	100
3100	Range Land, Herbaceous (Dry Prairie)	0	0	100
3200	Shrub and Brushland	0	0	100
3300	Mixed Rangeland	0	0	100
4100	Upland Coniferous Forests	0	0	100
4200	Upland Hardwood Forests	0	0	100
4300	Hardwood Coniferous – Mixed	0	0	100
4400	Forest Regeneration Areas	0	0	100
5200	Lakes	100	100	0
5300	Reservoirs	100	100	0
6100	Wetland Hardwood Forests	100	100	0
6200	Wetland Coniferous Forests	100	100	0
6300	Wetland Forested Mixed	100	100	0
6400	Vegetated Non-Forested Wetlands	100	100	0
6500	Non-Vegetated Wetlands	100	100	0
7400	Disturbed Lands	4	0	96
8100	Transportation	72	38	28
8200	Communications	12	1	88
8300	Utilities	22	22	78

The non-DCIA CNs were calculated based on the percent impervious, minus the DCIA percentage, and the pervious fractions, which were based on open space in good condition and the soil hydraulic group. The impervious areas were assigned a CN value of 98. A lookup table was developed to relate soil hydrologic group to pervious area CNs [see **Table 4-7**, which were referenced from the USDA Urban Hydrology for Small Watersheds (TR-55) (June 1986)]. The overall non-DCIA CNs were then determined by taking an area-weighted average of the impervious and pervious fractions of the non-DCIA CNs.

Table 4-7: Curve Number Lookup Table

Land Use	A	B	C	D	W
Open Space in Good Condition (Grass Cover > 75%)	39	61	74	80	100
Water	100	100	100	100	100
Wetlands	100	100	100	100	100

The soils data used for this modeling effort were presented in **Section 4.4.3.3**. Stormwater runoff is generated when the rate of rainfall exceeds the infiltration capacity of the site soils, resulting in water flow along the land surface. For pits and urban land, soil types were assumed to be HSG D soil group. When dual HSGs were found, an average value was assigned (i.e., soils A/D were assigned a B runoff potential, soils B/D were assigned a C runoff potential, soils C/D were assigned a D runoff potential). This assumption is appropriate because the SIMPLE-Seasonal model is based on an average annual analysis and dual-classed soils will sometimes behave as one hydrologic group and other times behave as the other. If the worst-case hydrologic group is taken, as is done for event-based floodplain modeling, it would result in an over estimation of volume of stormwater generated and thus pollutant loading.

Pollutant loads for direct runoff are determined by multiplying the average annual runoff volumes by the appropriate EMCs. The EMC values used for this study were a combination of values determined by the City (2015) and those reported by Harper and Baker (2007). Water and wetland land use types were assigned a value of zero (0) as they are assumed in this analysis to not contribute pollutants but act as a pollutant sink. **Table 4-8** shows the EMC values used for the SIMPLE-Seasonal model. Mean annual runoff coefficients were calculated for each polygon resulting from the intersection of the land use layer and the soils layer, based on the FSQAH (FDEP, 2010).

Table 4-8: Event Mean Concentration by Land Use

SIMPLE-Seasonal Aggregated Description	TP (mg/L)	TN (mg/L)	Reference
General Agriculture	0.94	1.32	City, 2015
High Density Residential	0.43	1.58	City, 2015
Commercial and Services	0.22	1.05	City, 2015
Highway	0.22	1.64	Harper, 2007
Light Industrial	0.13	1.22	City, 2015
Low Density Residential	0.27	1.18	City, 2015
Low Intensity Commercial[1]	0.18	1.18	Harper, 2007
Medium Density Residential	0.43	1.58	City, 2015
Water[2]	0.0	0.0	-
Wetlands[2]	0.0	0.0	-
Undeveloped/Rangeland/Forest	0.11	0.79	City, 2015
Recreational/Parks/Open Space	1.13	2.33	City, 2015

Note:

1. Low density commercial land use type was used for institutional land use type.
2. EMCs assumed to be zero (0) since water bodies and wetlands are typically assumed to be sinks and not sources of pollutant loads within a watershed.

Water quality treatment provided by existing BMPs within the subbasins were considered as part of this analysis. Runoff BMPs were identified and classified as wet detention, wet retention, dry retention, or dry detention. Aerial imagery, 2018 Leon County DEM, and BMP shapefiles from the City, Leon County, and FDOT were reviewed to identify BMPs within the subbasins draining to Lake Jackson greater than 1 acre. **Figure 4-33** shows the BMPs by subbasin. The BMPs were assigned a removal efficiency based on the type of practice. The removal efficiencies for BMPs are provided in **Table 4-9** and also on **Figure 4-33**. The values were based on the study conducted by Harper and Baker (2007) and the draft Environmental Resource Permit (ERP) Applicant's Handbook (AH) Volume I Section 8 from FDEP (2022). Based on guidance from the City, all the dry detention ponds were assumed to have sand filters due to local land development regulations.

Table 4-9: Direct Runoff BMP Removal Efficiencies

BMP Type	TN (%)	TP (%)
Wet Detention[1]	30	65
Wet Retention[2]	80	80
Dry Retention[1]	99	99
Dry Detention[1]	30	40

Note:

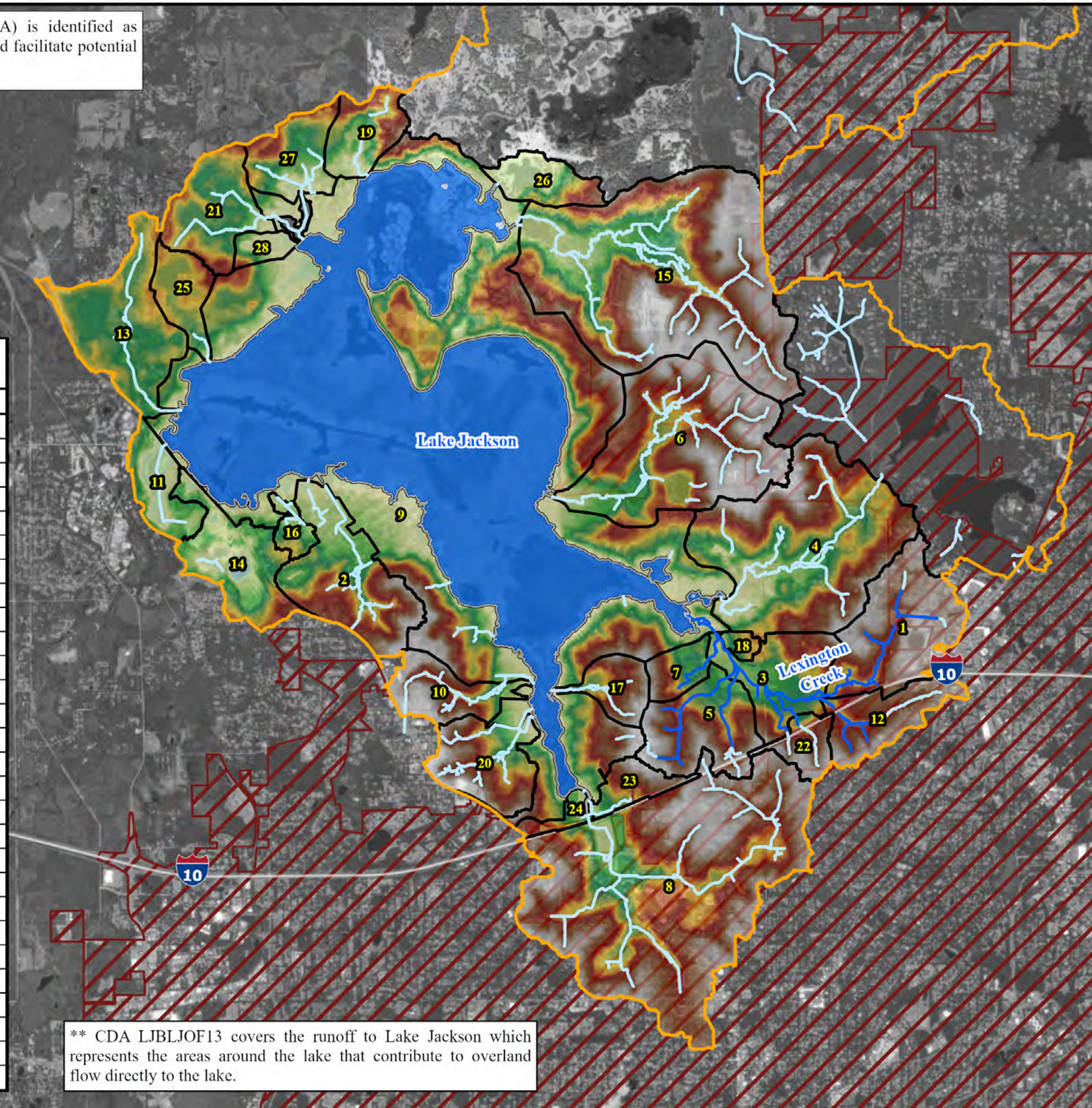
1. The values were from H. Harper and D. Baker, *Evaluation of Current Stormwater Design Criteria within the State of Florida* (June 2007).
2. Stormwater quality nutrient permitting requirements (FDEP 2022)

Natural depressions, wetlands, and natural waterbodies were not included as BMPs since removal efficiencies are based on retaining a certain design volume from engineered systems. Additionally, as outlined previously, any BMP less than 1 acre was not considered due to the scale of this study. Based on the assumptions outlined above, the SIMPLE modeling presented for Lake Jackson and subsequent waterbodies has the potential to calculate high load values due to not considering removal associated with natural features and small local BMPs as well as other processes. As such, the purpose of the SIMPLE model is to provide total loads and per acre loading for comparison between contributing areas around the waterbody, and total loads for comparison to other loading sources to the waterbody.

For the purposes of the loading calculations, the subbasins were grouped into Concentrated Discharge Areas (CDA) which represent discrete areas of loading to Lake Jackson. The loads from the subbasins were then summed for each of the CDAs. **Figure 4-35** presents the CDAs along with their associated acreage. The CDAs represent the discrete areas upon which evaluations of total loading and per acre loading are presented below.

Utilizing the calculated total loads and the per acre loads, the various CDAs were ranked. The approach for the ranking was to order the total loads and the per acre load from lowest to highest and assign a numeric order number for each waterbody, where the highest load would receive the higher numeric order number and the lowest load would receive the lower. This represents a score that can be used to identify CDAs of interest. The two scores were then added together (total load rank and per acre load rank) to get a total score. These were then ordered from highest to lowest value to define the ranking.

A Concentrated Discharge Area (CDA) is identified as possessing concentrated flows that could facilitate potential water quality treatment projects.



Summary of Concentrated Discharge Area

Number	CDA ID	Acres
1	LJBLCOF05	543.0
2	LJBLJOF14	534.2
3	LJBLCOF01	347.7
4	LJBLJOF06	1,191.4
5	LJBLCOF03	392.9
6	LJBLJOF05	1,068.1
7	LJBLCOF02	117.2
8	LJBMARS01	2,052.6
9	LJBLJOF13	3,261.0
10	LJBLJOF15	239.9
11	LJBLJOF09	204.8
12	LJBLCOF04	269.6
13	LJBLJOF08	544.2
14	LJBLJOF10	382.5
15	LJBLJOF07	1,785.2
16	LJBLJOF11	69.8
17	LJBLJOF16	156.2
18	LJBLCOF07	35.4
19	LJBLJOF18	218.7
20	LJBLJOF04	326.4
21	LJBLJOF20	346.8
22	LJBLCOF06	120.9
23	LJBLJOF03	123.7
24	LJBLJOF02	58.4
25	LJBLJOF19	182.1
26	LJBLJOF21	181.8
27	LJBLJOF17	255.4
28	LJBLJOF12	70.8

** CDA LJBLJOF13 covers the runoff to Lake Jackson which represents the areas around the lake that contribute to overland flow directly to the lake.

