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STATUS AND TRENDS IN WATER QUALITY AT SELECTED SITES IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

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STATUS AND TRENDS IN WATER QUALITY AT SELECTED SITES IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

by

Steve Winkler
and
Aisa Ceric

St. Johns River Water Management District
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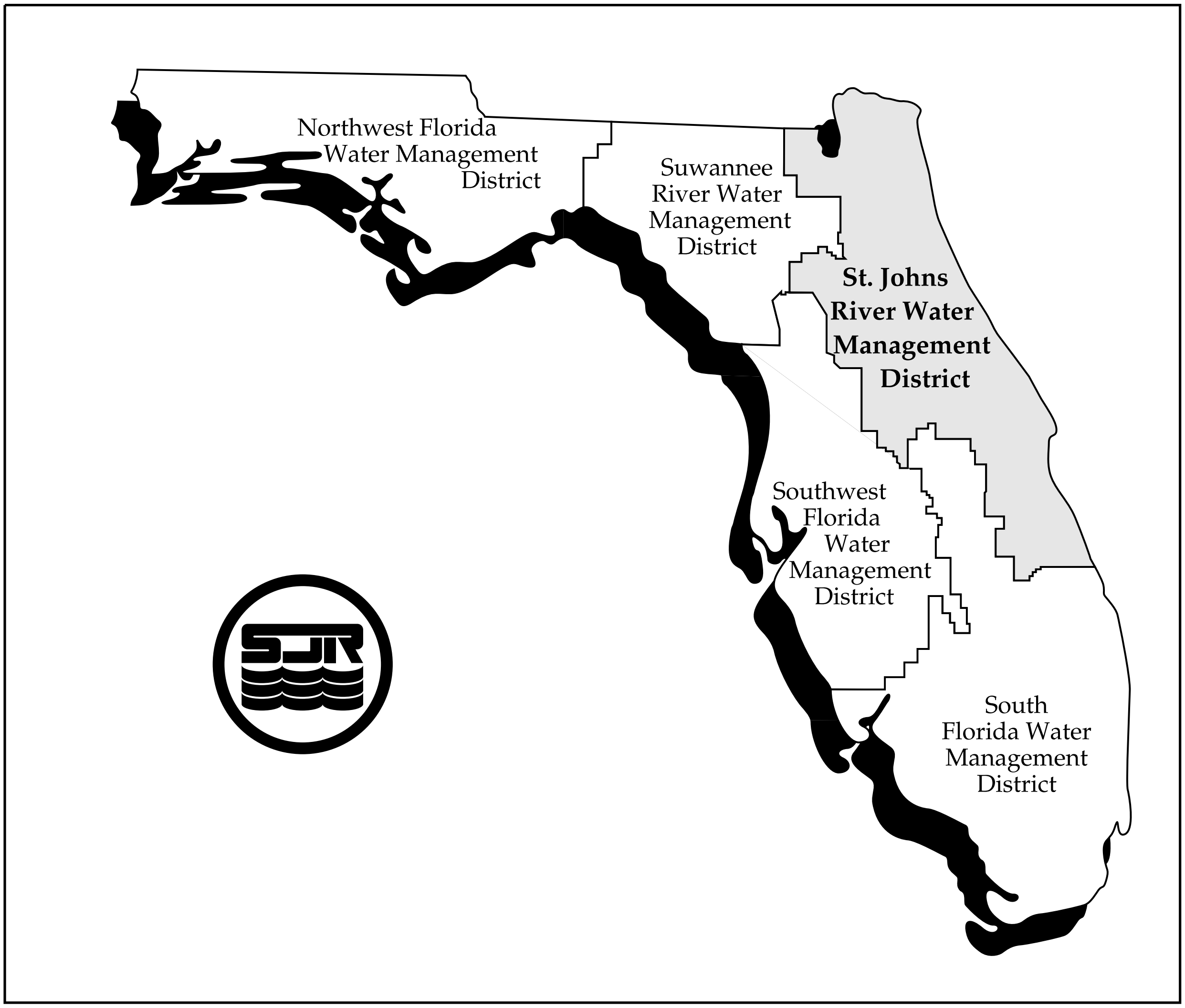

The St. Johns River Water Management District (SJRWMD) was created by the Florida Legislature in 1972 to be one of five water management districts in Florida. It includes all or part of 18 counties in northeast Florida. The mission of SJRWMD is to ensure the sustainable use and protection of water resources for the benefit of the people of the District and the state of Florida. SJRWMD accomplishes its mission through regulation; applied research; assistance to federal, state, and local governments; operation and maintenance of water control works; and land acquisition and management.

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Library
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Palatka, FL 32178-1429

Phone: (386) 329-4132

EXECUTIVE SUMMARY

The St. Johns River Water Management District (SJRWMD) was created by the Florida Legislature in 1972 as one of five water management districts in Florida and comprises all or parts of 18 counties in northeast and east-central Florida. SJRWMD's mission is to manage water resources to ensure their continued availability while maximizing environmental and economic benefits. SJRWMD accomplishes its mission through regulation, applied research, assistance to federal, state, and local governments, operation and maintenance of water control works, and land acquisition and management.

Ambient water quality data for a variety of water body sampling sites within SJRWMD were compiled and analyzed in order to evaluate status and trends. Status results indicate whether water quality at a particular site is good, fair, or poor, while trend results indicate whether water quality is improving or degrading. Spring and stream sites were evaluated using a water quality index; lake and estuarine sites were evaluated using a trophic state index. The water quality index incorporates nutrients, physical constituents, and bacteria, while the trophic state index incorporates nutrients and chlorophyll. Many water bodies lacked sufficient data for either a status or a trend assessment. Those sites that had sufficient data had historically been sampled on a regular basis. Most of the sites in SJRWMD exhibited good or fair water quality, although some sites were degrading. Forty percent of the sites assessed districtwide had good water quality, 42% had fair quality, and 18% had poor quality. Thirty-seven percent did not have enough data to calculate a trend, while 42% had a statistically insignificant trend. More sites were degrading (13%) than were improving (8%). This study did not consider what factors were responsible for the trends found.

CONTENTS

FIGURES

TABLES

INTRODUCTION

The St. Johns River Water Management District (SJRWMD) is one of five legislatively established water management districts in Florida. SJRWMD comprises approximately 12,600 square miles in northeast and east-central Florida and includes all or part of 18[1] counties (Map 1). Forest and wetlands comprise over 50% of the land cover, with urban and suburban development, agriculture, and rangeland covering most of the rest. Surface waters comprise slightly more than 9% of the SJRWMD area (Map 2). Although most of the area soils are highly permeable sands, organic soils or clays can be found in lowlands or wetlands. Urban and suburban development constitute a growing force for change in the Florida landscape. The current population of 3.5 million (Map 3) is expected to exceed 5 million by 2020 (Vergara 2000). Most of the population is concentrated in the major urban areas, such as Jacksonville, Orlando, Gainesville, Ocala, and a string of cities along the coast from St. Augustine to Vero Beach. Tourism, agriculture, silviculture, and paper manufacturing are just a few of the many economic activities that impact water resources within SJRWMD.

SJRWMD was divided into 10 hydrologic units or major surface water basins to facilitate the planning and management of surface waters (Map 4; Adamus et al. 1997). The surface water basins are subdivisions of hydrologic units established by the U.S. Geological Survey.

The St. Johns River and its main tributary, the Ocklawaha River, drain approximately 75% of the central SJRWMD area. The St. Johns River flows through four of the 10 major basins: the Upper St. Johns River Basin, the Middle St. Johns River Basin, Lake George Basin, and the Lower St. Johns River Basin. The headwaters of the St. Johns River are located in the marshes west of Vero Beach. The river flows northward approximately 310 miles to its mouth east of Jacksonville, and drops about 25 feet over that distance, for an average slope of 0.08 feet per mile (Morris 1995). Because of the very low gradient, tidal effects occasionally extend about 100 miles upstream. The entire St. Johns River, except for the Lake Washington dam and points south (which are Class 1 water bodies), is designated as a Class 3 water by the Florida Department of Environmental Protection (FDEP) for recreation, propagation, and maintenance

[1]As of July 1, 2003, the portion of the St. Johns River Water Management District that was in Polk County became part of the Southwest Florida Water Management District.

of fish and wildlife. Several large lakes are found along the St. Johns River, including Lake George, Florida's second largest lake after Lake Okeechobee.

East of the Upper St. Johns River Basin lies the Indian River Lagoon Basin. The Indian River, the Banana River, and the Mosquito Lagoon are all within the Indian River Lagoon Basin. Farther north lies the Northern Coastal Basin, which contains the Intracoastal Waterway (ICW) and its tributaries from Ponce de Leon Inlet to northern St. Johns County.

The Ocklawaha River Basin lies west of the St. Johns River. The primary surface water features located in the Ocklawaha River Basin are Lakes Apopka, Harris, Dora, Eustis, Yale, and Griffin.

The Nassau River Basin and the St. Marys River Basin lie north of the St. Johns River and drain most of SJRWMD's northern area. The Nassau River flows eastward to form part of the boundary between Nassau and Duval counties. The St. Marys River, with more than one-third of its contributing drainage area in Georgia, defines the boundary between Florida and Georgia for almost the entire length of the river. The land adjoining these two rivers is predominantly forested and is among the most pristine areas of SJRWMD.

Water quality districtwide was last assessed in 2000 as part of the *District Water Management Plan* (Vergara 2000). This assessment is a continuation of that effort and was undertaken to characterize the current status of and trends in water quality for water bodies districtwide. One hundred fifty-eight water quality monitoring sites located in lakes, estuaries, streams, and springs were selected to represent ambient water quality conditions for the assessment (Map 5). Sampling sites were selected to provide a representative cross section of the region, with respect to surrounding land use patterns and the types of water bodies monitored. Many of the monitoring sites were part of the districtwide ambient monitoring network and were sampled bimonthly. Other sites were part of basin-specific study areas, and the sampling frequency was often higher or lower than the ambient network frequency. Relevant water quality constituent values were obtained and compiled for the assessment. Characterization of these water bodies will allow SJRWMD to identify problem areas and to evaluate the success of remedial or mitigation efforts.

WATER QUALITY

The phrase “water quality” is often used to describe how “good” the water in question is. Arguably, a sample of pure water has the best water quality that could be found. Of course, such water does not naturally occur in surface waters. Surface waters act as a solvent for salts and other compounds, which may originate from sediments, shorelines, or precipitation. Surface waters can also transport sediments, suspended solids, contaminants from parking lots, fertilized lawns, and other surfaces to receiving waters, resulting in nonpoint source pollution. The fact that surface waters contain a multitude of substances means that defining “good” water quality can be problematic.

Nevertheless, in this assessment, water quality generally refers to the amount of impurities in the water. Generally, the fewer impurities in the water, the better the water quality. Most biologists believe there are concentrations of substances above which harmful or undesirable effects on plants and animals may occur. Such effects are generally regarded as undesirable for a number of reasons. For example, high nutrient concentrations in the water can lead to undesirable levels of algal growth, which ultimately contribute to lower dissolved oxygen in the water column, and can result in fish kills. Biologists in general have agreed on concentrations of nutrients which may be considered excessive, and such concentrations are reflected in the trophic state index, a measure of water quality. Similar limits have been established by statute, resulting in water quality standards. Standards represent concentrations of substances above or below which (depending on the water quality constituent) negative effects on animal and plant health can be expected to occur. In this report, poor water quality when used in reference to a lake or an estuary means water that is considered to have an unhealthy concentration of nutrients or chlorophyll *a*, or both. When used in reference to streams, blackwater streams, or springs, poor water quality refers to water considered to have unhealthy concentrations or levels of dissolved oxygen, turbidity, total suspended solids, total organic carbon, total coliform bacteria, fecal coliform bacteria, nutrients, or a combination of these.

Since only the aforementioned constituents were used in this assessment, there are at least two important caveats to interpreting the results. Primarily, good or fair status doesn’t eliminate the possibility that there are other pollutants of concern. For example, none of the samples evaluated for this analysis were ever tested for pesticides. Secondly, none of these results should be used to determine whether a water body meets its designated use, as defined by FDEP. Under the impaired waters rule, FDEP has developed an official methodology for analyzing water quality data to determine whether a water body meets its designated use. This report is not intended as a substitute for that methodology or process, but rather as a general overview of water quality throughout SJRWMD.

WATER QUALITY STATUS AND TRENDS

The overall approach to assessing status and trends in surface water quality was to use a trophic state index (TSI) and a water quality index (WQI). Indices are useful because they allow several different water quality characteristics to be combined into a single number. A TSI was used for lakes and estuaries (Huber et al. 1982) and was based on concentrations of chlorophyll *a*, total phosphorus, and total nitrogen. The TSI was developed primarily as a way of classifying lakes according to their eutrophication potential. Lakes with high TSI values are generally considered to be eutrophic.