CITY OF TALLAHASSEE

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Legend

- Lake Jackson Drainage Basin
- Lake Jackson
- Lexington Creek
- Concentrated Discharge Areas
- Watercourses
- Tallahassee Corporate Limits

Topographic Elevations

ft NAVD88

255

64

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
CDAs: Geosyntec, 2023
Roads: COT-Leon County, 2023
City Limits: COT, 2020
Sing Holes: Geosyntec, 2021
Elevation: COT-Leon County, 2018
City Limits: COT, 2020

Figure 4-35: Lake Jackson Concentrated Discharge Areas

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

The goal was for the ranking to consider both the total load from an area (which allows focus on areas with significant load) along with the per-acre loading (which allows focus on areas with high discharge concentrations or greater anthropogenic impact). The combining of the two allows focus on both available load for reduction and targeted higher concentration areas that represent greater opportunity for treatment.

Stormwater Nutrient Loads to Lake Jackson

For the load coming out of the MARS Facility upstream of Megginnis Arm, measured water quality data from downstream of the impoundment was used for the load calculation out of CDA LJBMARS01. The data were collected at Station LJB01 and were part of the data sets presented in earlier sections. The water quality at this station is representative of discharge from the MARS Facility prior to entering the polishing wetland system. The runoff volume calculated from the SIMPLE-Seasonal model was used as the volume discharged from the system. The TN and TP loads were then calculated by multiplying the volume by the measured average TN and TP concentrations (**Table 4-10**). The average value of the most recent 3 years of geometric mean TN and TP data was used for the load calculations. It is noted that no data earlier than 2017 were used for this analysis because it is not considered representative of current conditions. This approach is different than the SIMPLE modeling approach presented earlier as it accounts for the removal processes that occur upstream and within the MARS Facility. This was done because of the nature of the MARS Facility as a significant and unique regional treatment system, along with the availability of sufficient water quality data to perform the calculation.

Table 4-10: Concentration Data, Volumes, and Calculated Loads Representing the Discharge from the MARS Treatment Facility

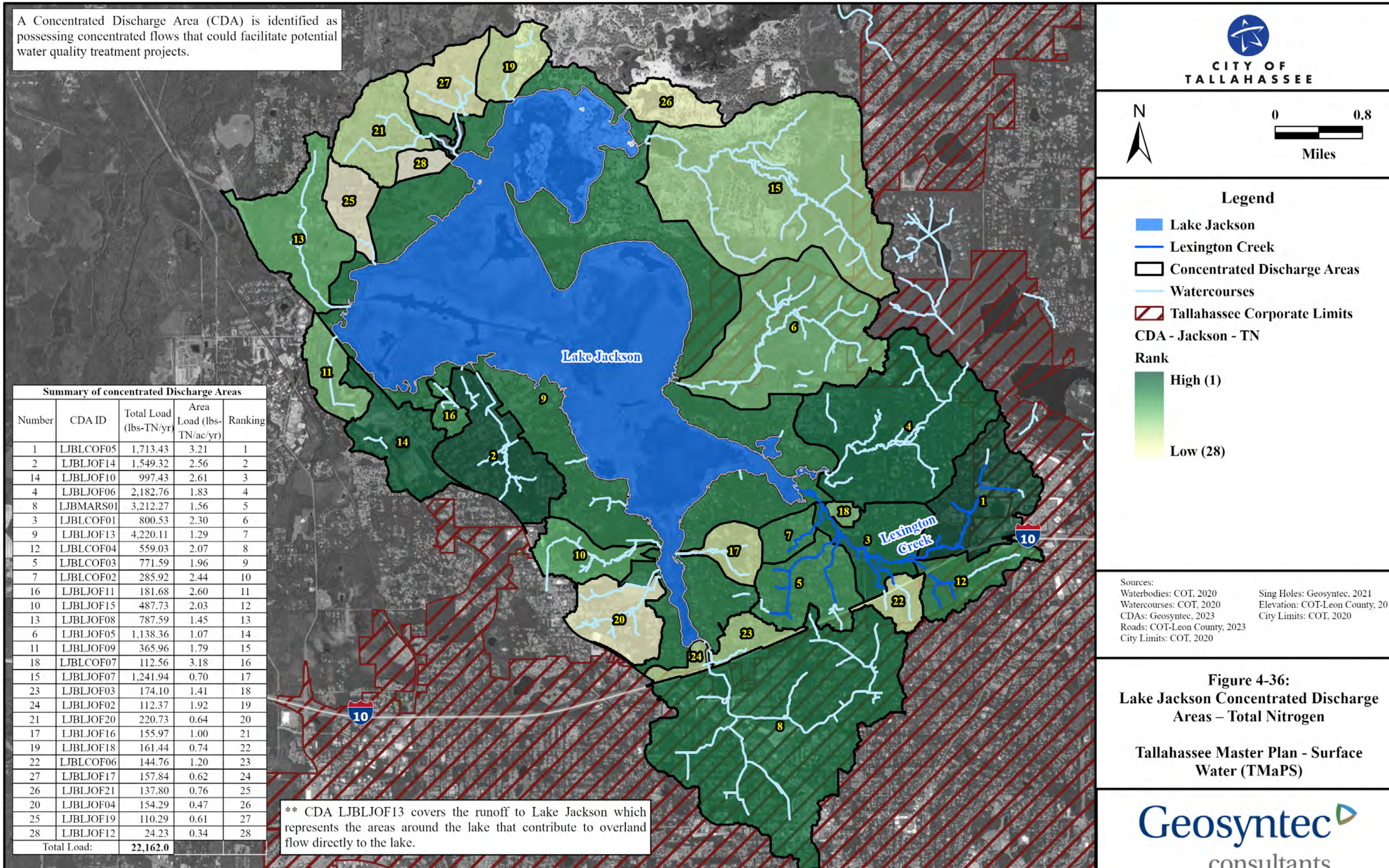
Station ID LJB01	Concentration (mg/L)	Year of data	Volume (ac-ft/yr)[1]	Loads (lb/yr)
Total N	0.435	2019-2021	2,717	3,212
Total P	0.078	2020-2022	2,717	574

Note:

1. The value was calculated in SIMPLE-Seasonal Model.

Figure 4-36 presents the distribution of the ranking of the CDAs for TN along with the total load and per acre loads (see the table on **Figure 4-36**). The rankings are color coded with the highest ranked CDAs in dark green, moving down to the lowest ranked in pale yellow. The calculated total stormwater TN loads from the CDAs ranged from as low as 24 pounds per year (lb/yr) up to 4,220 lb/yr. The per acre loads ranged from 0.34 pounds per acre per year (lb/acre/yr) up to 3.21 lb/acre/yr. The highest ranked CDAs were along Lexington Creek, the Overstreet Drain, and neighborhoods on the western side of the lake. The total potential stormwater runoff load for TN is 22,162 lb/yr.

A Concentrated Discharge Area (CDA) is identified as possessing concentrated flows that could facilitate potential water quality treatment projects.



Summary of concentrated Discharge Areas

Number	CDA ID	Total Load (lbs-TN/yr)	Area Load (lbs-TN/ac/yr)	Ranking
1	LJBLCOF05	1,713.43	3.21	1
2	LJBLJOF14	1,549.32	2.56	2
14	LJBLJOF10	997.43	2.61	3
4	LJBLJOF06	2,182.76	1.83	4
8	LJBMARS01	3,212.27	1.56	5
3	LJBLCOF01	800.53	2.30	6
9	LJBLJOF13	4,220.11	1.29	7
12	LJBLCOF04	559.03	2.07	8
5	LJBLCOF03	771.59	1.96	9
7	LJBLCOF02	285.92	2.44	10
16	LJBLJOF11	181.68	2.60	11
10	LJBLJOF15	487.73	2.03	12
13	LJBLJOF08	787.59	1.45	13
6	LJBLJOF05	1,138.36	1.07	14
11	LJBLJOF09	365.96	1.79	15
18	LJBLCOF07	112.56	3.18	16
15	LJBLJOF07	1,241.94	0.70	17
23	LJBLJOF03	174.10	1.41	18
24	LJBLJOF02	112.37	1.92	19
21	LJBLJOF20	220.73	0.64	20
17	LJBLJOF16	155.97	1.00	21
19	LJBLJOF18	161.44	0.74	22
22	LJBLCOF06	144.76	1.20	23
27	LJBLJOF17	157.84	0.62	24
26	LJBLJOF21	137.80	0.76	25
20	LJBLJOF04	154.29	0.47	26
25	LJBLJOF19	110.29	0.61	27
28	LJBLJOF12	24.23	0.34	28
Total Load:		**22,162.0**		

** CDA LJBLJOF13 covers the runoff to Lake Jackson which represents the areas around the lake that contribute to overland flow directly to the lake.

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
CDAs: Geosyntec, 2023
Roads: COT-Leon County, 2023
City Limits: COT, 2020
Sing Holes: Geosyntec, 2021
Elevation: COT-Leon County, 2018
City Limits: COT, 2020

Figure 4-36: Lake Jackson Concentrated Discharge Areas – Total Nitrogen

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

Figure 4-37 presents the distribution of the ranking of the CDAs for TP along with the total load and per acre loads (see the table on **Figure 4-37**). The calculated total stormwater TP loads from the CDAs ranged from as low as 3.4 lb/yr up to 894 lb/yr. The per acre loads ranged from 0.05 lb/acre/yr up to 0.63 lb/acre/yr. As was seen for TN, the highest ranked CDAs were along Lexington Creek, the Overstreet Drain, and a neighborhood on the western side of the lake, with some minor differences in overall ranking between the two constituents. The total potential stormwater runoff load for TP is 4,374 lb/yr.

4.4.5.2 Septic Load

Methodology

To quantify the potential nutrient load from septic tank units to Lake Jackson and other waterbodies within the Lake Jackson basin, the SPIL method, as adopted by FDEP, was utilized. The SPIL method calculates the TN load based on the number of septic tanks within a specified distance to the waterbody and an assumed loading of 9.012 lb of TN per person per year. Additionally, per the SPIL method, a percent loss of 50 percent is assumed as septic tank effluent moves through the unsaturated zone to groundwater.