A WQI was used for streams, blackwater streams, and springs. The WQI provides a way of "standardizing" water quality values taken across a broad spectrum of water quality parameters, all of which may use different measurement scales. The WQI is based on concentrations of total suspended solids, dissolved oxygen, total organic carbon, total and fecal coliform bacteria, total phosphorus, total nitrogen, total nitrate / nitrite, and levels of turbidity. Water bodies with a high WQI are considered to have poor water quality.

Water body status was rated as good, fair, or poor based on the median of annual seasonal median TSI or WQI calculated using data reported for the 5-year period from 1997 to 2001. Trends were based on seasonal median values of the TSI or the WQI, calculated from data reported for the 15-year period from 1987 to 2001. At least 10 years of data from the 15-year period were required in order to calculate a trend. Water body sites were rated as improving, degrading, or stable, if the trend was statistically significant ($p \leq 0.10$). Many water bodies had insufficient data to calculate trends, and many more had insignificant trends ($p > 0.10$).

METHODS

SAMPLE COLLECTION

Water quality samples were collected using standard techniques (SJRWMD 1999). Most of the samples were grab samples, which were obtained when the sampler physically placed a sample bottle in the water at 0.5-meter depth in an inverted position, then righted the bottle to fill it. Samples were also collected using a Van Dorn sampler, when appropriate. Samples were preserved, placed on ice, and shipped to the analytical laboratory for analysis.

DATA COMPILATION

Water quality data from 158 ambient stations were compiled into a SAS dataset. All of the data came from in-house project databases, which were decentralized and locally accessed. Although a large number of constituents was available, the indices only required those listed in Table 1. The SJRWMD laboratory analyzed many of the samples; many others were analyzed by contracted laboratories.

Sample Depth

Since most sampling stations did not have profile data, values from depths greater than 1 meter were excluded.

Comment Codes

Field samplers often associate letter codes with data to indicate the type (e.g., ambient, experimental) of sample obtained and its depth. This information was used to help determine whether or not the data could be used (Table 2).

Samples that had no sample code associated with them were assumed to be ambient. In addition, analytical laboratories also used letter codes to qualify the data. Table 3 lists those qualifier codes considered acceptable for the analysis.

A sample with no associated remark code was assumed to be a valid, useful data point.

Table 1. Water quality analytes used in the assessment

Analyte	Unit	STORET Code*
Chlorophyll *a*	µg/L	32210
Dissolved oxygen	mg/L	299
Fecal coliforms	#/100 mL colony forming units	31616
Total nitrate/nitrite	mg/L as N	630
Dissolved nitrate/nitrite	mg/L as N	631
Total coliforms	#/100 mL colony forming units	31505
Total Kjeldahl nitrogen	mg/L	625
Total nitrogen	mg/L as N	600
Total organic carbon	mg/L as C	680
Total phosphorus	mg/L as P	665
Total suspended solids	mg/L	530
Turbidity	Nephelometric turbidity units (NTU)	82079

Note: µg/L = micrograms per liter
mg/L = milligrams per liter
mL = milliliter

*STORET code is an EPA STORET database analyte identification number.

Table 2. Acceptable data sample codes

Sample Code	Description
A	Ambient sample
AP1	Ambient sample from 1-meter depth
AS	Ambient split sample
GRAB	Grab sample
P	Surface profile sample
P00.00	Surface profile at 0 meters
P00.50	Profile sample at 0.5 meter
P01, P01.00	Surface profile at 1 meter
T, T01, T02, T03	Transect samples 1 to 3

Table 3. Acceptable data qualifier codes

Data Code	Description
1	Over 20% cv-trophic, es remark code
2	Dissolved greater than total
3	Constituents greater than total
3K	Combination
A	Average of two or more samples
G	Maximum of two or more determinations
K	Actual value is known to be less than value given
L	Actual value is known to be higher than value given
M	Presence of material verified but not quantified
N	Presumptive evidence of presence of material
Q	Sample held beyond accepted holding time
Q1-5	Sample held 1–5 days beyond accepted holding time
T	Value reported is less than lab detection limit
T Q	Combination
T T	Error, but still a t
TQ1-4	Combination; specifies 1–4 days past holding time
U	Material analyzed for but not detected
UQ1-5	Combination; out of holding time 1–5 days
V	Analyte detected in blank and sample at > 2x MDL (replaced by < code)
W	Value is less than lowest reportable under the t code
W Q	Combination
WQ2	Combination

Data Combination

Certain sampling stations and station names were evaluated in addition to comment codes. Over the years, some stations had been discontinued, but were then re-sampled again under a different station name. In addition, multiple stations currently sampled that were located at the same site were identified. Such stations' data were combined (Table 4). Also, the associated dates of collection for some stations were known to be incorrect, and these were not used in the analysis.

Table 4. Available site names for selected ambient sites

Site Location	Available Site Names
Hatchet Creek at SR 26	02240800, HAT26
St. Johns River at SR 16	PI54, SJSR16
Ocklawaha River at Highway 21	20020404, OR006
Lake Eustis	EUS, 20020368
Wolf Creek at SR 419 bridge	NWOLF, USJ918
Orange Lake	OLK, OLC
Lake Griffin	LGC, 20020381
Haines Creek at Lisbon	DEPHCB, 02238000
St. Johns River at Palatka	PA32, SJP
St. Johns River at Buffalo Bluff	BB22, SRB
St. Johns River at Racy Point	FP44, SRP
Bivens Arm Lake	OR908, BIVARM
Hogtown Creek at SW 2nd Avenue	HOG30, HOGSW2ND
Little Lake Harris	LLHARRIS, LHAR
Holiday Springs	HOLSPA, HOLIDSPG
Lake Harris	20020377, HAR
Lake Yale	20020371, LYC
St. Johns River near Picolata	SJWSIL, PI52, SJCM25

Period of Record

For this assessment, trends required at least 10 years of data reported during the last 15 years. Thus, any data in the record prior to January 1, 1987, were excluded. Status results were based on the most recent 5 years of data, which means data reported since January 1, 1997.

Additional Data Checks

Values that were missing or greater than 88000 were excluded, because in some databases, 88888.888 indicated a null value. Any data values deemed erroneous after an in-house data review by database managers were excluded. Finally, the daily mean for any duplicate constituent values was calculated so that no more than one constituent value would appear for any given day.

Outlier Analysis

Outliers are data values that lie far outside the normal range of values for a particular constituent and station. Outliers were screened using a simple range checking procedure modified from a 'hinge method' (Hoaglin et al. 1983). In order to derive the acceptable range, a dataset for each site and constituent was compiled. For datasets with at least six values, the 25th percentile (p25), 75th percentile (p75) and interquartile range (IQR) were calculated. A low and a high range limit were calculated according to the following equations:

$$\textit{high range limit} = p75 + (IQR*10)$$
$$\textit{low range limit} = p25 - (IQR*10)$$

Outliers were rejected if they exceeded either range limit. Any pH values less than 0 or greater than 14 were also excluded.

WATER BODY CATEGORIZATION

Water bodies were grouped into one of five different categories for this assessment (Map 5). Categorization was important, as it would determine which index would be used. The TSI was applied only to lakes and estuaries, while the WQI was applied to streams, blackwater streams, and springs. A blackwater stream differs from a stream in that it has acidic, highly colored, slow-moving waters, typically drains flatwoods or swamps, and is not biologically very productive (Hand et al. 2000). It wasn't always obvious which category applied to a given site.

Some of the sites had a number code indicating whether they were a lake or a stream. However, many sites were not labeled in any way, and these were assigned a lake or stream designation based on their location. Further evaluation of the sample site data provided guidance as to whether a lake or stream site should actually be considered estuarine or whether a stream site should be considered as a blackwater stream site.

Further data evaluation meant that the median of annual median values for color, pH, conductivity, and chlorides was calculated and a new water body category assigned. For example, stream and lake sites were evaluated to determine whether they should actually be considered as estuarine sites. If the median of annual median conductivity was greater than 5,000 micromhos per centimeter or the median of annual median chloride was greater than 1,500 milligrams per liter (mg/L), then the lake or stream was evaluated as an estuary. These cutoff values are used to differentiate freshwaters from marine waters in the Florida Water Quality Standards (Chapter 62-302, *Florida Administrative Code* [*F.A.C.*]; see also FDEP 1996). Also, the median of annual median color and pH were calculated for streams, and if the color was greater than 275 PCU and the pH was less than 6, the stream was re-categorized as a blackwater stream (FDEP 1996). The final results of the categorization process were reviewed by various basin experts. If they determined, based on vegetation, benthic organism assemblage, and professional opinion, that a water body category should be re-categorized, it was. For example, many St. Johns River sites north of Green Cove Springs were originally analyzed as lakes, but after a review by basin experts, the sites were reanalyzed as estuarine sites.

TOTAL NITROGEN

Both the TSI and the WQI incorporate total nitrogen. Unfortunately, total nitrogen was rarely measured for most of the sites. Ammonia, total Kjeldahl nitrogen (TKN), and total nitrate / nitrite (NOx) were usually available. TKN and total NOx were summed for an estimate of total nitrogen. If total NOx was missing, then dissolved NOx was used in its place, if it was available. If TKN was missing, total nitrogen was not calculated, since TKN comprises most of the TN for these water bodies.

INDICES

Water quality was assessed using indices. Indices provide a convenient way of evaluating a number of different water quality measurements. Although individual constituents could be evaluated, it can be difficult to interpret results. For example, an examination of nutrients at a site may reveal an increasing trend in total phosphorus concentration and a decreasing trend in total nitrogen concentration. Such results make it difficult to summarize water quality conditions. An index can be helpful in overcoming this type of problem. The two indices used in this assessment were a trophic state index for lakes and estuaries and a water quality index for streams, blackwater streams, and springs. These indices are primarily based on indices used in the FDEP 305b reporting process (FDEP 1996). However, others have used indices as well (Cude 2001; Stambuk-Giljanovic 1999). In Oregon, temperature, dissolved oxygen, biological oxygen demand, pH, ammonia, nitrate, total phosphorus, total solids, and fecal coliforms were all combined into the Oregon Water Quality Index (OWQI). The purpose of the index was to provide a simple and concise method for expressing the ambient water quality of Oregon's streams. According to Cude (2001), the OWQI improves comprehension of general water quality issues, communicates water quality status, and illustrates the need for and effectiveness of protective practices. However, the OWQI cannot be used to determine the quality of water for specific uses, nor should it be used to provide information about water quality without considering all appropriate chemical, biological, and physical data, as well as all health hazards.

Trophic State Index

The TSI was originally developed by Carlson (1977). FDEP was interested in using TSI methodology to characterize lake quality throughout Florida. In a study commissioned by FDEP, Brezonik (1976) pointed out that a TSI would be helpful in conveying lake quality information to the public and it would also be useful in comparing overall trophic conditions between lakes. Also, a TSI could help scientists evaluate the direction and rate of trophic change, and it could be used to develop empirical models of trophic conditions as functions of watershed "enrichment" factors. In other words, an index would be useful in evaluating cultural eutrophication. Indicators that change with eutrophication include total nitrogen (TN), total phosphorus (TP), chlorophyll *a*, conductivity, total dissolved solids, dissolved oxygen, and Secchi depth, and some or all of these should be included in a TSI. Since primary productivity results in eutrophication and primary productivity correlates well with chlorophyll *a* and nutrients, an index can be based on nutrients and chlorophyll *a*. Such an index was developed for Florida lakes (Huber et al. 1982) and is the index used in this assessment, with some modifications. Under the original index, a lake is considered to be impaired if the Secchi depth is less than 1 meter, chlorophyll is greater than 20 micrograms per liter (µg/L), total phosphorus is greater than 50 µg/L, or total nitrogen is greater than 1 mg/L (Table 5). So, a TSI of 60 or higher would generally indicate poor water quality. Estuaries were also evaluated using the TSI, but the comparison scale is 10 points lower than that for lakes (FDEP 1996).

Although the TSI was originally calculated using chlorophyll *a*, TN, TP, and Secchi depth, the Secchi depth was not used in this assessment due to the fact that many Florida waters are naturally dark from blackwater stream inputs (FDEP 1996). As a result, low Secchi measurements may not necessarily indicate eutrophic conditions.

Table 5. Concentration limits for key nutrients and chlorophyll *a* in lakes

Parameter	Problem Level	Corresponding TSI
Secchi depth	<1 meter	60
Chlorophyll *a*	>20 µg/L	60
Total phosphorus	>50 µg/L	69
Total nitrogen	>1 mg/L	60

Note: µg/L = micrograms per liter
mg/L = milligrams per liter
TSI = trophic state index

Source: Huber et al. 1982

The equations used in this assessment are therefore based only on TP, TN, and chlorophyll *a*. Overall TSI for a given water body site was determined by averaging results from these constituent-based TSI equations (see Huber et al. 1982).

The chlorophyll trophic state index (TSIchl) was used for all lakes and estuaries where chlorophyll data were available. The equation is

$$TSIchl = 16.8 + 14.4 * \log(chl\_a) \qquad \text{(uncorrected chlorophyll a)}$$

Nutrient TSI equations were also used, and in fact, no overall TSI was calculated unless TN and TP were available. A TN/TP ratio was calculated to determine whether the lake was phosphorus-limited, nitrogen-limited, or neither. The TN/TP ratio was calculated using the median of annual median TN and TP for each lake or estuary. If the ratio was less than 10, then the lake was considered to be nitrogen-limited. In that case, the overall TSI was based on the average of the TSIchl and the TSItnn:

$$TSItnn = 10*(5.96+2.15*\log(TN)) \qquad \text{(TN as mg/L N)}$$

If the ratio was greater than 30, then the lake was phosphorus-limited and the overall TSI was based on the average of TSIchl and TSItpp:

$$TSItpp = 10*(1.86*\log(TP*(1000) - 2.38) \qquad \text{(TP as } \mu\text{g/L P)}$$

The TP was multiplied by 1000 to convert the mg/L reported by the lab to μg/L, as required for the equation. Finally, if the ratio was between 10 and 30, then an average of two nutrient TSI equations was calculated, and then the overall TSI was the average of that result and TSIchl:

$$TSItp = 10\ (1.86*log(TP*(1000) – 1.84)$$
$$TSItn = 10(5.6+1.98log(TN))$$

An overall TSI was calculated at each site on each day where sufficient data existed for the calculation. In other words, daily raw nutrient and chlorophyll *a* data were converted to a daily TSI and all further calculations incorporated the daily TSI.

One problem encountered when using raw daily data in the TSI equations was that negative results were occasionally reported by the analytical laboratory. Negative numbers occur when the laboratory gets results that are less than zero on the analytical machine’s calibration curve. Since negative numbers aren’t defined in the logarithmic terms of the equations, SAS produces a missing result when attempting such a calculation. The missing result was set to 0 in these cases to avoid losing data points that reflect low concentrations of TP, TN, or chlorophyll *a*.

Water Quality Index

The WQI used in this assessment was originally based on a U.S. Environmental Protection Agency (EPA) STORET product produced by Ray Peterson (EPA Region X) in 1980. FDEP modified the index and then correlated the “new” Florida WQI with Peterson’s EPA National Profiles Index (NPI). The EPA NPI combined dissolved oxygen, pH, bacteria, nutrients, turbidity, and inorganic and organic toxics into a single index ranging from 0 to 100. Index values less than 30 indicated good water quality, those between 30 and 60 indicated fair quality, and over 60 indicated poor quality. The index values were based on water quality criteria curves, which were a synthesis of national criteria, state standards, literature values, and professional judgment (Wenzel and McVety 1986). When FDEP correlated the Florida WQI with the EPA index, the cutoff ranges moved slightly. Thus, for the Florida WQI, index values less than 45 were considered good quality, those between 45 and 60 were fair quality, and those over 60 were considered poor quality.

The underlying concept behind the WQI is that different constituents contribute to water quality and these constituents can be grouped into appropriate classes. The following equally weighted constituent classes comprise the WQI: water clarity, dissolved oxygen, oxygen-demanding substances, nutrients, bacteria, and macroinvertebrate diversity (Table 6). In order to derive the overall WQI for a site, an index value for each class must first be calculated. In order to calculate an index value for each class, the constituent raw data within each class was first converted to a percentile value. The mean of all such percentile values within each class became the index value for that class. For example, to determine an index value for the water clarity class, both a turbidity and a total suspended solids raw data value were converted to a percentile. The mean of the two percentiles became the index value for the water clarity component of the WQI for a given day.

Table 6. Florida water quality index classes

Class	Constituents
Water clarity	Turbidity, total suspended solids
Dissolved oxygen	Dissolved oxygen
Oxygen-demanding substances	Total organic carbon, biochemical oxygen demand, chemical oxygen demand
Nutrients	Total nitrogen, total phosphorus, nitrate and nitrite
Bacteria	Total coliforms and fecal coliforms
Macroinvertebrate diversity	Natural substrate, artificial substrate, Beck's biotic index

An overall daily WQI was calculated as an average of all classes for which data were available. Although the overall WQI could be based on a single class, the index becomes more representative as more classes are present. For this assessment, at least two classes were required in order to calculate an overall WQI.

In order to use the cutoff values associated with the Florida WQI, SJRWMD data needed conversion to the same percentile distribution used by FDEP. In order to determine the appropriate percentiles, Minitab® was used to determine a best-fit regression for each constituent using data points found in Table 2-5 of the 1996 FDEP 305b report (see Table 7).

SJRWMD data were adjusted to fit the FDEP distribution as shown in Table 7, so that the qualitative cutoff points for poor, fair, and good water quality could be applied. Basically, the regression provides a rough estimate of the cumulative distribution function for each constituent. In some cases, log transformed data from Table 7 provided the best-fit equation. All equations had minima and maxima, so limits were put on the upper and lower ranges of input values (not unprecedented; see Cude 2001). The following equations were used:

Table 7. Percentile distribution of 1996 FDEP ambient water quality data

Parameter	Unit	P10	P20	P30	P40	P50	P60	P70	P80	P90
Turbidity	JTU	1.5	3	4	4.5	5.2	8.8	12.2	16.5	21
TSS	mg/L	2	3	4	5.5	6.5	9.5	12.5	18	26.5
DO	mg/L	8	7.3	6.7	6.3	5.8	5.3	4.8	4.	3.1
BOD	mg/L	0.8	1	1.1	1.3	1.5	1.9	2.3	3.3	5.1
COD	mg/L	16	24	32	38	46	58	72	102	146
TOC	mg/L	5	7	9.5	12	14	17.5	21	27.5	37
TN	mg/L	0.55	0.75	0.9	1	1.2	1.4	1.6	2	2.7
NOx	mg/L	0.01	0.03	0.05	0.07	0.10	0.14	.20	0.32	0.64
TP	mg/L	0.02	0.03	0.05	0.07	0.09	0.16	0.24	0.46	0.89
Total coliform	#/100 mL	100	150	250	425	600	1,100	1,600	3,700	7,600
Fecal coliform	#/100 mL	10	20	35	55	75	135	190	470	960

Note: BOD = biochemical oxygen demand
COD = chemical oxygen demand
DO = dissolved oxygen
JTU = Jackson turbidity unit
NOx = nitrate and nitrite
TN = total nitrogen
TOC = total organic carbon
TP = total phosphorus
TSS = total suspended solids

Dissolved oxygen

$DO_{index} = 0.657360*(value^3) - 11.8029*(value^2) + 50.0321*value + 28.2168$
for values < 2.8, the index = 90, and for values > 9.2, the index = 1; $r^2 = 99.9$;
r^2 adj. = 99.8

Total suspended solids

$TSS_{index} = 0.0105882*(value^3) - 0.612914*(value^2) + 12.6748*value - 12.3346$
for values < 1.0229, the index = 0, and for values > 29.5, the index = 100;
$r^2 = 99.7$; r^2 adj. = 99.6

Total nitrogen

$TN_{index} = -1.26550*(value^3) - 11.5127*(value^2) + 86.7858*value - 35.7678$
for values < 0.43895, the index = 0, and for values > 2.7, the index = 90; $r^2 = 99.6$;
r^2 adj. = 99.4

Nitrite and nitrate

$NOx_{index} = 1200.32*(value^3) - 1464.71*(value^2) + 579.148*value + 4.66934$
for values < 0.00058, the index = 5, and for values > 0.68535, the index = 100;
$r^2 = 99.9$; r^2 adj. = 99.8

Total phosphorus

$TP_{index} = -8.01647*(log10(value))^3 - 31.0489*(log10(value))^2 + 17.9150*log10(value) + 90.4962$
for values > 1.85, the index = 93, and for values < 0.012975, the index = 0;
$r^2 = 99.7$; r^2 adj. = 99.5

Total organic carbon

$TOC_{index} = 0.0007096*value^3 - 0.119937*value^2 + 6.42497*value - 19.6830$
for values < 3.2579, the index = 0, and for values > 44, the index = 91; $r^2 = 99.9$;
r^2 adj. = 99.8

Total coliform

$TC_{index} = -4.17749*(\log10(value))^3 + 29.5153*(\log10(value))^2 - 19.4043*\log10(value) - 35.4442$
for values < 60, the index = 0, and for values > 23000, the index = 95; $r^2 = 99.8$; r^2 adj. = 99.7

Fecal coliform

$FC_{index} = -10.8087*(\log10(value))^3 + 59.9267*(\log10(value))^2 - 59.4367*\log10(value) + 19.8947$
for values < 3.9, the index = 3, and for values > 1250, the index = 90; $r^2 = 99.6$; r^2 adj. = 99.4

Turbidity

$Turbidity_{index} = 0.0202426*value^3 - 0.894427value^2 + 14.7368*value - 12.0948$
for values < 0.86528, the index = 0, and for values > 23.003, the index = 100; $r^2 = 98.4$; r^2 adj. = 97.4

Using these equations, a percentile (index value) was calculated that relates the concentration of a constituent to the distribution used by FDEP and for which the cutoff values are relevant.

The constituents were then assigned to their proper class (Table 6). However, depending on the type of water body, the class did not always contain the same group of constituents (Table 8). For example, the water clarity class has total suspended solids and turbidity in it, and is used for all waters. However, the dissolved oxygen class is used only for streams, since springs and blackwater streams are naturally low in dissolved oxygen (FDEP 1996). Including the dissolved oxygen class in blackwater streams and springs would inappropriately increase the overall index for those types of water bodies, making them appear worse than they actually are. Similarly, total organic carbon was not used for blackwater streams, since they have naturally high concentrations of total organic carbon (FDEP 1996).

Although total phosphorus was used for all water body types, total nitrogen was used only for streams, while nitrate/nitrite was used only for blackwater streams and springs. Total nitrogen is comprised of both organic nitrogen (TKN) and inorganic nitrogen (NOx). Blackwater streams have naturally high

Table 8. Water quality index constituents used, by water body type

Parameter	Stream	Blackwater Stream	Spring
Turbidity	Yes	Yes	Yes
Total suspended solids	Yes	Yes	Yes
Dissolved oxygen	Yes	No	No
Total organic carbon	Yes	No	Yes
Total phosphorus	Yes	Yes	Yes
Total nitrogen	Yes	No	No
Nitrate and nitrite	No	Yes	Yes

concentrations of organic nitrogen, and using TKN as an estimate of TN would make these appear to be worse than they really are. Thus, NOx was used instead of TN. Streams have naturally low concentrations of TKN and NOx, but both can be increased by pollution. Thus, TN was used in the index. Unpolluted springs also have naturally low concentrations of both organic and inorganic nitrogen, but pollution can increase NOx, and it is important to adequately characterize these (FDEP 1996).

All of these WQI and TSI daily calculations resulted in a dataset that was further analyzed for status and then for trend.

Seasonal Medians Calculation

SJRWMD has a warm-temperate climate. Summers tend to be hot and wet, while winters are mild and dry. Rao et al. (1989) found that most rainfall in SJRWMD occurred during the months of June through October, which is the wet season. Conversely, they found the dry season to run from November through May. An examination of the dataset for this assessment showed uneven sampling frequencies across years and seasons. In order to reduce the effect of these uneven frequencies, seasonal median values were used for status and trend analysis. Daily index values were assigned to either the wet or dry season, and then a median of those values was calculated. Dry season daily index values that occurred in November or December were assigned to the dry season (January–May) of the subsequent year. The Wilcoxon rank-sum test function in PROC NPAR1WAY (SAS) was used to determine whether seasonality existed at a given station ($p \leq 0.1$). Sites exhibiting seasonality were analyzed for trend using the Seasonal Mann-Kendall test.

DETERMINING STATUS

Status calculations were based on the most recent 5 years of data reported since January 1, 1997. The median of all seasonal median TSI or WQI values over the 5-year period became the overall index used to rate a given water body. A qualitative rating was then assigned based on the median value (Table 9).

Table 9. Index cutoff values, by water body type

Water Body	Good	Fair	Poor
Lake	Index < 60	60 ≤ index < 70	Index ≥ 70
Estuary	Index < 50	50 ≤ index < 60	Index ≥ 60
Stream, blackwater stream, spring	Index < 45	45 ≤ index < 60	Index ≥ 60

DETERMINING TREND

Trend determination indicates whether water quality is getting better or worse at a particular site. The Mann-Kendall test, a non-parametric test, was used for this assessment. The Seasonal Kendall test, a modification of the Mann-Kendall test, was used for datasets that had seasonality. A 10-year minimum period of record for trend determination was selected in order to attenuate the effects of drought cycles and to ensure that sufficient data were available to analyze trends (see also Cude 2001).