The equation for estimating potential loading is:

S * P * I * L = Total TN (lb) per year

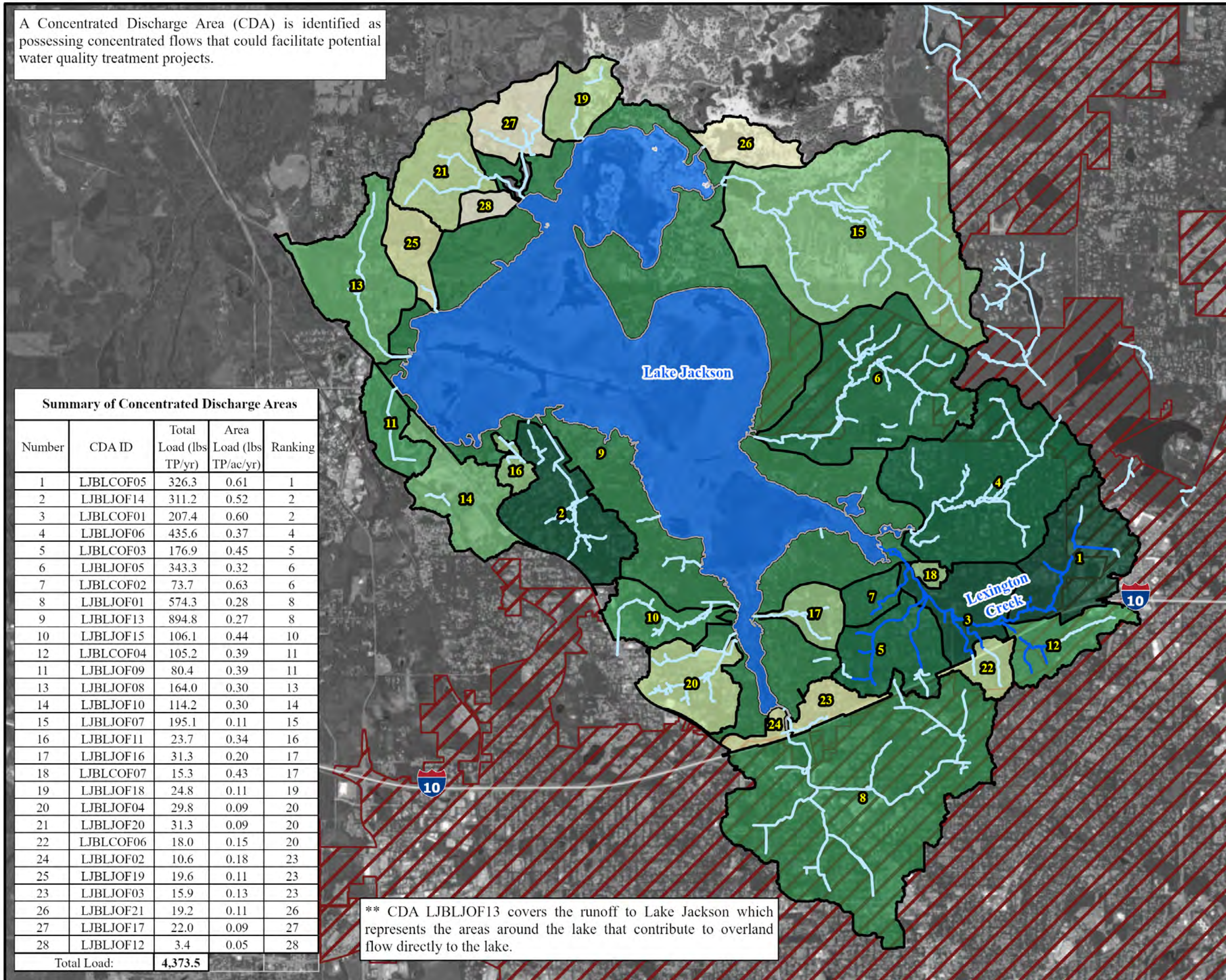
Where:

- **S** = Number of known septic tanks within 200 meters of a waterbody
- **P** = Average number of people per household
- **I** = Constituent annual load
- **L** = Percentage of nutrient loss during seepage

The latest available census data was utilized to calculate the 2.4 persons per household within Leon County. The buffer zone for selecting septic tanks was also applied to tributaries discharging to the waterbody of interest, as delineated by the City. The inclusion of the tributaries in the loading calculation deviates from the approach utilized by FDEP, but based on internal project team discussion, was felt to be a reasonable addition as these represent a direct connection to the waterbody.

The FDEP method only calculates TN load since the majority of phosphorous in septic tank effluent is assumed to be adsorbed onto soil particles before reaching the groundwater table. Published studies on phosphorus attenuation in groundwater show that phosphorus plumes from septic units typically do not extend beyond 50 meters, with approximately 96 percent of phosphorus removal occurring within the first 10 meters (Corbett et al., 2002; Robertson et al., 2019). Therefore, FDEP's decision to not include TP was followed in this study.

A Concentrated Discharge Area (CDA) is identified as possessing concentrated flows that could facilitate potential water quality treatment projects.



Summary of Concentrated Discharge Areas

Number	CDA ID	Total Load (lbs TP/yr)	Area Load (lbs TP/ac/yr)	Ranking
1	LJBLCOF05	326.3	0.61	1
2	LJBLJOF14	311.2	0.52	2
3	LJBLCOF01	207.4	0.60	2
4	LJBLJOF06	435.6	0.37	4
5	LJBLCOF03	176.9	0.45	5
6	LJBLJOF05	343.3	0.32	6
7	LJBLCOF02	73.7	0.63	6
8	LJBLJOF01	574.3	0.28	8
9	LJBLJOF13	894.8	0.27	8
10	LJBLJOF15	106.1	0.44	10
12	LJBLCOF04	105.2	0.39	11
11	LJBLJOF09	80.4	0.39	11
13	LJBLJOF08	164.0	0.30	13
14	LJBLJOF10	114.2	0.30	14
15	LJBLJOF07	195.1	0.11	15
16	LJBLJOF11	23.7	0.34	16
17	LJBLJOF16	31.3	0.20	17
18	LJBLCOF07	15.3	0.43	17
19	LJBLJOF18	24.8	0.11	19
20	LJBLJOF04	29.8	0.09	20
21	LJBLJOF20	31.3	0.09	20
22	LJBLCOF06	18.0	0.15	20
24	LJBLJOF02	10.6	0.18	23
25	LJBLJOF19	19.6	0.11	23
23	LJBLJOF03	15.9	0.13	23
26	LJBLJOF21	19.2	0.11	26
27	LJBLJOF17	22.0	0.09	27
28	LJBLJOF12	3.4	0.05	28
Total Load:		**4,373.5**		

** CDA LJBLJOF13 covers the runoff to Lake Jackson which represents the areas around the lake that contribute to overland flow directly to the lake.

CITY OF TALLAHASSEE

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Miles

Legend

- Lake Jackson
- Lexington Creek
- Concentrated Discharge Areas
- Watercourses
- Tallahassee Corporate Limits

CDA - Jackson - TP

Rank

High (1)

Low (28)

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
CDAs: Geosyntec, 2023
Roads: COT-Leon County, 2023
City Limits: COT, 2020
Sing Holes: Geosyntec, 2021
Elevation: COT-Leon County, 2018
City Limits: COT, 2020

Figure 4-37:
Lake Jackson Concentrated Discharge Areas – Total Phosphorus

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

The literature review also indicated that the 200-meter buffer around waterways that FDEP uses to capture septic tank TN contributions is a conservative approach. The literature suggests that most of the TN attenuation takes place within the first 10 meters (Corbett et al., 2022; Robertson et al., 2019; Van Stempvoort et al., 2021). For the purpose of identifying potential problem areas and based on general soil characteristics in and around tributaries and the lake (higher water table conditions), the 200-meter buffer (as defined by FDEP) for TN contributions was maintained. The watercourse layer provided by the City was used to assess the 200-meter buffer.

Based on the available literature on septic movement, it is understood that the approach presented herein may overpredict the nitrogen load to the waterbodies and, therefore, potentially represents a conservative potential load. Presently, further study is needed to better quantify septic loading to the lake and other waterbodies in the basin.

Results

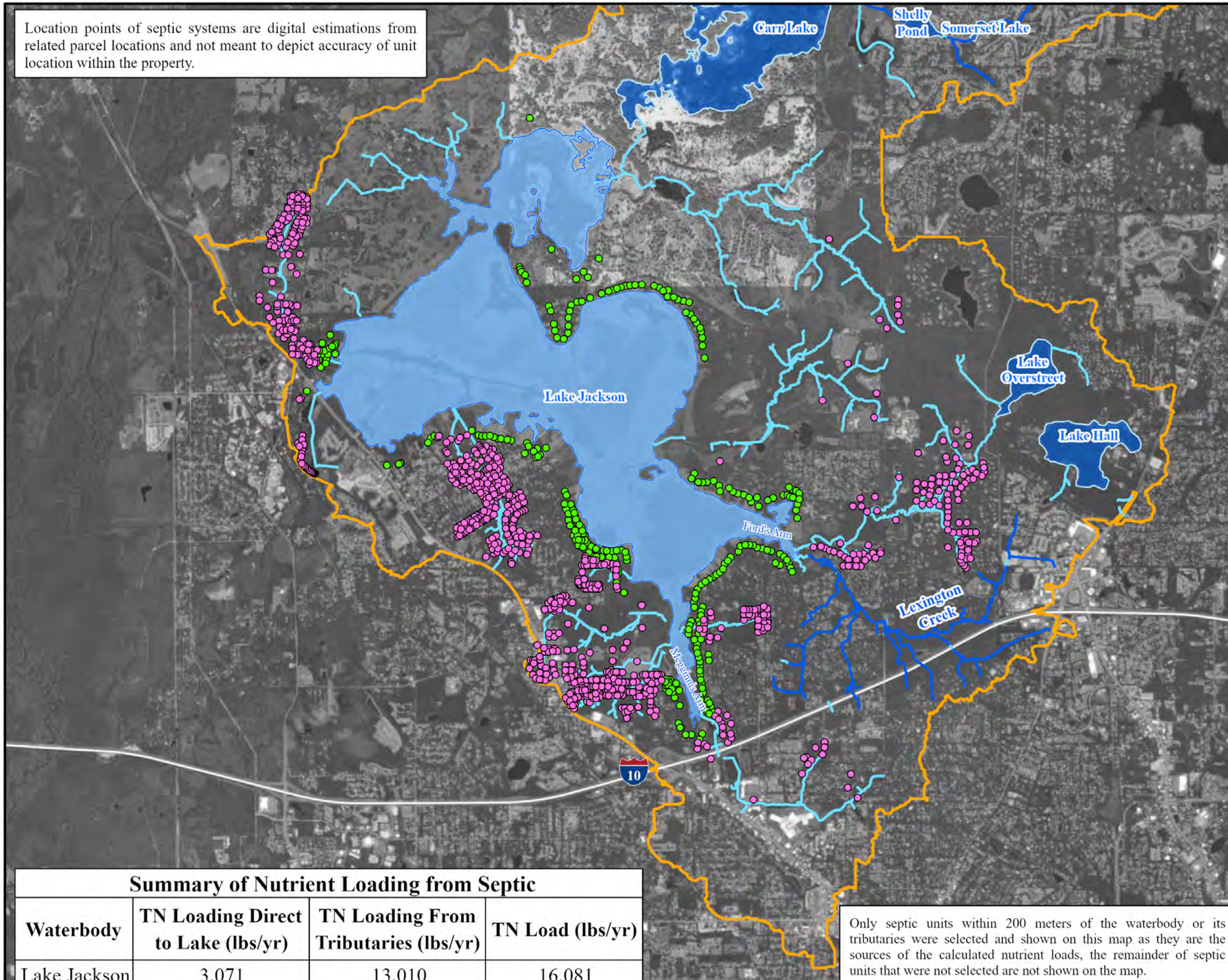
An estimated 1,316 septic tank units were identified within 200 meters of Lake Jackson and primary tributaries that drain to Lake Jackson. **Figure 4-38** shows the septic systems utilized in this analysis, with green representing those associated with direct loading to the waterbody and pink representing those associated with loading to tributaries. A table provided on the figure summarizes the calculated nutrient load from septic units for Lake Jackson. Lake Jackson has an estimated annual TN load of 14,232 lb/yr. The majority of that load is from tributaries flowing into Lake Jackson. Direct septic loading to the lake is at about 3,071 lb/yr.

4.4.5.3 Point Source Load

A source of pollution that is discretely identifiable and from which pollutants are discharged is known as a point source. Common types of point sources include facilities like factories, paper/pulp mills, and water treatment plants. Effluent from these facilities can be discharged either directly to a waterbody or via land application on designated sprayfields. In either case, these discharges pose the potential to be a source of pollutants to waterbodies in the basin. This section of the report, and subsequent sections for other waterbodies, focuses on known point sources within the Lake Jackson basin and reviews their potential for impacting water quality as a function of loading, with a focus on TN and TP.