Mann-Kendall Trend Test

The Mann-Kendall test did not require normally distributed data and was well suited for analyzing datasets that have missing, tied, or left-censored data (Gilbert 1987; Cude 2001). The test first ranked all seasonal median indices by date order. Then the difference between each successive value was calculated and the sum of the signs of those differences was evaluated as the Kendall sum statistic, or K. This process was repeated in an iterative fashion until all possible differences were evaluated. The number of observations was important in determining the critical value for comparison with the Kendall K. For a dataset with less than four observations, no critical values were available. For datasets with 40 or fewer observations, the probability associated with the Kendall K was found in “Upper-Tail Probabilities for the Null Distribution of the Kendall K Statistic” (Hollander and Wolfe 1999, Table A.30). If the dataset had more than 40 observations, a z-score was calculated based on the K statistic and the variance. The z-score was calculated according to one of the following equations (Gilbert 1987):

$$
\begin{array}{ll}
Z = K-1/\sqrt{(variance\ K)} & \text{for } K > 0 \\
Z = 0 & \text{for } K = 0 \\
Z = K+1/\sqrt{(variance\ K)} & \text{for } K < 0
\end{array}
$$

The z-score was then compared to critical values from a normal distribution table ($p \le 0.1$). If the Kendall K was positive, it meant that the seasonal median index values were in general increasing over time, which meant a degrading trend. If the Kendall K was negative, then the trend was improving, since in that case index values were decreasing over time.

Seasonal Kendall Trend Test

The Seasonal Kendall test was based on the same principle as the Mann-Kendall test, but the variance calculation was more complicated. The variance equation accounts for the number of tied values and the number of groups of tied values across all years in each season. Additionally, the variance equation accounts for the number of years in each season that had multiple data, and the number of multiple data in each year. After ranking the seasonal median values as before, the number of values per season was calculated. The variance was calculated for each site, and a z-score calculated as before. For the seasonal test, all z-scores were evaluated using the normal probability table ($p \le 0.1$).

RESULTS AND DISCUSSION

Status and trends were assessed for 158 sites located in nine major drainage basins within SJRWMD (Map 6). Details on these sites can be found in Appendix A, Table A1. Status results for each station can be found in Appendix A, Table A2, and trend results for each station are in Appendix A, Table A3.

ST. MARYS RIVER BASIN

The St. Marys River drains southeastern Georgia and the northeastern part of Florida and serves as a state boundary. The river drains an extensive tidal marsh system in its lower reaches. The headwaters drain much of the Okefenokee swamp (Hand et al. 2000), and the river terminates at the ICW, where tidal influences cause reverse flows on a regular basis. The St. Marys River Basin is about 1,580 square miles in size, with 873 square miles in SJRWMD. Land cover is predominantly upland forest for silviculture (Figure 1). Although the basin is not highly developed, urban development continues in the Amelia Island and Macclenny / Glen St. Mary areas.

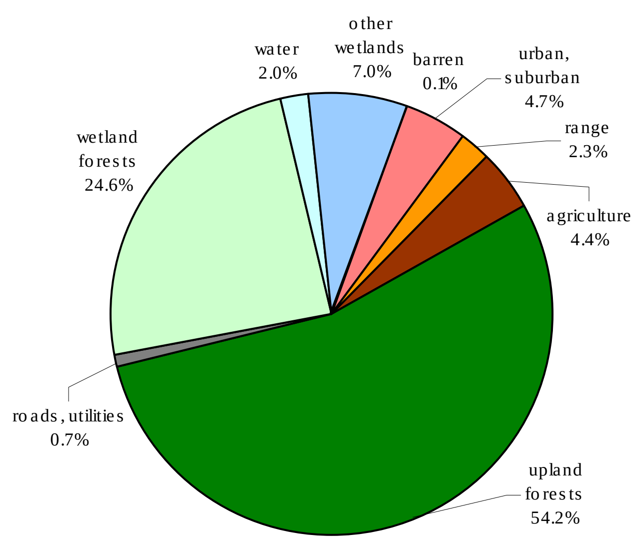

Figure 1. St. Marys River Basin land cover (1995)

Three stations were located on the river and its tributaries: State Road (SR) 2, the Middle Prong at Highway (Hwy) 127, and U.S. 17, which is at the Georgia state line (Map 7). The site at SR 2 (**19010006**) and at the Middle Prong (**MPS**) showed good water quality, with the water becoming fair at U.S. 17 (**19010001**), which is many miles downstream from the headwaters. The two upstream sites were evaluated as blackwater streams, which means that both had higher color and lower pH than the downstream site, which was evaluated as a stream. Both mainstem sites had insufficient data for trend analysis, but the Middle Prong had an insignificant trend, based on 11 years of data. Overall, the St. Marys River appears to have good or fair water quality, but more sampling needs to be done on the main stem of the river for trend determination.

NASSAU RIVER BASIN

The Nassau River drains much of the salt marsh west of Amelia Island and empties to the ICW. It also serves as a border between Nassau County and Duval County. This basin of about 430 square miles has a predominant land cover of upland forests for silviculture (Figure 2).

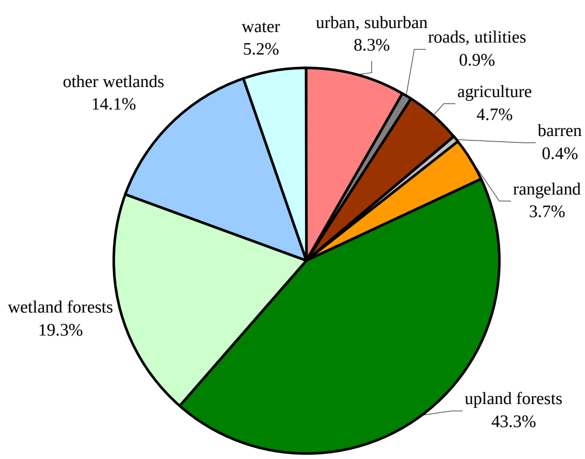

Figure 2. Nassau River Basin land cover (1995)

There was one station on the Nassau River, the Nassau River near Italia **(NRI)** (Map 8). The site has fair water quality but insufficient data to calculate a trend. The station was evaluated as a stream. The area is tidally influenced.

BASINS OF THE ST. JOHNS RIVER

The St. Johns River drains most of SJRWMD; its headwaters are west of Vero Beach. The river flows north and empties to the Atlantic Ocean 20 miles east of Jacksonville. The river has many tributaries. Tides and a low gradient cause the river to regularly experience reverse flows north of Lake George. The river has traditionally been subdivided into three main sections—lower, middle, and upper. The lower St. Johns River comprises the area from the Ocklawaha River confluence north to the St. Johns River mouth at Mayport. The middle St. Johns River extends from the Econlockhatchee River confluence to the Ocklawaha River confluence and includes the Lake George Basin. The upper St. Johns River comprises the headwaters to the river's confluence with the Econlockhatchee River.

Upper St. Johns River Basin

The St. Johns River's headwaters are the floodplain marshes west of Vero Beach. The basin contains two surface waters used for potable supplies: Lake Washington and Taylor Creek. The Upper St. Johns River Basin (USJRB) comprises approximately 1,700 square miles, and the predominant land cover is agriculture (Figure 3). Three lakes and four streams were sampled for this assessment (Map 9). Blue Cypress Lake **(BCL)** showed good water quality and had an insignificant trend. Lake Washington **(LWC)** and Lake Poinsett **(LPO)** both had good water quality, although the trend at LPO is degrading. Farther north, the St. Johns River at SR 50 **(SRS)** had fair water quality but was getting worse. The three tributaries assessed in this area were Jane Green Creek **(JGS)**, Crabgrass Creek **(USJ055)**, and Wolf Creek **(USJ918)**. All three tributaries had fair water quality and insignificant trends. In summary, there were no poor water quality sites in the USJRB. The St. Johns River south of Lake Poinsett appears to have better quality than the tributaries in this area. North of Lake Poinsett, the St. Johns River does show degrading trends.

Middle St. Johns River Basin

A few more stations were assessed in the Middle St. Johns River Basin (MSJRB) than in the USJRB. With an area of 1,200 square miles, the predominant land cover is urban and suburban (Figure 4).

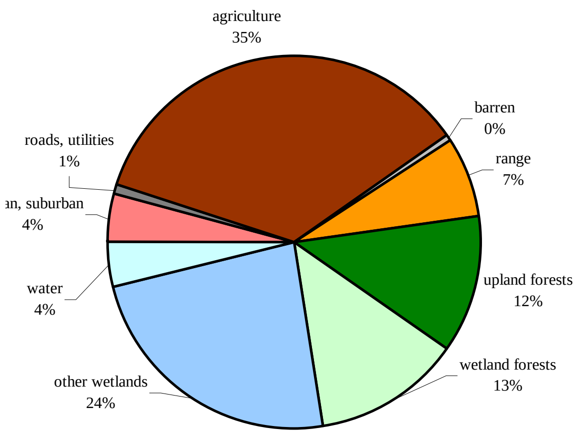

Figure 3. Upper St. Johns River Basin land cover (1995)

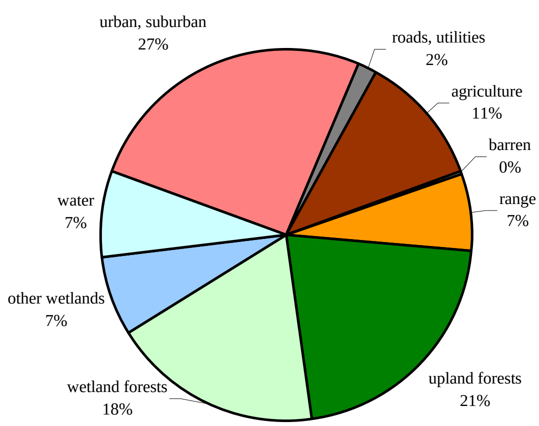

Figure 4. Middle St. Johns River Basin land cover (1995)

The MSJRB contains tributaries of both the Econlockhatchee and Wekiva rivers. Three blackwater stream, six lake, and seven stream sites were sampled in the MSJRB (Map 10). The mainstem site at SR 46 **(SRN)** had fair quality and was degrading. The Econlockhatchee River **(ECH)** had good water quality with no significant trend. Deep Creek **(DMR)** drains Lake Ashby and appears to have good water quality with an insignificant trend. Lake Ashby **(ASH)** also has good quality but appears to be getting worse. Lake Jesup is the next lake along the river. The St. Johns River sites near the mouth of Lake Jesup **(OW-SJR-1, OW-SJR-2)** showed fair water quality, but there were insufficient data for a trend evaluation. However, Lake Jesup had three stations on it **(OW-2, OW-4, OW-6)** that were all poor quality but without enough data to determine trends. Lake Monroe **(LMAC)** had fair quality, but no discernable trends. The Lake Monroe outlet **(20010003)** showed good quality but there were not enough data to calculate a trend. The Wekiva River joins the St. Johns River farther north, and Blackwater Creek is a tributary to it. The Wekiva River **(02235000)** showed good water quality, as did the Little Wekiva River **(20010137),** but there were insufficient data for trends. Historically, there were seven wastewater treatment plants and a citrus processing plant discharging to the Little Wekiva River (FDEP 1997). These stopped discharging in the mid 1970s, and now there is only an intermittent discharge from the Altamonte Springs Wastewater Treatment Plant. The main concerns in the Little Wekiva River are urban stormwater runoff, erosion, and streambed alterations (FDEP 1997). Blackwater Creek **(BWC44, BWCCPB)** had good quality also, but no significant trends could be detected. Lake Winimisset **(WIN)** was also sampled in this basin and showed good quality but no significant trend.

According to FDEP (2002), Lake Jesup's pea-green color is due to unicellular algae which feed on large amounts of nutrients. Since May 1983, sewage outfalls have been diverted from lake tributaries to the Iron Bridge Wastewater Treatment Plant. A long history of intense agriculture in the watershed, recent population growth in the surrounding cities, and a restriction of the lake's outlet to the St. Johns River have contributed to the hypereutrophication of the lake. Both Lake Monroe and Lake Ashby had better water quality than Lake Jesup.