To identify potential point source discharges within the Lake Jackson basin, Discharge Monitoring Report (DMR) datasets provided by the City were reviewed along with a search of permits within FDEP's Oculus database. At present, no active permitted point sources were identified within the Lake Jackson basin. Therefore, the point source loads for TN and TP are set to 0 lb/yr for Lake Jackson.

Location points of septic systems are digital estimations from related parcel locations and not meant to depict accuracy of unit location within the property.



CITY OF TALLAHASSEE

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Miles

Legend

- Lake Jackson Drainage Basin
- Lake Jackson
- Waterbodies in Study
- Watercourses

Relevant Septic Sites

- Lake
- Tributaries

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Septic Systems: COT, 2020
Watershed: COT, 2020
Roads: COT-Leon County, 2023

Figure 4-38: Septic Loading to Lake Jackson

Tallahassee Master Plan - Surface Water (TMaPS)

Summary of Nutrient Loading from Septic

Waterbody	TN Loading Direct to Lake (lbs/yr)	TN Loading From Tributaries (lbs/yr)	TN Load (lbs/yr)
Lake Jackson	3,071	13,010	16,081

Only septic units within 200 meters of the waterbody or its tributaries were selected and shown on this map as they are the sources of the calculated nutrient loads, the remainder of septic units that were not selected are not shown on the map.

Geosyntec consultants

4.4.5.4 Lake Inflow Load

Methodology

Surface water connections between waterbodies are inherently potential sources of pollutants to a downstream waterbody. This section, and others to follow, focuses on the interconnectivity of lakes within the Lake Jackson basin and their potential for impacting water quality as a function of loading from one lake to another. Estimation of this loading requires having flow and water quality data. When assessing the potential for inter-lake loading to Lake Jackson, and other lakes within the basin, the analyses will focus on nutrient loading (TN and TP) and considerations of impairment and nutrient concentrations in the upstream and downstream lakes.

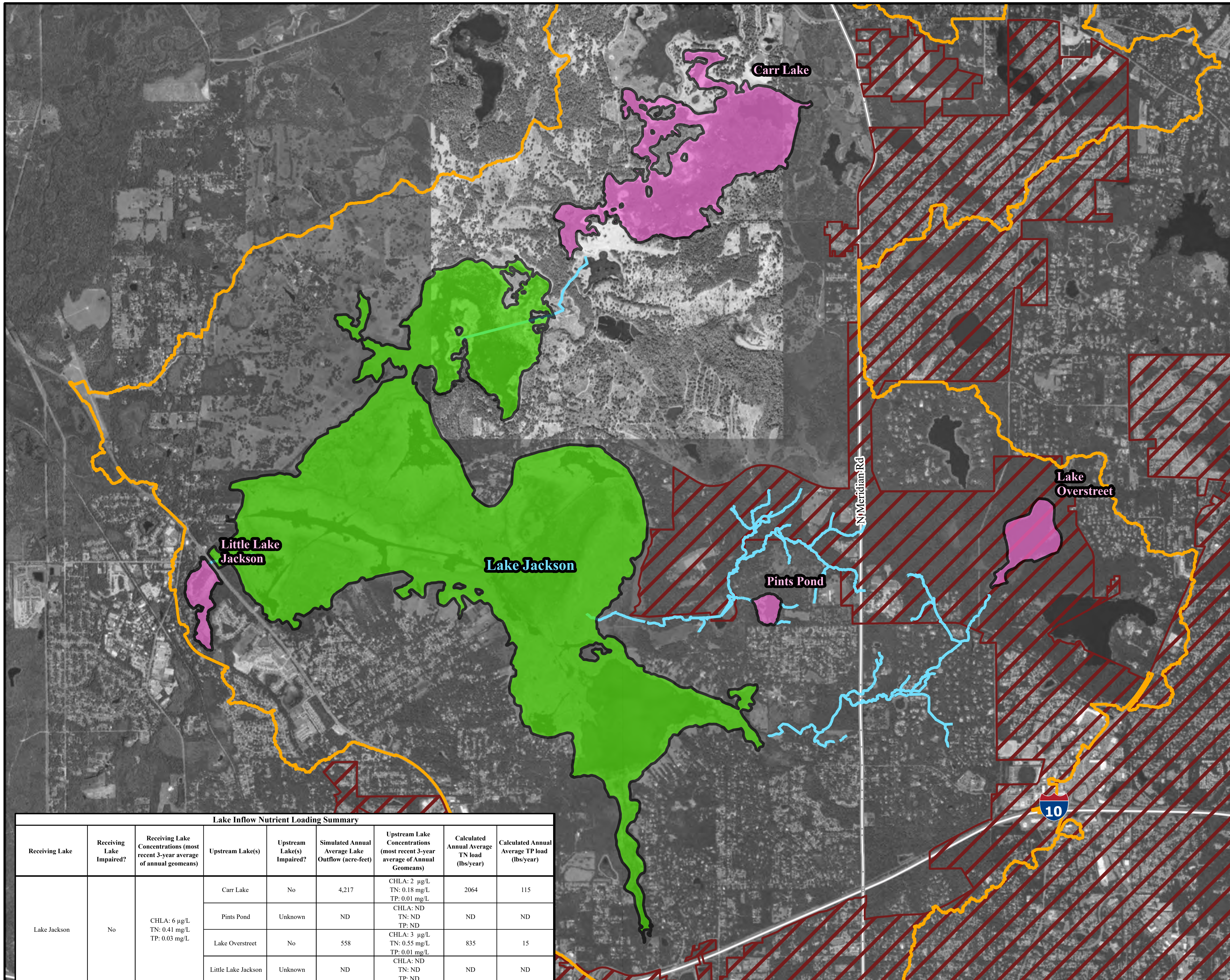
At present, there are no direct flow measurements immediately downstream of the lakes discussed as sources in this and subsequent sections. Therefore, to calculate annual nutrient loads out of the lakes (where nutrient concentration data are available), an average annual flow volume out must be calculated. To this end, the results from the SIMPLE-Seasonal modeling performed as part of the analysis presented in **Section 4.4.5.1** were used to estimate the annual average flows into the upstream lakes. The average annual flow into the lakes was then assumed to be equivalent to the average annual flow out (rainfall and evaporation generally being equivalent on an average annual basis). The calculated flows were then multiplied by TN and TP concentrations in the upstream lake. The TN and TP concentrations represent averages of the latest 3 years of geomeans with no data prior to 2017 utilized. This approach was utilized for all the lake loading calculations within the Lake Jackson basin where recent lake nutrient concentration data are available and direct inflows have been calculated using the SIMPLE-Seasonal model.

Results

There were four lakes identified with surface connections and the potential to flow into Lake Jackson in **Section 4.4.4.7**, Little Lake Jackson, Carr Lake, Pints Pond, and Lake Overstreet. While none were determined to be significant potential sources of pollutant loads to Lake Jackson, data are available to calculate the loads from Carr Lake and Lake Overstreet based on the methodology listed above. The following presents the loading from each.

The lakes and connections are shown in **Figure 4-39** along with a table that presents information on the water quality within the various waterbodies along with the calculated annual average flow and nutrient loads (where data allows). The waterbody concentrations (presented in the table on **Figure 4-39**) are based on the average of the latest 3 years of annual geomeans where data are available after 2017.

For Carr Lake, utilizing the calculated flow and the average in-lake concentrations, the TN and TP loads are 2,064 lb/yr and 115 lb/yr, respectively. For Lake Overstreet, utilizing the calculated flow and the average lake TN and TP concentrations, the loads were calculated as 835 lb/yr and 15 lb/yr, respectively.



Lake Inflow Nutrient Loading Summary

Receiving Lake	Receiving Lake Impaired?	Receiving Lake Concentrations (most recent 3-year average of annual geomeans)	Upstream Lake(s)	Upstream Lake(s) Impaired?	Simulated Annual Average Lake Outflow (acre-feet)	Upstream Lake Concentrations (most recent 3-year average of Annual Geomeans)	Calculated Annual Average TN load (lbs/year)	Calculated Annual Average TP load (lbs/year)
Lake Jackson	No	CHLA: 6 µg/L TN: 0.41 mg/L TP: 0.03 mg/L	Carr Lake	No	4,217	CHLA: 2 µg/L TN: 0.18 mg/L TP: 0.01 mg/L	2064	115
			Pints Pond	Unknown	ND	CHLA: ND TN: ND TP: ND	ND	ND
			Lake Overstreet	No	558	CHLA: 3 µg/L TN: 0.55 mg/L TP: 0.01 mg/L	835	15
			Little Lake Jackson	Unknown	ND	CHLA: ND TN: ND TP: ND	ND	ND

CITY OF TALLAHASSEE

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Miles

Legend

- Lake Jackson Drainage Basin
- Lake Jackson
- Inflowing Lakes
- Flows Into Jackson
- Tallahassee Corporate Limits

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
City Limits: COT, 2020

Figure 4-39:
Inflow Loading to Lake Jackson

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

4.4.5.5 Internal Lake Load

Internal recycling loads represent fluxes from benthic substrate that build up from the deposition of ongoing or legacy loads coming into a waterbody. Additionally, build up can also occur through the accumulation of organic material that settles following algal blooms. These algal blooms occur due to excess nutrient loading to the water column, which results in a positive feedback loop of benthic nutrient releases followed by algal blooms. Nutrients are bound into the benthic substrate and, under different conditions (depending upon the nature of the nutrients in the sediments), can be released into the water column. In many lakes within Florida, benthic flux, or internal recycling, can be a significant portion of the nutrient budget. While naturally occurring flux does occur, it is the portion caused by the excessive historical and/or ongoing anthropogenic impacts that would require remediation.

In the qualitative assessment of potential pollutant loads to Lake Jackson (**Section 4.4.4.4**), an assessment was made relative to the potential for anthropogenically driven internal loading to play a significant role in the nutrient balance of Lake Jackson. The assessment pointed out that historical studies identified internal recycling to be a significant portion of the loading to Lake Jackson. That is partially based on naturally occurring internal processes associated with the extensive vegetation cover throughout the lake. In the late 1990s, a large volume of sediments (nearly 3 million cubic yards) was removed from the southern lobe of the lake where Megginnis and Fords Arm drain. This effort was to mitigate historical sediment loading that occurred prior to the installation of upstream stormwater treatment throughout the subbasins for the highly developed area draining to these two inflows. Finally, the naturally occurring dry-out of the lake bottom, which was discussed in **Section 4.4.1**, creates conditions where a significant portion of the bottom sediments are periodically desiccated. A dry down of the lake recently occurred in 2021. The assessment in **Section 4.4.4.4** concluded that overall, the levels of nutrient flux from the sediments have likely been reduced compared to historical conditions. The earlier assessment also identified that recent evaluations of organic sediments within the excavated portion of the lake on the southern side did not show significant build up, supporting the premise that anthropogenic internal loading of nutrients is not an issue at present.

No direct data/studies were identified to quantify the present benthic flux conditions in Lake Jackson. A method for identifying the presence of benthic flux is the analysis of vertical profiles of water quality data, including specific conductance, dissolved oxygen (DO), temperature and nutrient species. Specific conductance measures the presence of ions in the water column. When benthic flux occurs, specific ions can flux into the water column, therefore a significant vertical variation or increase in near-bottom specific conductance can be an indication of benthic flux. Additionally, under anoxic conditions, orthophosphate (PO_4) liberates from iron and can flux into the water column. While profile data within Lake Jackson is limited due to its shallow nature, some locations did collect surface and near-bottom data. Evaluation of the available data for Lake Jackson identified three locations where surface and bottom data were collected. One was within the eastern side of the main lake, one was in the southeastern lobe just outside of where Megginnis Arm flows in, and one was in Megginnis Arm. **Table 4-11** shows a summary of this data for specific conductance and percent saturation. **Exhibit 4-7** in **Section 4.4.3.7** presented the locations of the water quality sampling stations. In all three locations, for all the samples, the bottom and surface specific conductance values were nearly identical. Only one of the samples (main lake station) showed near anoxic conditions with the vertical variation in the other samples small. This limited information supports the idea of benthic flux playing a lesser role in Lake Jackson.