Overall, more streams in the Middle St. Johns River Basin had good water quality than fair, and none were poor (Figure 5). The majority of streams had insufficient data for trend determination, but there were as many degrading sites as there were sites with insignificant trends (Figure 6). None of the streams evaluated showed an improving trend. All of the blackwater stream sites in this basin had good water quality and no significant trends. The three

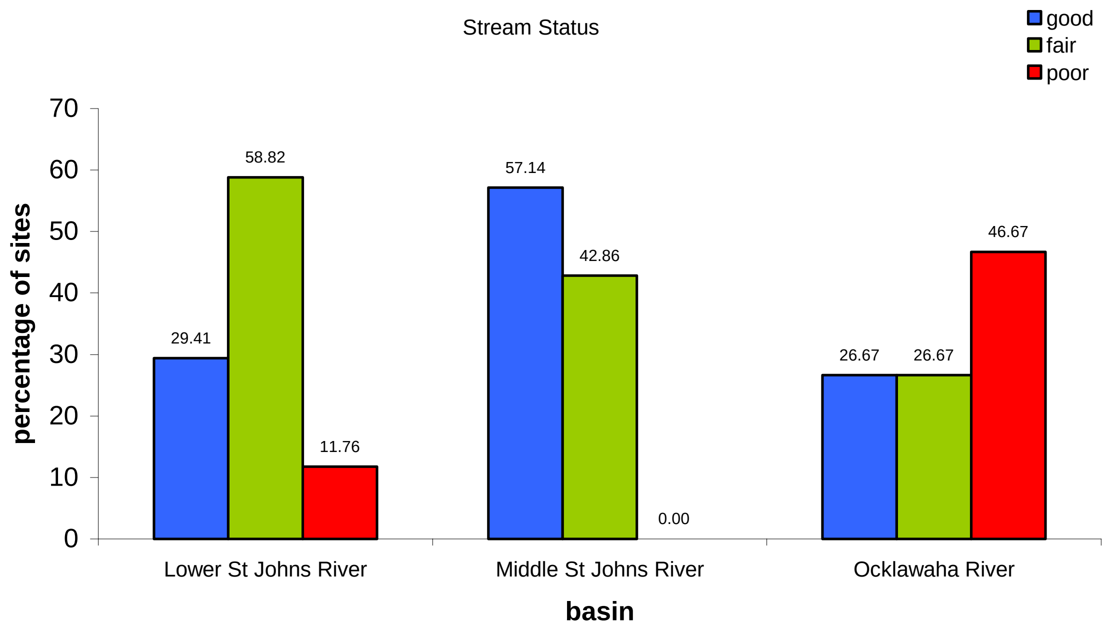

Figure 5. Stream status for selected basins

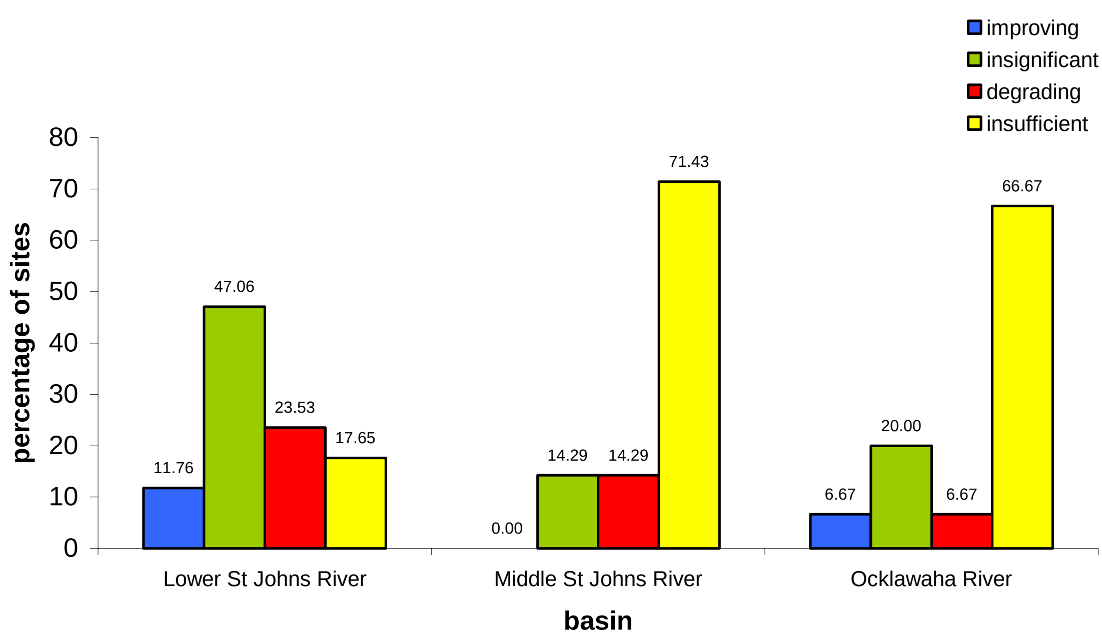

Figure 6. Stream trends for selected basins

sites on Lake Jesup accounted for the 50% of lake sites that rated poor in the basin, while two others were good and one was fair (Figure 7). The Lake Jesup sites also accounted for that half of the sites with insufficient data for trends, while two others had insignificant trends and one was degrading (Figure 8). None of the lake sites were improving in the basin.

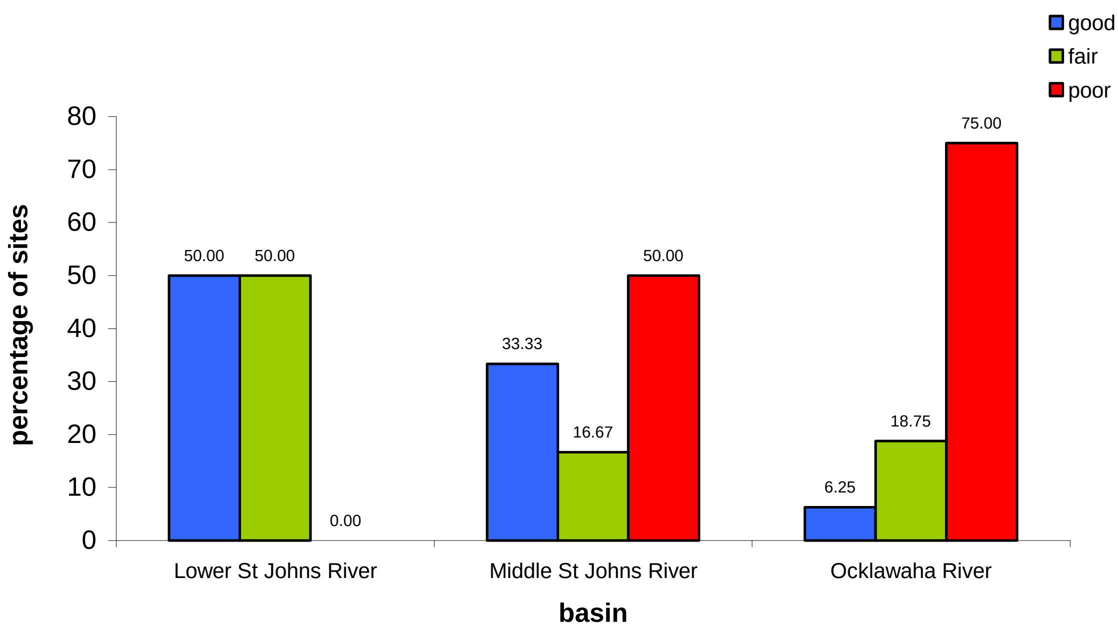

Figure 7. Lake status for selected basins

Lake George Basin

Farther north along the river lies the Lake George Basin. Lake George covers an area of 46,000 acres and provides habitat for the second largest population of bald eagles in the United States (not including Alaska). There are two wastewater treatment plants that discharge to the St. Johns River in this basin. The basin is 816 square miles in size, and the predominant land cover is upland forests (Figure 9). Three lake, one spring, and three stream sites were sampled in this basin (Map 11). Blue Spring **(BLSPR)** had good water quality but was getting worse, and was the only spring evaluated for this entire assessment. It supplies the St. Johns River below DeLand **(02236000)**, where the water quality

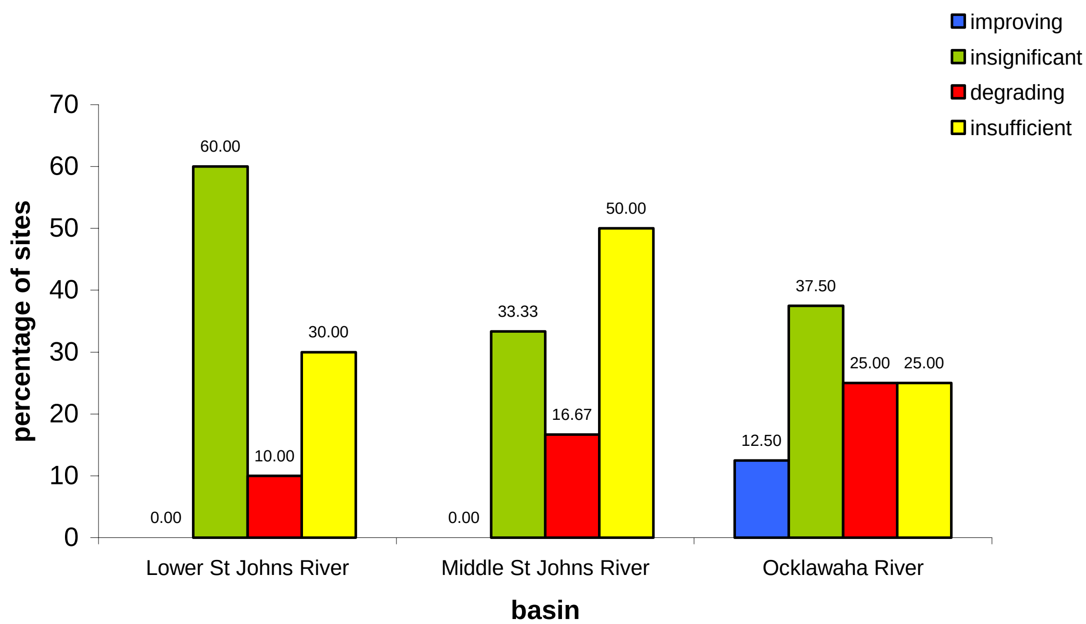

Figure 8. Lake trends for selected basins

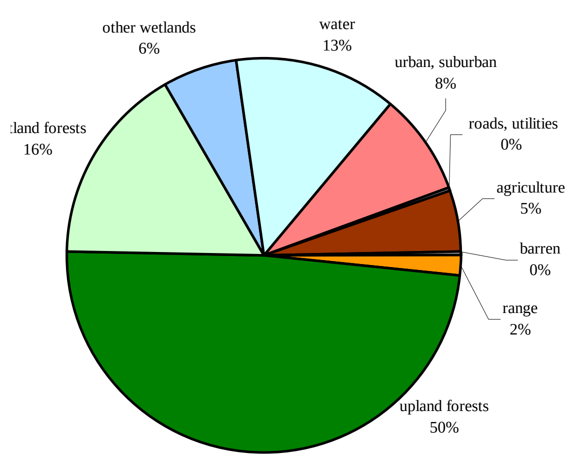

Figure 9. Lake George Basin land cover (1995)

was fair with insufficient data for trend determination. Lake Woodruff **(LKWOOD)** is farther north and had good quality with insufficient data for trend determination. The St. Johns River at SR 40 **(20010002)** showed good quality with insufficient data for trend evaluation. Lake George **(LEO)** had fair quality but no significant trends. Lake Kerr **(KER)** drains to the north end of Lake George and had good quality but an insignificant trend. The St. Johns River at channel marker 72 (**20030373**) had good quality but insufficient data for trend determination.

Lower St. Johns River Basin

The lower St. Johns River (LSJR) is the stretch of river below the Ocklawaha River mouth and terminating in the Atlantic Ocean east of Jacksonville. The LSJR is a major route for transportation to Jacksonville, which is one of the largest ports on the east coast. Commercial and sport fishing are also large industries on the river. The basin is 2,750 square miles in size, and the predominant land cover is upland forest (Figure 10). The LSJR is characterized by tidal influences and a brackish salt wedge that comes as far south as Green Cove Springs but can come farther south on occasion. According to Hendrickson and Konwinski (1999), the LSJR is a sixth-order dark-water river

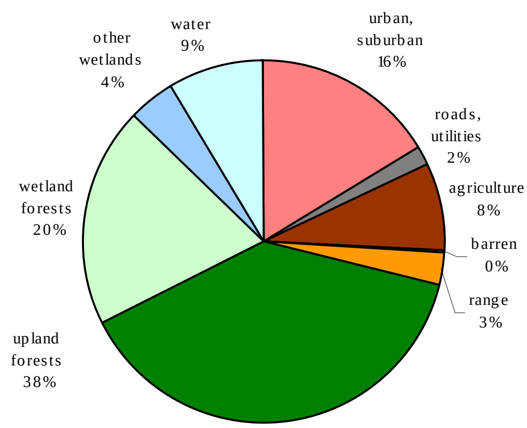

Figure 10. Lower St. Johns River Basin land cover (1995)

Many sampling sites were located in the LSJR. Four blackwater stream, nine estuarine, 10 lake, and 17 stream sites were evaluated in this basin (Map 12). Moving north from Lake George, the river at Buffalo Bluff **(SRB)** had good quality but no significant trend. The Ocklawaha River joins the St. Johns River south of this area. Dunns Creek **(DNC)** joins the St. Johns River north of Buffalo Bluff; it showed fair water quality but was degrading. The river from Palatka north to Picolata showed fair water quality. Trends differed—in Palatka **(SJP)** there was no significant trend, there were insufficient data for trends off Rice Creek **(SJRCC)** and at channel marker 37 **(SJM37)**, and off Racy Point **(SRP)** the water quality was getting worse. Tributaries in this area included Rice Creek, which had good quality at SR 100 **(LSJ918)** with no significant trend, but had poor quality where it enters the St. Johns River **(RCB)**, still with no significant trend. Simms Creek **(SIM)**, which drains to Rice Creek, had good quality as well but no significant trend. Dog Branch **(DBR)** is a tributary to the river that had fair quality that was improving. The Hastings Drainage District site **(OHD)** showed fair quality with no significant trend. Deep Creek **(DPB)** had fair quality but was getting worse. Moccasin Branch on SR 13 **(MOB)** was fair but had no significant trend. North of Picolata, Sixmile Creek **(SMC)** joins the river and had fair quality but a degrading trend. The St. Johns River at marker 25 **(SJCM25)** had fair quality but no significant trend.

Estuarine conditions predominate in the St. Johns River north of Green Cove, so sites located in that stretch of river were analyzed as estuarine sites. At Green Cove **(SJSR16)**, the quality was fair with no significant trend. The river from Green Cove to Piney Point had fair water quality. Hallowes Cove **(HCC)** and Hibernia Point **(SJRHBP)** had no significant trends, while Julington Creek at the mouth **(20030153)** and Piney Point **(JAXSJR40)** had insufficient data to calculate trends. Beauclerc Bluff **(JAXSJR30)** was showing improvement. There are many tributaries to the river in this area. Peters Creek **(PTC)** is one such tributary; it had good water quality and was improving. Black Creek is a major tributary, and both the South Fork **(BSF)** and the creek at Hwy 209 **(BLC)** had good water quality but were getting worse. The North Fork **(NBC)** also had good quality, but an insignificant trend. Swimming Pen Creek **(SPCR)** drains to Doctors Lake and had fair water quality with an insignificant trend. Doctors Lake **(DTL)** had poor quality but no significant trends. Big Davis Creek and Durbin Creek are tributaries to Julington Creek. Durbin Creek **(LSJ087)** had fair water quality with no significant trend, while Big Davis Creek **(LSJ099)** had good quality but with not enough data to determine a trend. Both the Ortega River at Collins Road **(20030349)** and Cedar Creek at Blanding Boulevard **(20030083)** had fair quality but insufficient data for trends. Farther north, the St. Johns River at the Main Street bridge **(JAXSJR21)** showed fair quality and an improving trend, while Moncrief Creek **(20030115)** showed fair quality but with insufficient data for trends. In the area south of Crescent Lake, Little Haw Creek **(LSJ070)** showed good quality and had an insignificant trend. The Haw Creek outlet at Dead Lake **(HAW)** had poor water quality and was getting worse.

Some lakes were sampled in the basin as well. Georges Lake **(20030400)** showed good water quality but had insufficient data for trends. Lake Sheelar **(SHEEL)** had good quality and an insignificant trend. Lake Geneva **(GEN)**, Lake Disston **(CLD)**, and Lake Winona **(WIO)** all showed good water quality but had insignificant trends.

Overall, 29% of stream sites sampled in this basin had good water quality, while 12% were poor (Figure 5). The majority had fair quality. Unfortunately, 24% of the stream sites were showing a degrading trend while only 12% were improving (Figure 6). Again, the majority of streams had either an insignificant trend or lacked sufficient data for a trend analysis. All four of the blackwater stream sites had good quality, but two had degrading trends and the other two had insignificant trends.

According to Deuerling and Cooner (1995), the major problem in the LSJR appears to be stormwater runoff. They claim that stormwater runoff deposits 80% to 95% of the heavy metals that reach the river and a majority of the coliforms and disease organisms and viruses that reach the river. In addition, excessive freshwater and oxygen-demanding substances are brought into the river by storm water.

None of the lake sites had poor quality, and there were as many good sites as fair sites (Figure 7). Nevertheless, 10% of those sites showed a degrading trend, and none were improving (Figure 8). The majority of sites had either an insignificant trend or insufficient data to determine a trend. It is important to point out that most of the mainstem sites on the river from Palatka to Green Cove were evaluated as lake sites, not stream sites (Map 5).

Finally, several estuarine sites were sampled in this basin. All mainstem river sites from Green Cove Springs northward were analyzed as estuarine sites due to tidal influence on the river. The majority of estuarine sites in the basin had fair quality, although none had good quality (Figure 11); 11% had poor quality. Fortunately, none were degrading and 22% were improving (Figure 12). The majority of sites (78%) had either an insignificant trend or did not have sufficient data for trend analysis.

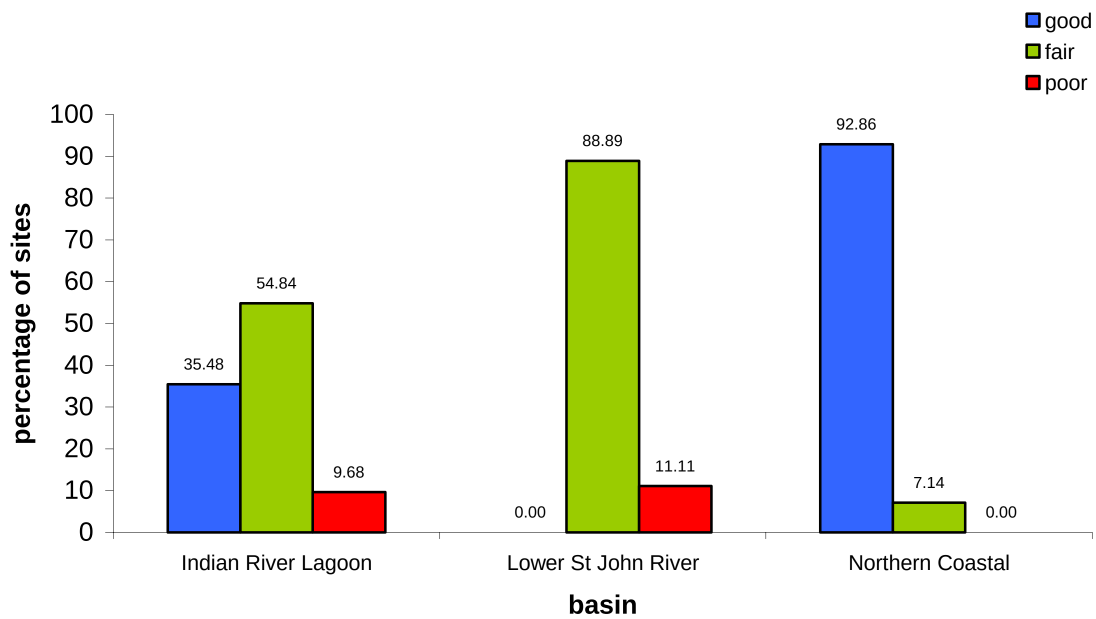

Figure 11. Estuarine status for selected basins

OCKLAWAHA RIVER BASIN

The headwaters of the Ocklawaha River are the Lake Apopka chain of lakes and the Palatlakaha River in northern Polk County.[2] Surface waters in the basin have been affected by farming, navigation, flood control, and the now-defunct Cross Florida Barge Canal. In recent decades, the Ocklawaha River Basin (approximately 2,116 square miles) has had poor water quality due to the hypereutrophic conditions found in the Lake Apopka chain of lakes. The predominant land cover is upland forests (Figure 13). SJRWMD is currently restoring thousands of acres of muck farms along the river and adjacent to Lake Apopka and the Harris Chain of Lakes to aquatic and wetland habitat.

[2]As of July 1, 2003, the portion of the St. Johns River Water Management District that was in Polk County became part of the Southwest Florida Water Management District.

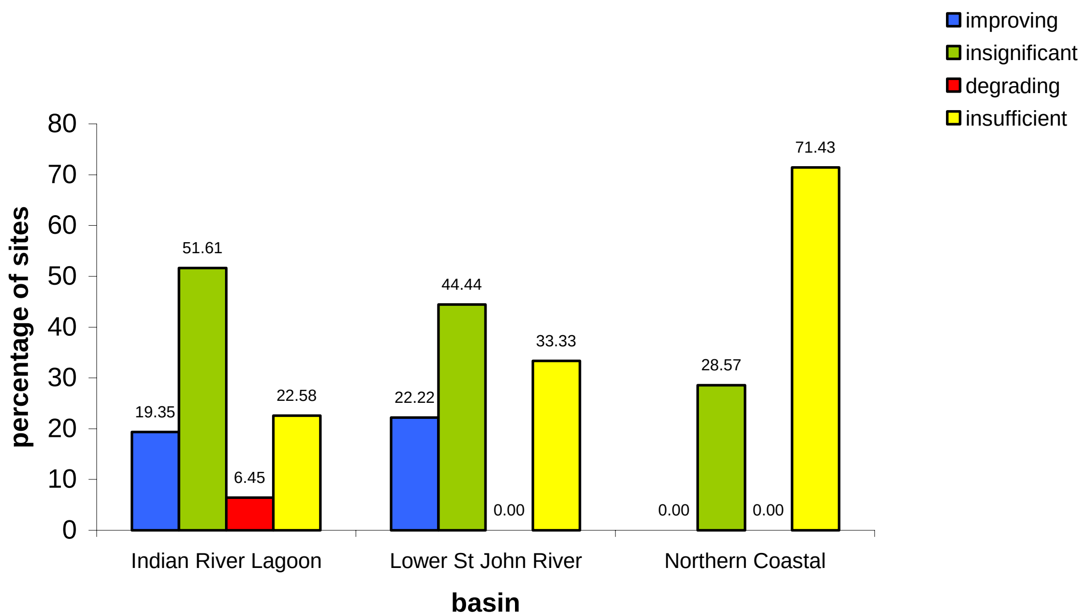

Figure 12. Estuarine trends for selected basins

Historically, Lake Apopka was clear, densely vegetated, and well known for its sports fishery. Today, the lake is one of the most polluted lakes in the state, and its pea-green color is due to continuous algal blooms. Agriculture, urban development, and stream channelization have caused major losses of fish and wildlife habitat.

The Orange Creek Basin is part of the Ocklawaha River Basin. The Orange Creek Basin is 600 square miles in size, and its main feature is Paynes Prairie. Conversion of wetlands along Orange Creek for agricultural use has diminished water quality and habitat. In addition, Newnans Lake has become hypereutrophic and woody vegetation has spread over parts of Paynes Prairie.

Sixteen lake sites and 15 stream sites were sampled in this basin (Map 13). Three of the lake stations were sampled on Lake Apopka, and all had poor water quality. However, although the southernmost lake station **(SLA)** showed no significant trend, the center lake station **(CLA)** and the northern station **(NLA)** showed improving trends. The Apopka Beauclair Canal **(ABC)** also had poor water quality but was improving. Lake Beauclair East **(BCE)** and Lake Dora **(DOR)** were both poor with no significant trend. These lakes are considered eutrophic (Fulton 1995). Lake Harris **(HAR)** was poor and getting worse, Lake Denham **(DNE)** was poor with no significant trend, and Helena

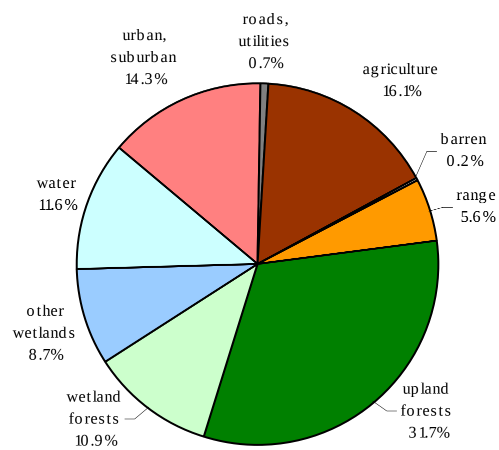

Figure 13. Ocklawaha River Basin land cover (1995)

Run **(HRFA)** out of Lake Denham was fair but getting worse. Lake Eustis **(20020368)** had fair quality with no significant trend, but the two sites on Haines Creek **(02238000, DEPHCA)**, which connects Lake Eustis to Lake Griffin, had poor quality with insufficient data to determine a trend. Both sites in Lake Griffin **(LGN, 20020381)** had poor water quality and had insufficient data for trends. Lake Yale **(LYC)** showed fair quality but was getting worse, while the canal that connects Lake Yale to Lake Griffin **(YGCC)** showed poor quality with insufficient data for trends. Lake Weir **(CLW)** was good and had no significant trend.