Table 4-11: Measurements of Vertical Variation in Specific Conductance and Percent Saturation within Lake Jackson

Station ID	Station Name	Date	Depth (m)	Percent Saturation (%)	Specific Conductance (umhos/cm)
21FLGW 55588	Z1-LL-13014 LAKE JACKSON	4/6/2016	0.3	76.7	33
			1.7	62.8	31
		5/23/19	0.3	77.9	39
			1.4	8.3	38
21FLTLHRG1 TLHR0123	Megginnis Arm off Fuller Road Ramp	1/15/2020	0.3	98.6	124.9
			2.1	88.9	125.9
21FLTLHRG1 TLHR0124	Megginnis Arm off Crowder Landing	2/10/2020	0.3	97.7	60.0
			1.5	92.0	59.8

4.4.5.6 Atmospheric Deposition

In order to calculate the atmospheric deposition loading for nutrients to Lake Jackson, the data from the Quincy station (FL14), identified in earlier sections and shown on **Figure 4-15**, were utilized. The National Atmospheric Deposition Program (NADP) provides a clearinghouse for deposition data. The NADP sites collect nitrogen data but not phosphorus, as such, only TN is available. **Table 4-12** presents the annual TN loads per acre from 2010 to 2020. No data were available at the Quincy station for 2020 so the value from the next nearest station (Sumatra – FL23) was utilized. Averaging the annual load per acre over the 10-year period gives a value of 2.56 lb/acre/yr. Multiplying the 2.56 lb/acre/yr TN load by the acreage of Lake Jackson (4,200 acres) gives a total average TN load of 10,752 lb/yr.

Table 4-12: Annual Atmospheric Total Nitrogen Load per Acre from Quincy Station

Year	TN (lb/acre)
2010	2.19
2011	2.31
2012	2.20
2013	2.57
2014	4.95
2015	2.57
2016	2.47
2017	2.31
2018	2.40
2019	1.97
2020*	2.16*

*Data from NADP Website Sumatra Station

4.4.5.7 Summary of Calculated Loads

Nutrient loads to Lake Jackson were calculated for stormwater runoff, septic systems, interconnected flow (where data allowed), and atmospheric deposition. **Table 4-13** presents the calculated total loads to the lake for TN and TP. For septic systems and atmospheric deposition, only TN loads were calculated (see **Section 4.4.5.2** and **Section 4.4.5.6** respectively for explanation).

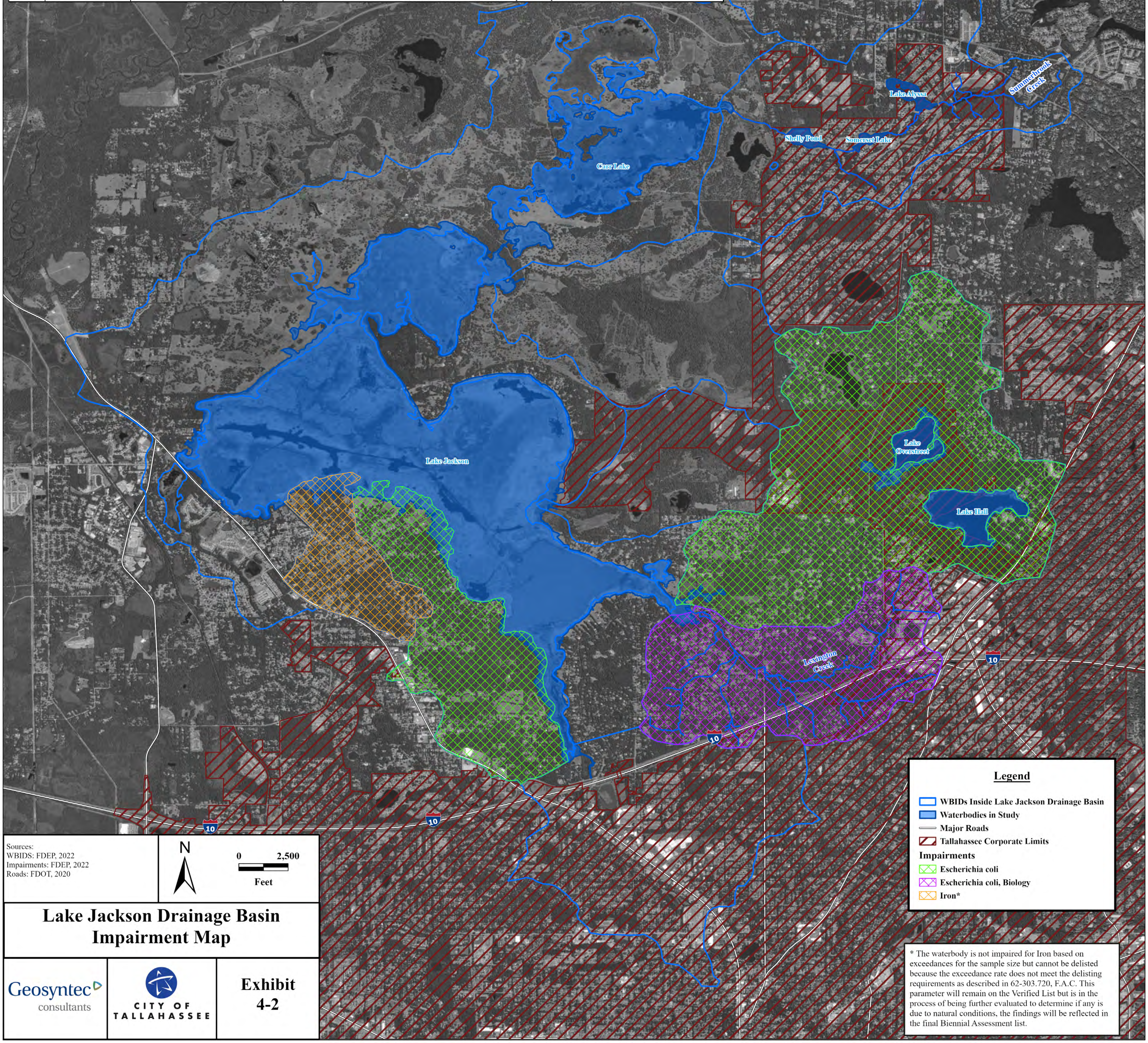
Table 4-13: Summary of Calculated Loads to Lake Jackson

Source	TN (lb/year)	TP (lb/year)
Stormwater Runoff	22,162	4,374
Septic Systems	14,232	NC
Interconnected Flow	3,524	142
Atmospheric Deposition	10,752	NC

NC – Not calculated

Impaired Waterbodies

WBID	Waterbody Name	Parameters Assessed Using the Impaired Surface Waters Rule (IWR)	Criterion Concentration or Threshold Not Met
582F	Butler Mill Creek	Escherichia coli	≤ 410 Counts / 100 mL
689	Lake Overstreet Drain	Escherichia coli	≤ 410 Counts / 100 mL
746A	Jackson Heights Creek	Iron	≤ 1.0 mg/L
758	Lexington Creek	Biology	Average score of at least two temporally independent SCI scores ≥ 40; or both of the two most recent SCI scores ≥ 35; or if there are only two SCI scores and there is less than or equal to a 20 point difference.



Sources:
WBIDS: FDEP, 2022
Impairments: FDEP, 2022
Roads: FDOT, 2020

Lake Jackson Drainage Basin Impairment Map

Geosyntec consultants

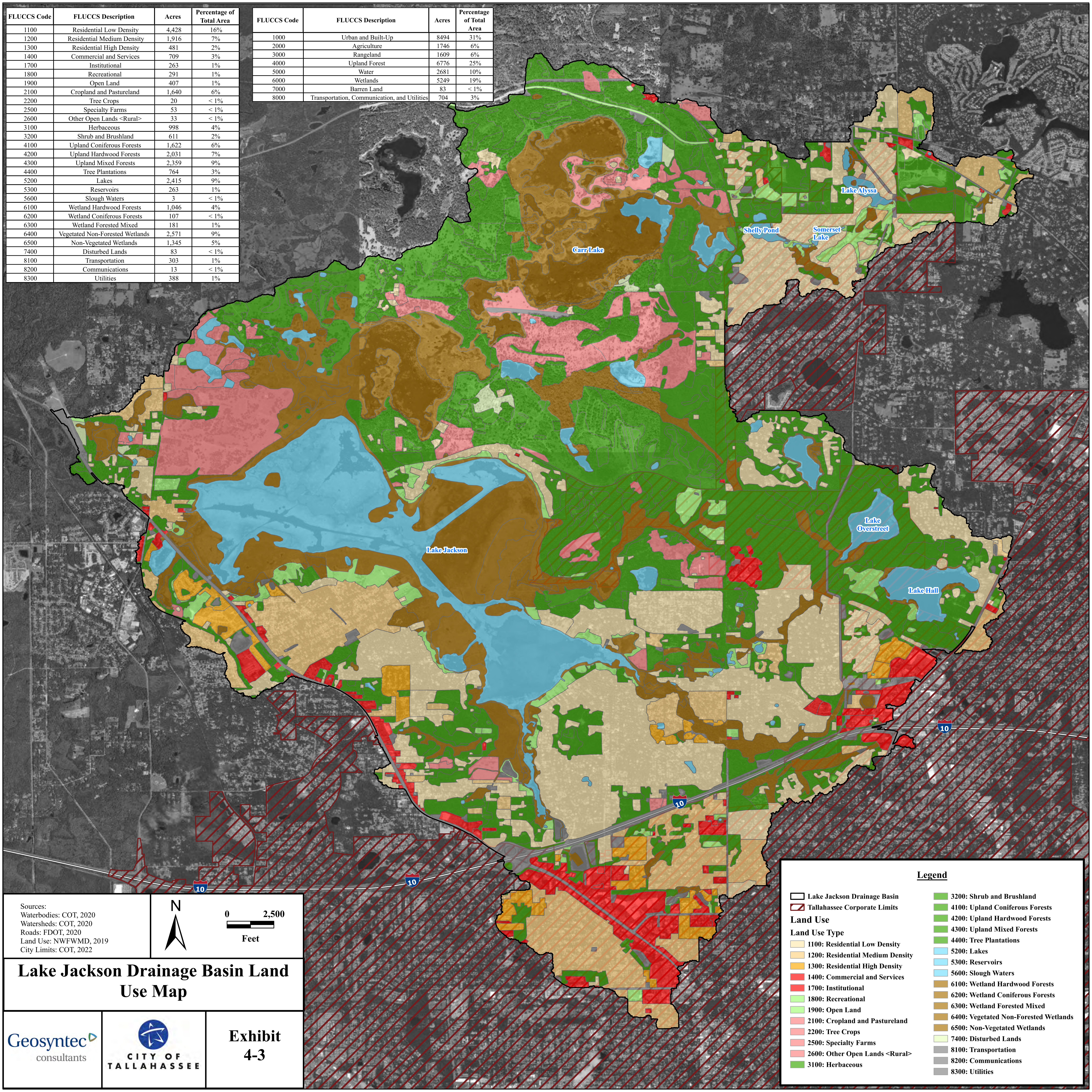
CITY OF TALLAHASSEE

Exhibit 4-2

* The waterbody is not impaired for Iron based on exceedances for the sample size but cannot be delisted because the exceedance rate does not meet the delisting requirements as described in 62-303.720, F.A.C. This parameter will remain on the Verified List but is in the process of being further evaluated to determine if any is due to natural conditions, the findings will be reflected in the final Biennial Assessment list.

FLUCCS Code	FLUCCS Description	Acres	Percentage of Total Area
1100	Residential Low Density	4,428	16%
1200	Residential Medium Density	1,916	7%
1300	Residential High Density	481	2%
1400	Commercial and Services	709	3%
1700	Institutional	263	1%
1800	Recreational	291	1%
1900	Open Land	407	1%
2100	Cropland and Pastureland	1,640	6%
2200	Tree Crops	20	< 1%
2500	Specialty Farms	53	< 1%
2600	Other Open Lands <Rural>	33	< 1%
3100	Herbaceous	998	4%
3200	Shrub and Brushland	611	2%
4100	Upland Coniferous Forests	1,622	6%
4200	Upland Hardwood Forests	2,031	7%
4300	Upland Mixed Forests	2,359	9%
4400	Tree Plantations	764	3%
5200	Lakes	2,415	9%
5300	Reservoirs	263	1%
5600	Slough Waters	3	< 1%
6100	Wetland Hardwood Forests	1,046	4%
6200	Wetland Coniferous Forests	107	< 1%
6300	Wetland Forested Mixed	181	1%
6400	Vegetated Non-Forested Wetlands	2,571	9%
6500	Non-Vegetated Wetlands	1,345	5%
7400	Disturbed Lands	83	< 1%
8100	Transportation	303	1%
8200	Communications	13	< 1%
8300	Utilities	388	1%

FLUCCS Code	FLUCCS Description	Acres	Percentage of Total Area
1000	Urban and Built-Up	8494	31%
2000	Agriculture	1746	6%
3000	Rangeland	1609	6%
4000	Upland Forest	6776	25%
5000	Water	2681	10%
6000	Wetlands	5249	19%
7000	Barren Land	83	< 1%
8000	Transportation, Communication, and Utilities	704	3%



Sources:
Waterbodies: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
Land Use: NWFWMD, 2019
City Limits: COT, 2022

Lake Jackson Drainage Basin Land Use Map

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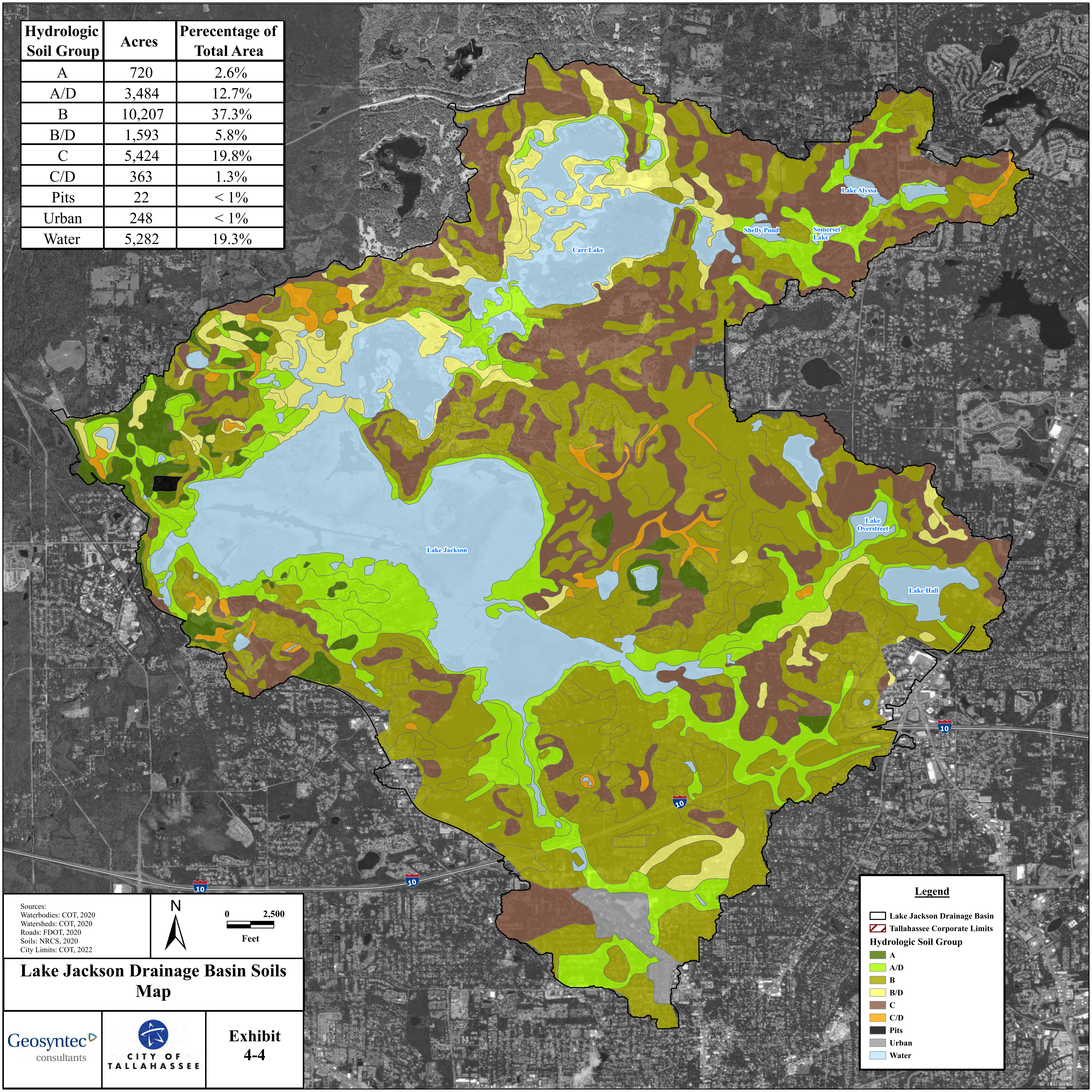
CITY OF TALLAHASSEE

Exhibit 4-3

Hydrologic Soil Group	Acres	Perecentage of Total Area
A	720	2.6%
A/D	3,484	12.7%
B	10,207	37.3%
B/D	1,593	5.8%
C	5,424	19.8%
C/D	363	1.3%
Pits	22	< 1%
Urban	248	< 1%
Water	5,282	19.3%



Sources:
Waterbodies: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
Soils: NRCS, 2020
City Limits: COT, 2022

Lake Jackson Drainage Basin Soils Map

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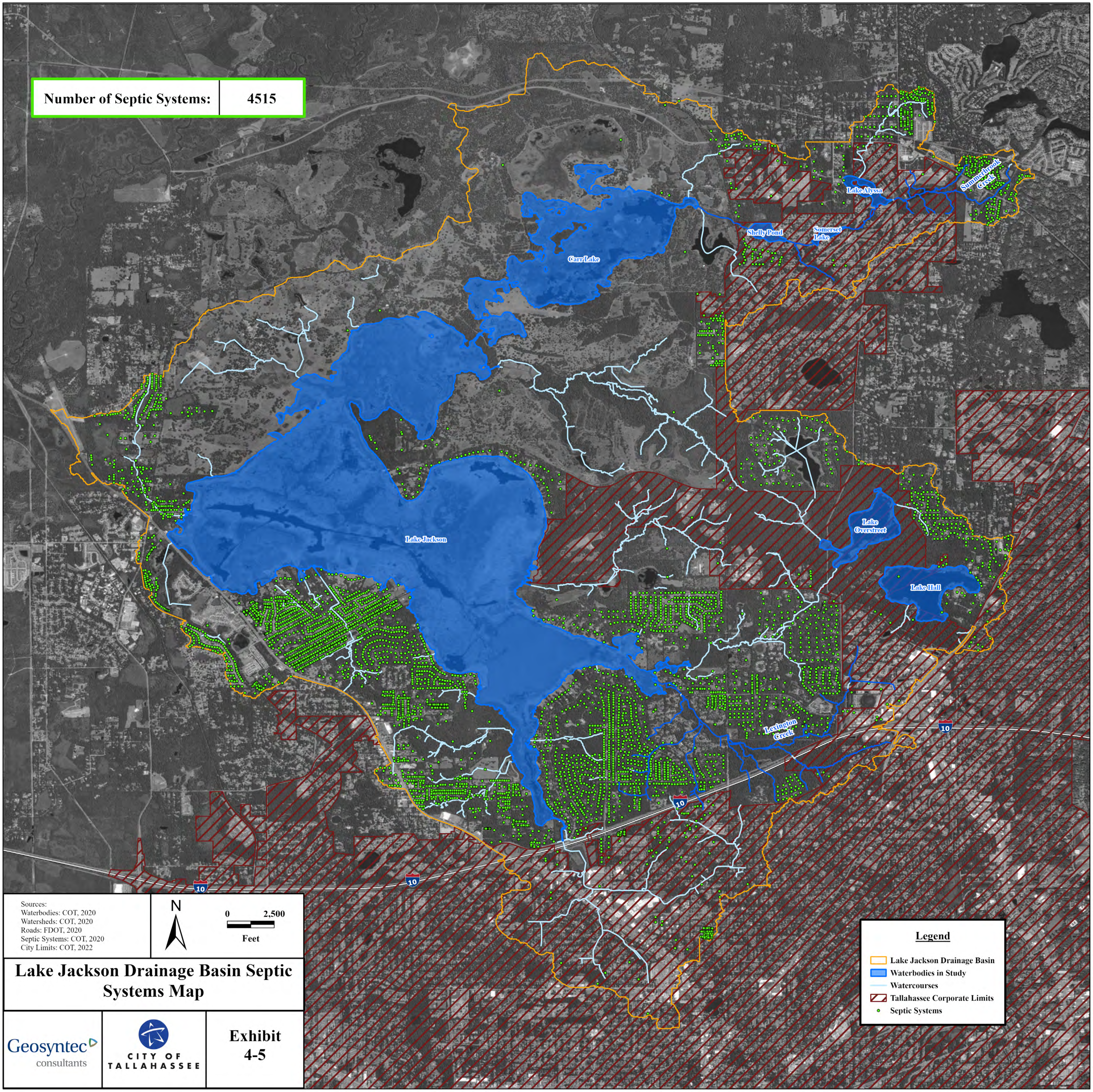
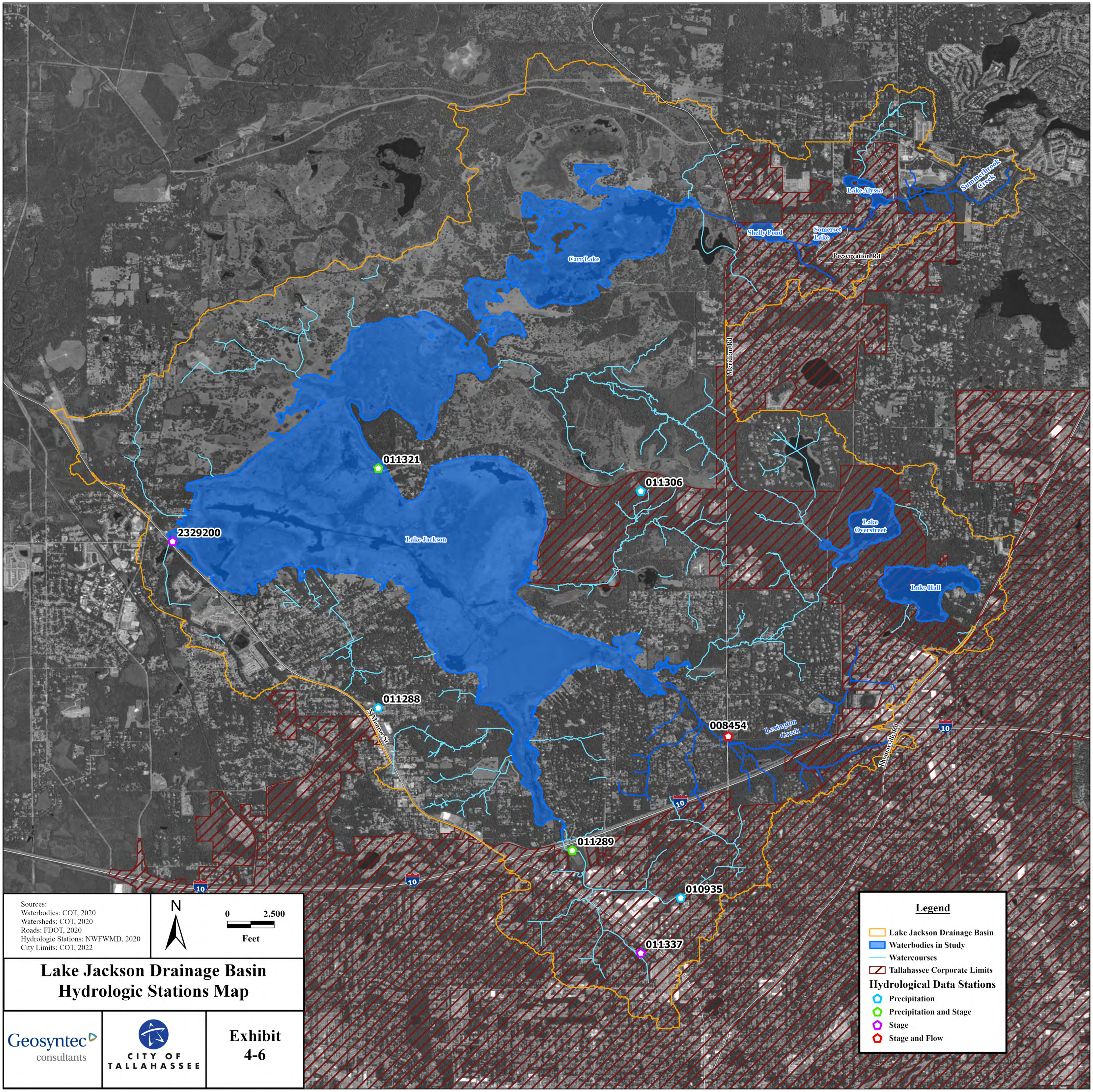
CITY OF TALLAHASSEE