Farther downstream on the Ocklawaha River, the site at C-231 canal **(SHORIA)** had poor water quality and an insignificant trend. Even farther downstream at Moss Bluff, the upstream side of the lock **(MBU)** had poor quality and an insignificant trend, while the downstream side **(20020001)** showed fair quality but had insufficient data for trend evaluation. The Ocklawaha River at SR 40 **(ORD)** showed good quality but had insufficient data for trends. The Ocklawaha River at County Road (CR) 316 **(20020012)** was also good but had insufficient data for trends. A tributary to the Ocklawaha River, Orange Creek **(OR006),** was sampled at Hwy 21, and it showed good quality and had an insignificant trend. The other sites in this basin were lakes in and around the Gainesville area. Lake Lochloosa **(LOL)** was poor and getting worse, while Orange Lake **(OLC)** was fair and getting worse. Newnans Lake **(NEW)** had poor quality, but there were not enough data to determine a trend. The two sites on Little Hatchet Creek **(LHAT26, LHT26E)** showed fair and poor water quality respectively, and neither had enough data for trends. The Hatchet Creek site **(HAT26)** showed fair quality but had insufficient data for trends. Bivens Arm Lake **(BIVARM)** was poor with insufficient data for trends, and Hogtown Creek **(HOGSW2ND)** showed good quality but had insufficient data for trends.

Overall, 27% of stream sites were good and 27% were fair, while 47% were poor (Figure 5). The majority of stream sites (67%) did not have enough data to determine a trend or had an insignificant trend (20%) (Figure 6). There were as many improving sites (7%) as there were degrading. FDEP (2001) found that 66% of stream miles were impaired for nutrients and that the most common stressors in this basin for streams were dissolved oxygen, nutrients, fecal and total coliforms, and lead.

A majority of the lake sites—75%—were poor, the highest of any of the basins sampled (Figure 7). This corroborates the FDEP (2001) finding that 70% of lakes were impaired for nutrients. FDEP also indicated that the most significant water quality problems were low and supersaturated concentrations of dissolved oxygen and nutrient enrichment. Only 6% of the sites had good quality, while 19% had fair quality. Although 38% had an insignificant trend, 25% were degrading, twice as many as those that were improving (Figure 8). Finally, 25% of the sites had insufficient data for trend determination. According to Fulton (1995), eutrophication of the surface waters was the result of domestic, industrial, and agricultural wastes discharged directly to receiving waters, destruction of aquatic habitats, and channelization. Current water quality management actions in the basin are concerned with removing internal and external nutrient loads, restoring wetland and river habitats, and managing water levels to mimic the natural hydrologic cycle (FDEP 2001).

INDIAN RIVER LAGOON BASIN

The Indian River Lagoon (IRL) is composed of three major water bodies: the Mosquito Lagoon, Banana River, and Indian River (Map 14). The IRL is one of the most diverse estuaries in North America, providing 50% of the east Florida fish catch and 90% of Florida’s clam harvest. Healthy seagrass beds are vital to maintaining this level of productivity. Farms in the area produce world famous Indian River citrus. The economic impact of lagoon activities is estimated to be $730 million annually. The IRL receives salt water through inlets to the ocean and freshwater from rain, groundwater seepage, surface water runoff, and discharges from tributaries and drainage canals. Since 1916, the lagoon's watershed drainage area has increased from 572,000 acres to more than 1.4 million acres. The concomitant increase in freshwater inputs has had a major effect on the lagoon. Sedimentation is a concern in the basin, and it negatively impacts seagrass beds and benthos. Although wastewater treatment plants have discharged to the lagoon in the past, the 1990 IRL No Discharge Act has reduced those inputs. In the 1950s and 1960s, over 75% of the salt marsh in the lagoon was diked for mosquito control, eliminating a vital nursery function. One of the goals of the IRL Surface Water Improvement and Management program is the restoration of the impoundments. The lagoon comprises almost 1,380 square miles in SJRWMD; the predominant land cover is water (Figure 14).

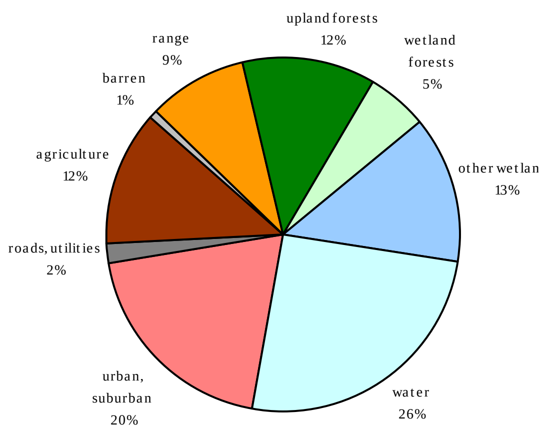

Figure 14. Indian River Basin land cover (1995)

Thirty-one estuarine sites and four stream sites were sampled in the Indian River Lagoon Basin (Map 14). In the Indian River, the Vero South Canal **(IRLVSC)** showed fair quality with no significant trend. The lagoon offshore of the Vero Canal **(IRLIRJ12, IRLIRJ07)** had good quality with no significant trends. The Vero Main Canal **(IRLVMC**) showed good quality with no significant trend, and the lagoon offshore of it **(IRLIRJ05)** had fair quality with no significant trend. The Vero North Canal **(IRLVNC)** showed good water quality with no significant trend, and the lagoon off that area **(IRLIRJ04, IRLIRJ10)** had fair quality with no significant trend just off the canal. Farther north, the lagoon off Spratt Point **(IRLIRJ01)** had good quality with no significant trend. The lagoon off the Sebastian River **(IRLSUS)** was fair and improving. The lagoon near Grant Farm Island **(IRLI27)** was good with an insignificant trend. The lagoon off Goat Creek **(IRLGUS)** was good and improving. The area around Crane Creek was fair, but there were not enough data to determine trends for the creek **(CC03)** or the lagoon **(IRLI23)**. There was an improving trend at the mouth of the creek **(IRLCCU)**. The Eau Gallie River mouth **(IRLEGU)** was poor with no significant trend, whereas the lagoon offshore of the Eau Gallie River **(IRLI21)** was fair with insufficient data for trends. Horse Creek **(IRLHUS)** was good with a degrading trend.

The lagoon just south of Pineda causeway **(IRLI18)** was fair with no significant trend. This area is where the Banana River branches off. The Indian River off Rockledge treatment plant discharge **(IRLI15)** is fair with insufficient data for trends. The lagoon at the SR 528 bridge **(IRLI13)** was good with insufficient data for trends. The NASA causeway area **(IRLI10)** was fair with insufficient data for trends. The area around Hwy 42 **(IRLI07)** was fair with no significant trends. The lagoon near the Haulover Canal **(27010875)** was fair with insufficient data for trends. The lagoon at Big Flounder Creek **(IRLBFC)** was poor with no significant trend. The Indian River offshore of IRLBFC **(IRLI02)** was fair but getting worse. The northernmost site on the lagoon **(IRLTBC)** showed poor water quality with no significant trend. According to Sigua et al. (1999), the water quality in the northern lagoon is influenced by urban and agricultural development and proximity to inlets.

In the Banana River, the southernmost site **(IRLB09)** at the confluence with the Indian River had fair quality with no significant trend. Farther north, the Banana River **(IRLB06)** was fair but had insufficient data for trends. The river was fair with no significant trend near the 520 causeway **(IRLB04)**, and slightly farther north **(IRLB02)** the river had good water quality with no significant trends. According to Sigua et al. (1999), water quality in the Banana River Lagoon is dependent on urban development and wastewater discharge in the area.

The southernmost site **(IRLML02)** on the Mosquito Lagoon had good quality with no significant trend. The Mosquito Lagoon at Oak Hill Dock **(IRLV17)**, farther north **(IRLV11)**, and at channel marker 47 **(IRLV05)** had good quality and was getting better. These results seem to corroborate those of Sigua et al. (1999) who found that the Mosquito Lagoon exhibits good water quality, mainly due to the pristine habitat in the area, lack of urbanization, and a negligible amount of agricultural discharges from nearby citrus groves.

Overall, estuarine water quality in the IRL is mostly good or fair, with only 10% of the stations sampled showing poor status (Figure 11). Nineteen percent of the sampled estuarine sites were improving while 6% were degrading, so more sites are improving than are degrading (Figure 12). However, the majority of estuarine sites (74%) had an insignificant trend or insufficient data to determine a trend.

NORTHERN COASTAL BASIN

The Northern Coastal Basin is the coastal area, including the ICW, from the Ponte Vedra area south to the Spruce Creek area in Volusia County. The basin is about 680 square miles in size, and the predominant land cover is upland forests (Figure 15). The Tomoka River, Spruce Creek, and Pellicer Creek, along with parts of the Guana-Tolomato-Matanzas system, are classified as Outstanding Florida Waters. Fourteen estuarine sites and four stream sites were assessed (Map 15). The southernmost sites all showed fair water quality. So Spruce Creek **(02248000)**, the Tomoka River **(27010579)**, and Bulow Creek **(BUL)** were fair, but Bulow Creek had an insignificant trend and there were not enough data to determine trends for the other two. The ICW at Fox Cut **(JXTR26)** was good with insufficient data, the ICW at Matanzas Inlet area **(MAT)** had good quality with an insignificant trend, and the ICW at the confluence with Pellicer Creek **(MRT)** had good quality with insufficient data for trends. Pellicer Creek itself **(PEL)** had fair water quality but was degrading. Farther north, both the ICW at Crescent Beach **(JXTR21)** and at Moultrie Creek **(MCICW)** had good quality but did not have enough data for trends. Farther upstream, Moultrie Creek **(MTC)** had fair quality but an insignificant trend. The ICW at the CR 312 bridge **(MR312)** had good quality but no significant trend, while the San Sebastian River **(SSB)** had good quality but insufficient data for trend detection. Moving farther north, the two sites on the Guana River **(JXTR17, GAR)** had good quality but insufficient data for trends. Farther north, tributaries to the ICW, including Casa Cola Creek **(CCC)**, Stokes Creek **(STOKESCR)**, and Smiths Creek **(SMITHSCR),** all showed good quality but had insufficient data for trends. The ICW in this area **(TOL)** had good water quality, although no significant trends were apparent.

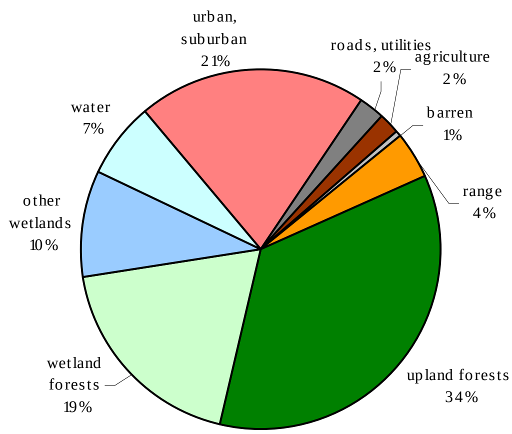

Figure 15. Northern Coastal Basin land cover (1995)

Overall, the Northern Coastal Basin sites appear to have some of the best water quality of all the basins. Of the estuarine sites sampled, 93% had good water quality, 7% were fair, and there weren't any poorly rated sites (Figure 11). The basin has only recently been sampled, as 71% of those estuarine sites did not have at least 10 years of data for a trend analysis, while 29% showed an insignificant trend (Figure 12).

All four streams had fair status, and only Pellicer Creek was degrading. The other three stream sites either had insufficient data for trends or showed an insignificant trend.

DISTRICTWIDE RESULTS FOR ALL WATER BODY TYPES

Results were combined for water body types over all basins (Figures 16 and 17, Map 5).

Status and trend results were also combined over all basins and water body types (Figures 18 and 19).