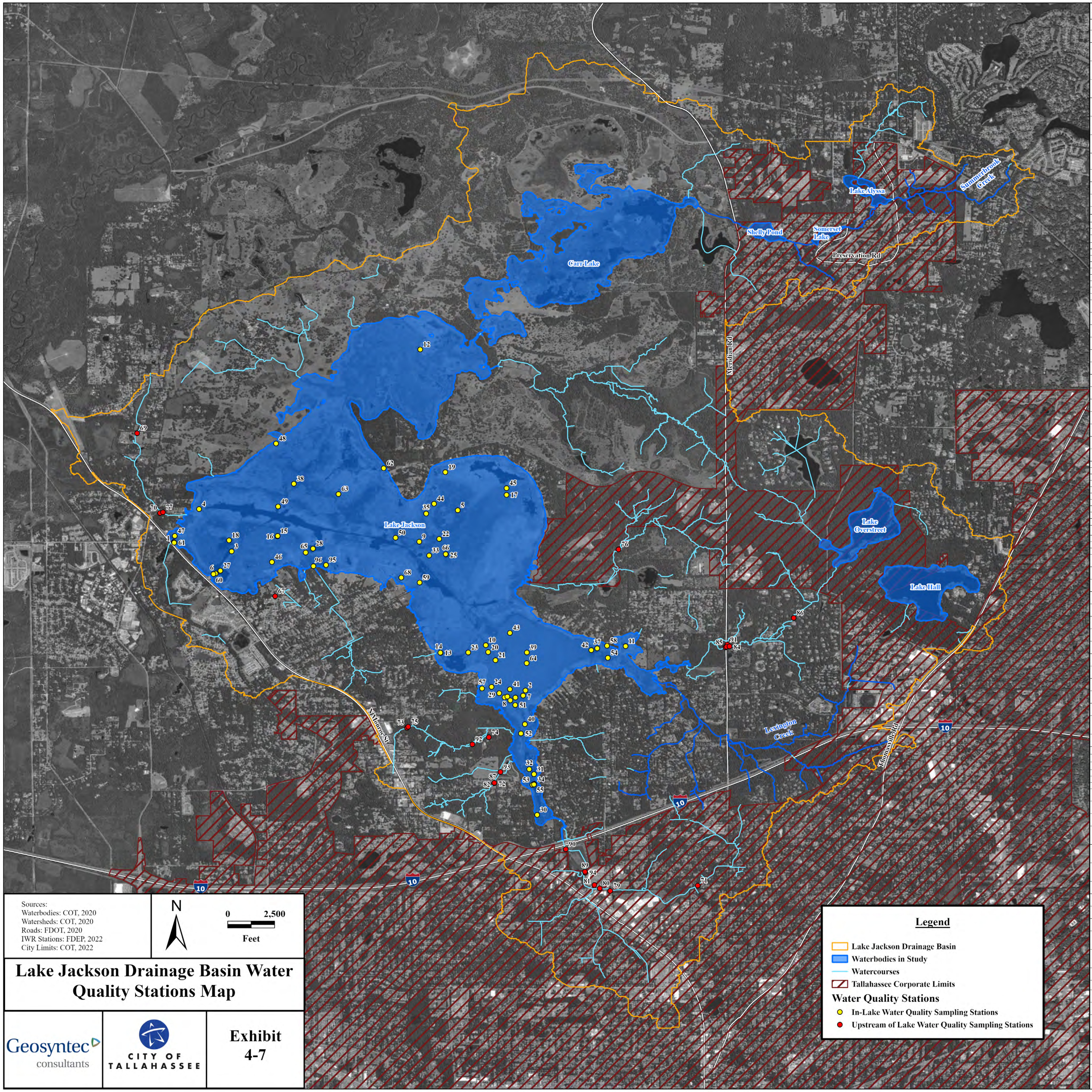
Exhibit 4-4



Lake Jackson Drainage Basin Septic Systems Map

Exhibit 4-5


Carr Lake
Lake Alyssa
Summerbrook Creek
Shelly Pond
Somerset Lake
Preservation Rd
Meridian Rd
Lake Jackson
Lake Overstreet
Lake Hall
Lexington Creek
Thomasville Rd
N Monroe St
011321
011306
2329200
011288
008454
011289
010935
011337
10
Sources:
Waterbodies: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
Hydrologic Stations: NWFWMD, 2020
City Limits: COT, 2022
N
0
2,500
Feet
Lake Jackson Drainage Basin
Hydrologic Stations Map
Geosyntec consultants
CITY OF TALLAHASSEE
Exhibit
4-6
Legend
Lake Jackson Drainage Basin
Waterbodies in Study
Watercourses
Tallahassee Corporate Limits
Hydrological Data Stations
Precipitation
Precipitation and Stage
Stage
Stage and Flow



Sources:
Waterbodies: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
IWR Stations: FDEP, 2022
City Limits: COT, 2022

Lake Jackson Drainage Basin Water Quality Stations Map

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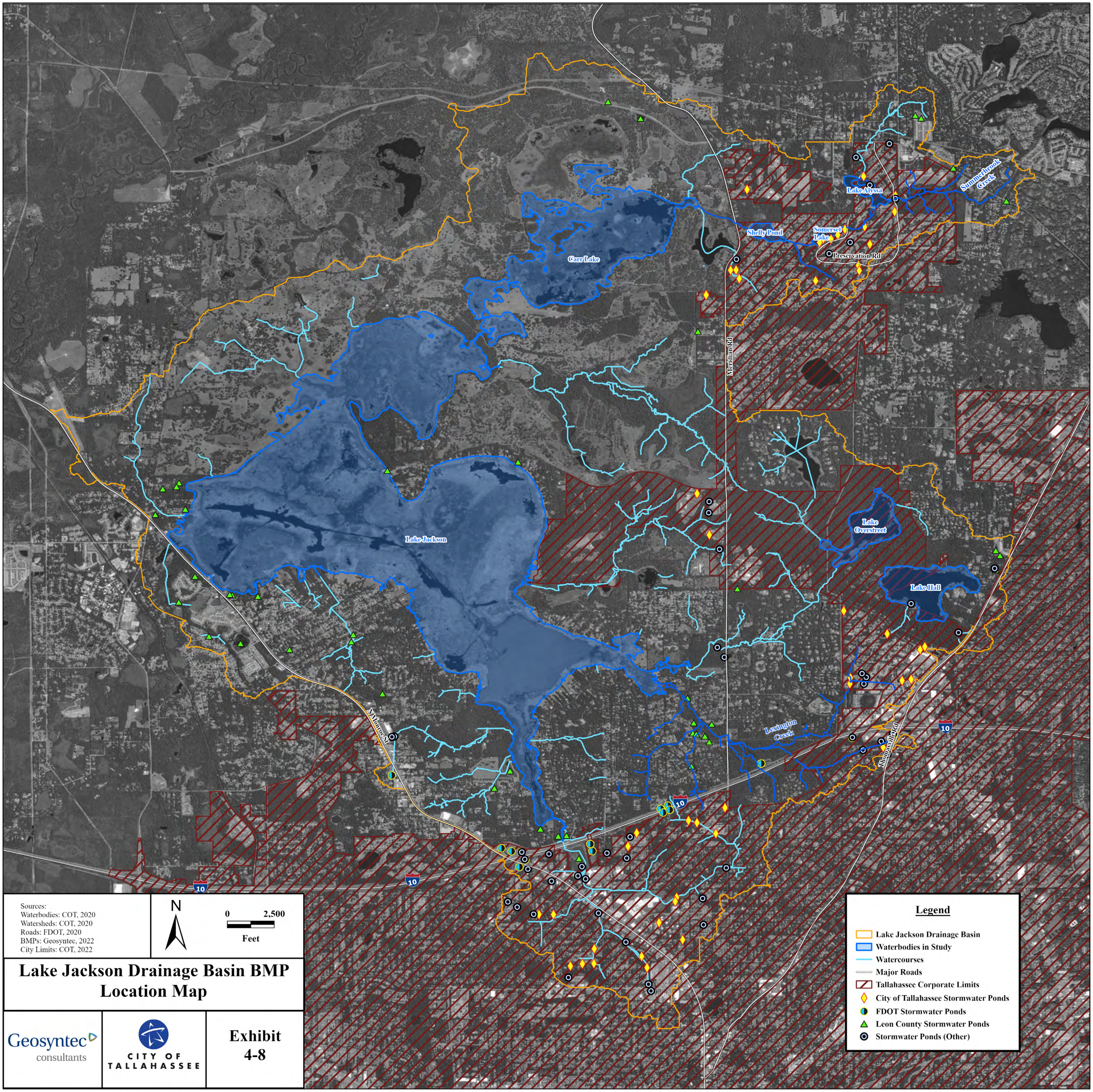
CITY OF TALLAHASSEE

Exhibit 4-7

Number	StationID	Station Name	Start of Record	End of Record	Source	Location
1	112WRD 02329200	LAKE JACKSON NR TALLAHASSEE, FLA.	1965	1981	USGS	In-Lake
2	112WRD 303025084182500	MEGGINNIS ARM NR TALLAHASSEE,FL	1981	1981	USGS	In-Lake
3	21FLBRA 582-B	582 - Lake Jackson - 400m NE of US-27 boat ramp	2006	2007	Biological Research Associates	Upstream of Lake
4	21FLBRA 582-C	582 - Lake Jackson - 100m S of dock (Jackson Cove Landing)	2006	2006	Biological Research Associates	In-Lake
5	21FLBRA 582-D	582 - Lake Jackson - 50m W of Miller's Landing boat ramp	2006	2007	Biological Research Associates	In-Lake
6	21FLBRA 582-E	582 - Lake Jackson - at US-27 boat ramp	2006	2007	Biological Research Associates	In-Lake
7	21FLBRA 582-F	582 - Lake Jackson - near MacGinnis Arms Inlet	2007	2007	Biological Research Associates	In-Lake
8	21FLBRA 582-G	582 - Lake Jackson - near connectivity to MacGinnis Arm	2007	2007	Biological Research Associates	In-Lake
9	21FLCOT LAKE JACKSON NORTH	Lake Jackson North	2017	2020	City of Tallahassee	In-Lake
10	21FLCOT LAKE JACKSON SOUTH	Lake Jackson South	2017	2020	City of Tallahassee	Upstream of Lake
11	21FLGFWF03120003-LJ-01	Lake Jackson Station 1	1996	1999	FWC	Upstream of Lake
12	21FLGFWF03120003-LJ-04	Lake Jackson Station 4	1996	1998	FWC	Upstream of Lake
13	21FLGW 36992	Z1-LL-3017 JACKSON, LAKE	2009	2009	FDEP	Upstream of Lake
14	21FLGW 37928	Z1-LL-3017R JACKSON, LAKE	2009	2009	FDEP	Upstream of Lake
15	21FLGW 38706	Z1-LL-4008 JACKSON, LAKE	2010	2010	FDEP	In-Lake
16	21FLGW 39367	Z1-LL-4008R JACKSON, LAKE	2010	2010	FDEP	In-Lake
17	21FLGW 43541	Z1-LL-7003 JACKSON, LAKE	2013	2013	FDEP	Upstream of Lake
18	21FLGW 43550	Z1-LL-7014 JACKSON, LAKE	2013	2013	FDEP	In-Lake
19	21FLGW 45472	Z1-LL-8007 JACKSON, LAKE	2014	2014	FDEP	In-Lake
20	21FLGW 45475	Z1-LL-8011 JACKSON, LAKE	2014	2014	FDEP	In-Lake
21	21FLGW 46930	Z1-LL-9016 JACKSON, LAKE	2015	2015	FDEP	In-Lake
22	21FLGW 49151	Z1-LL-10007 JACKSON, LAKE	2016	2016	FDEP	In-Lake
23	21FLGW 51073	Z1-LL-11024 JACKSON, LAKE	2017	2017	FDEP	In-Lake
24	21FLGW 53810	Z1-LL-12017 LAKE JACKSON	2018	2018	FDEP	In-Lake
25	21FLGW 55588	Z1-LL-13014 LAKE JACKSON	2019	2019	FDEP	In-Lake
26	21FLGW 9233	NWA-LL-1003 LAKE JACKSON	2000	2000	FDEP	In-Lake
27	21FLKWATLEO-JACKSON-1	LEO-JACKSON-1	2002	2019	FL LAKEWATCH	In-Lake
28	21FLKWATLEO-JACKSON-2	LEO-JACKSON-2	2002	2019	FL LAKEWATCH	In-Lake
29	21FLKWATLEO-JACKSON-3	LEO-JACKSON-3	2002	2019	FL LAKEWATCH	In-Lake
30	21FLKWATLEO-MEGINNIS-1	LEO-MEGINNIS-1	1999	2002	FL LAKEWATCH	In-Lake
31	21FLKWATLEO-MEGINNIS-2	LEO-MEGINNIS-2	1999	2002	FL LAKEWATCH	In-Lake
32	21FLKWATLEO-MEGINNIS-3	LEO-MEGINNIS-3	1999	2002	FL LAKEWATCH	In-Lake
33	21FLLEONJ143052684320	Lake Jackson	2008	2019	Leon County	In-Lake
34	21FLLEONLCLJ01304984305	Lake Jackson Meginnis Arm	2010	2019	Leon County	In-Lake
35	21FLLEONLCLJ13053384321	Lake Jackson North	2007	2007	Leon County	In-Lake
36	21FLLEONLCLJ33050684310	Lake Jackson South	2006	2019	Leon County	In-Lake
37	21FLLEONLCLJ53051384296	Lake Jackson South East	2006	2019	Leon County	In-Lake
38	21FLLEONLCLJ63053784341	Lake Jackson Mid Lake West	2007	2019	Leon County	In-Lake
39	21FLLEONLCLJ83051384307	Lake Jackson Mid South	2006	2007	Leon County	In-Lake
40	21FLMCGLJ01	Megginnis Arm Near Livingston Landing	2001	2006	McGlynn Lab	In-Lake
41	21FLMCGLJ03	Megginis Arm	1991	2006	McGlynn Lab	In-Lake
42	21FLMCGLJ05	Ford's Arm	1991	2006	McGlynn Lab	In-Lake
43	21FLMCGLJ08	Center of SE part of Lake	1991	2006	McGlynn Lab	In-Lake
44	21FLMCGLJ10	Center of Lake near Porter Hole	1991	2006	McGlynn Lab	In-Lake
45	21FLMCGLJ11	Church Cove	1991	1999	McGlynn Lab	In-Lake
46	21FLMCGLJ13	The Lake's Condo's near holding pond	1991	1999	McGlynn Lab	In-Lake
47	21FLMCGLJ14	Red and Sams	1991	1997	McGlynn Lab	In-Lake
48	21FLMCGLJ15	Near Phipps Plantation	1991	1997	McGlynn Lab	In-Lake
49	21FLMCGLJ16	Center of NW part of Lake, Very near to Lime Sink	1991	2006	McGlynn Lab	In-Lake
50	21FLMCGLJPH	Porter Hole Sink, very near J10, stream flowing into sink	1999	2000	McGlynn Lab	In-Lake
51	21FLNWFDS141	North End, Megginnis Arm	1995	1999	NWWMD	In-Lake
52	21FLNWFDS142	Pipeline, Megginnis Arm	1995	1999	NWWMD	In-Lake
53	21FLNWFDS143	Fuller Road, Megginnis Arm	1995	1999	NWWMD	In-Lake
54	21FLTLHRG1TLHR0122	Fords Arm	2020	2020	FDEP	In-Lake
55	21FLTLHRG1TLHR0123	Megginnis Arm Off Fuller Rd Ramp	2020	2020	FDEP	In-Lake
56	21FLTLHRG1TLHR0124	Megginnis Arm Off Crowder Landing	2020	2020	FDEP	In-Lake
57	21FLWQA 303026708418475	Lake Jackson at Crowder Rd landing	2001	2006	FDEP	In-Lake
58	21FLWQA 303049208417417	Lake Jackson at Rhoden Cove Landing	2001	2001	FDEP	In-Lake
59	21FLWQA 303122408419203	Lake Jackson at Porter Sink near end of Faulk Dr	2001	2001	FDEP	In-Lake
60	21FLWQA 303126808421088	Lake Jackson at boat ramp at US 27	2001	2006	FDEP	Upstream of Lake
61	21FLWQA 303143408421295	Little Lake Jackson at culvert at US 27	2001	2001	FDEP	In-Lake
62	21FLWQA 303222508419392	Lake Jackson at Miller Landing Rd	2001	2006	FDEP	In-Lake
63	21FLWQSP99LAKES09	Lake Jackson West	2009	2009	FDEP	In-Lake
64	21FLWQSPLEO09JAC01	Lake Jackson East	2009	2009	FDEP	Upstream of Lake
65	21FLWQSPLEO120US	Jackson Heights Creek At Mouth (WBID 582B)	2005	2006	FDEP	Upstream of Lake
66	21FLWQSPLEO19JAC1	Lake Jackson	2019	2019	FDEP	Upstream of Lake
67	21FLBRA 582-A	582 - Lake Jackson - W-NW section	2006	2007	Biological Research Associates	Upstream of Lake
68	21FLGFWF03120003-LJ-03	Lake Jackson Station 3	1996	1999	FWC	Upstream of Lake
69	21FLNWFDS490	Kennel Road, Upper Sunset Landing Basin	1995	1995	NWWMD	Upstream of Lake
70	21FLNWFDS491	Lake Road, Lower Sunset Landing Basin	1995	1995	NWWMD	Upstream of Lake
71	21FLNWFDS136	Starmount Drive, above John Knox Pond	1995	1996	NWWMD	Upstream of Lake
72	21FLNWFDS483	Fuller Road, Lower Okeeheepkee Basin	1995	1996	NWWMD	In-Lake
73	21FLNWFDS484	Bellwood Road, Lake Jackson Mounds	1995	1996	NWWMD	In-Lake
74	21FLNWFDS485	Indian Mound State Park	1995	1996	NWWMD	In-Lake
75	21FLWQA 303006508419264	Butlers Mill Creek at end of Bellwood Dr	2001	2001	FDEP	Upstream of Lake
76	21FLWQA 303139908417356	Meridian Creek UPS small lake	2001	2001	FDEP	Upstream of Lake
77	21FLWQA 303159408421354	Sunset Creek at Lake Dr	2001	2001	FDEP	Upstream of Lake
78	21FLBRA 809-A	809 - Megginnis Arm Run - W of Movies 8	2006	2006	Biological Research Associates	Upstream of Lake
79	21FLBRA 809-B	809 - Megginnis Arm Run - at Allen Road	2006	2006	Biological Research Associates	Upstream of Lake
80	21FLBRA 809-D	809 - Megginnis Arm Run - South of Sharer Rd.	2006	2006	Biological Research Associates	Upstream of Lake
81	21FLWQA 302843308417484	Meginnis Creek at Sharer Rd	2006	2006	FDEP	In-Lake
82	21FLWQA 302937008418410	Okeeheepkee Creek at Fuller Rd	2001	2006	FDEP	Upstream of Lake
83	21FLWQA 303048608416389	Overstreet Trib at Meridian Rd (SR 155)	2001	2006	FDEP	In-Lake
84	21FLWQSPLEO124US	Overstreet Trib At Meridian Rd (SR 155) (WBID 689)	2005	2006	FDEP	In-Lake
85	21FLBRA 689-A	689 - Lake Overstreet Drain - at Meridian Rd.	2006	2007	Biological Research Associates	In-Lake
86	21FLBRA 689-B	689 - Lake Overstreet Drain - At West Bobbin Brook	2006	2007	Biological Research Associates	In-Lake
87	21FLPNS 302937008418410	Okeeheepkee Creek At Fuller Rd (also 21FLWQA)	2011	2011	FDEP	Upstream of Lake
88	21FLPNS 809-A	Megginnis Arm Run - W Of Movies 8 (also 21FLBRA)	2011	2012	FDEP	In-Lake
89	21FLWQA G1WA0033	Megginnis Arm Run Downstream of Sharer	2016	2018	FDEP	Upstream of Lake
90	21FLCOT LJB01	LJB01	2015	2020	City of Tallahassee	In-Lake
91	21FLTLHRG1TLHR0069	Lake Overstreet Drain @ N Meridian Rd	2017	2020	FDEP	Upstream of Lake
92	21FLTLHRG1TLHR0126	Butlers Mill Creek Upstream Of Dorris Dr	2020	2020	FDEP	In-Lake
93	21FLTLHRG1TLHR0127	Okeeheepkee Creek Above Park	2020	2020	FDEP	In-Lake
94	21FLTLHRG1TLHR0128	Megginnis Arm Run Downstream of Sharer Rd	2020	2020	FDEP	In-Lake
95	21FLWQA 303131708420095	Jackson Heights Creek at mouth	2001	2001	FDEP	Upstream of Lake
96	21FLLEONLCLJ3051984334	Jackson Heights Creek	2006	2019	Leon County	In-Lake



Lake Jackson Drainage Basin BMP Location Map

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CITY OF TALLAHASSEE

Exhibit 4-8