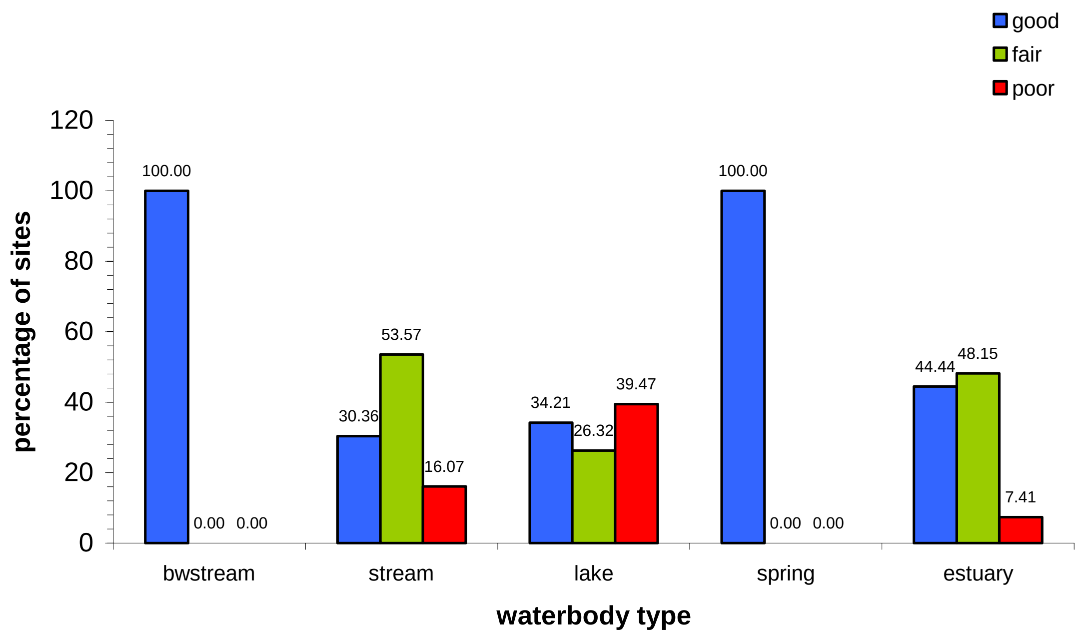

Figure 16. Status results by water body type over all basins

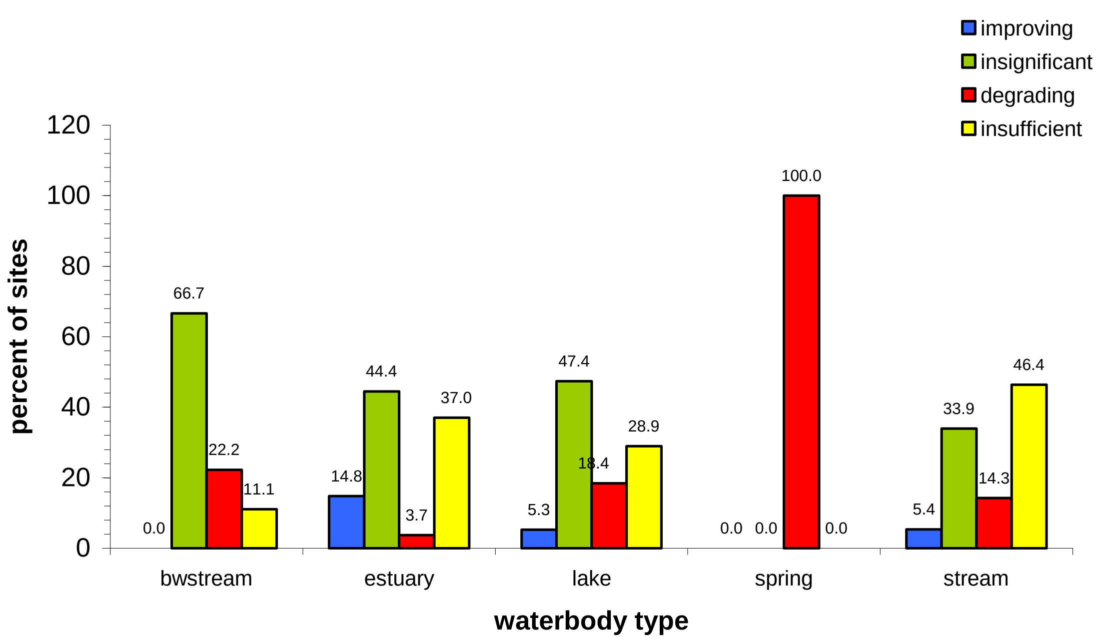

Figure 17. Trend results by water body type over all basins

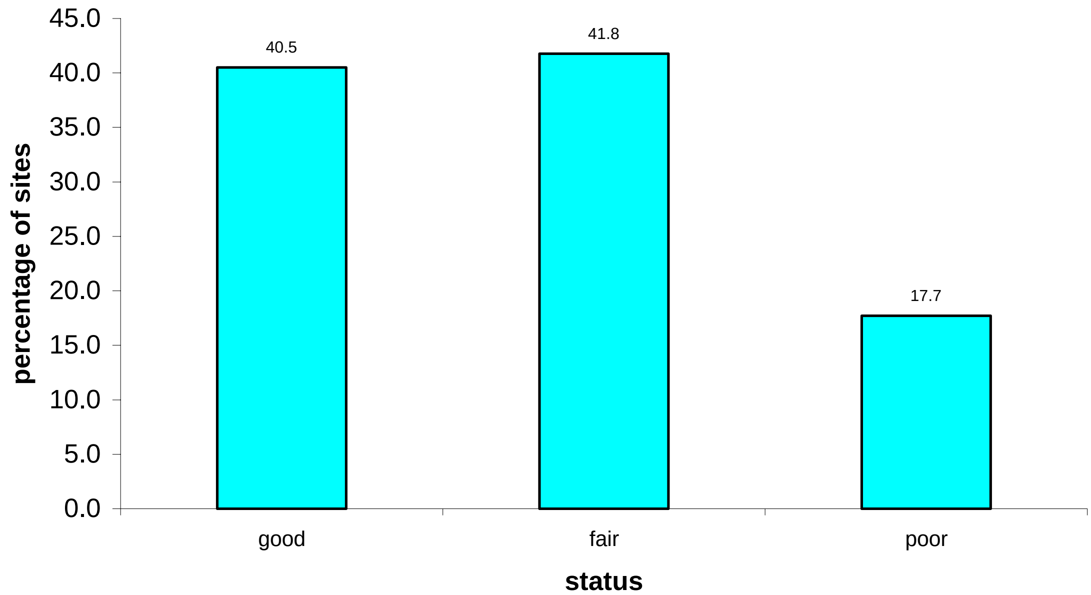

Figure 18. Status results over all basins

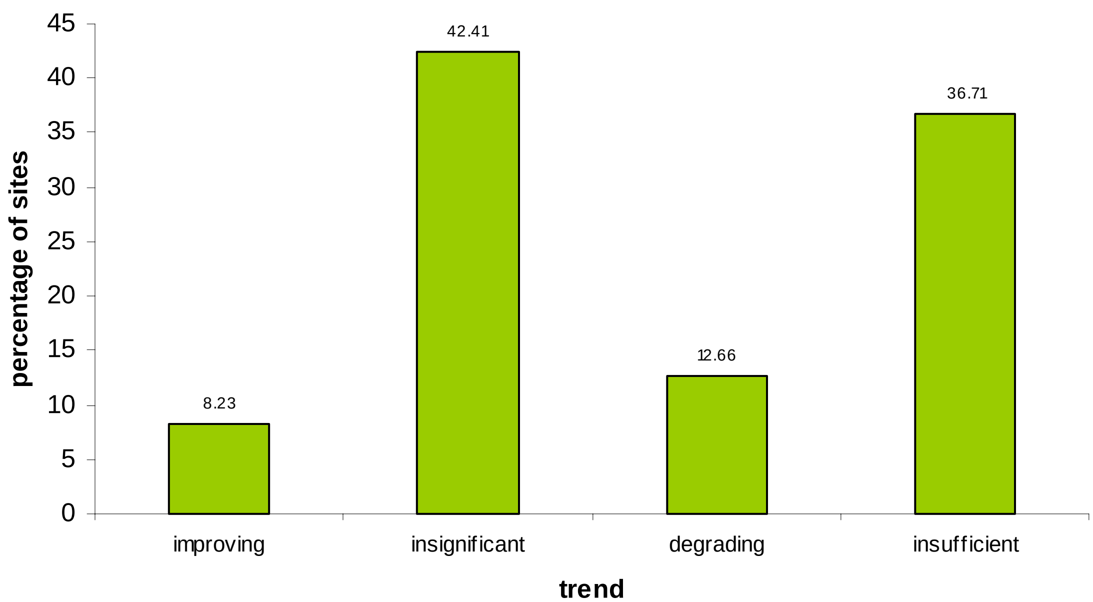

Figure 19. Trend results over all basins

Springs

Only one spring site, Blue Spring in Volusia County, was evaluated, and it had good water quality and a degrading trend.

Blackwater Streams

Nine blackwater stream sites were evaluated, and all had good status. However, none were improving, six had an insignificant trend, two were degrading, and one had insufficient data. Blackwater stream sites were located in the Lower and Middle St. Johns River basins and the St. Marys River Basin.

Lakes

Thirty-eight lake sites were evaluated, and 13 were good, 10 fair, and 15 poor. Eleven lake sites had insufficient data to determine a trend, while 18 were insignificant, two were improving, and seven were degrading. Most of the lake sites were located in the Lower St. Johns River and Ocklawaha River basins.

Streams

Fifty-six stream sites were evaluated, and 30 were fair, 17 were good, and nine were poor. Twenty-six had insufficient data for trends, 19 had insignificant trends, eight were degrading, and three were improving. Most of the stream sites were located in the Ocklawaha River and Lower St. Johns River basins.

Estuaries

Fifty-four estuarine sites were evaluated, and 24 were good, 26 were fair, and four were poor. Twenty had insufficient data for trend evaluation, while 24 were insignificant, eight were improving, and two were degrading. The majority of estuarine sites were in the Indian River Lagoon and Northern Coastal basins.

DISCUSSION

Status results show that springs and blackwater streams have the highest percentage of sites with good water quality (Figure 16). However, relatively few of these types of waters were sampled. Of the other water body types, estuaries had the highest percentage of sites with good water quality, while streams had the lowest. Streams had the most sites with fair quality, while lakes had the fewest. The highest percentage of poor sites were located in lakes, while the lowest percentage were located in estuaries.

Water quality at most of the sites appears to be either fair or good (Figure 18). Forty percent of the sites assessed districtwide had good water quality, 42% had fair quality, and 18% of the SJRWMD sites had poor water quality. The majority of the poor sites were located in lakes, and the majority of those were in the Ocklawaha River Basin.

The highest percentage of improving sites were estuarine (Figure 17). No blackwater stream sites were improving, and only 5% of lake sites were getting better. Five percent of stream sites were improving. Not counting the single spring site, blackwater streams had the highest percentage of sites that were degrading, followed by lake, stream, and then estuarine sites. A large number of sites had no significant trend or insufficient data to determine a trend.

Over all basins and water body types, approximately 8% of all sites sampled showed an improving trend, while almost 13% showed a degrading trend (Figure 19). The majority either had no significant trend (42%) or did not have enough data to calculate a trend (37%).

SUMMARY

Interpreting results from this assessment is complicated by the fact that the sites were not randomly chosen and therefore may not adequately represent the basins they are in. For example, it is statistically unsupportable to state that the results from a series of stations in the Lower St. Johns River actually represent all the water quality in the Lower St. Johns River Basin. At best, the water quality at each station does represent and adequately characterize the water body that it is located in. Fortunately, most of the stations are located in major water bodies, which comprise the majority of the surface water within the area of interest. So it is fair to say that this assessment does provide an indication of water quality for surface waters in each basin.

In summary, the St. Johns River appeared to have good quality upstream, but as it flowed north, the quality degraded somewhat. The river had fair water quality around Lake Jesup and was fair most of the way to the mouth. Peters Creek and Dog Branch were the only improving tributaries, while other tributaries were getting worse or had no trend. Lake Jesup had poor water quality, as did Rice Creek. The upper reaches of the Ocklawaha River have poor quality, most likely due to the poor water quality in the upstream lakes. As the Ocklawaha River flowed north, it did show improved water quality. The Indian River Lagoon had mostly fair quality, with a few poor tributaries. While the Banana River had similar quality, all of the sites in the Mosquito Lagoon showed good quality. The Indian River Lagoon had few significant trends, but most of those trends appeared to be improving. The Northern Coastal Basin sites appeared to have mostly good quality, as did sites in the Nassau River and St. Marys River basins. For most sites, there were not enough data to determine trends, and for many other sites, there were no significant trends.

This assessment was not designed to determine the causes of poor water quality or to determine the causes of degrading or improving trends. Florida remains in a long-term drought, which could have a significant impact on water quality in its lakes and streams and may have influenced the outcome of trend analysis in some cases.

Finally, a more adequate assessment could be performed if more data were available. We encourage continued, regular ambient monitoring to determine status and trends in water quality throughout SJRWMD.

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APPENDIX A—STATION LOCATIONS AND RESULTS TABLES

Table A1. Station locations by major basin

Station	Latitude	Longitude	Station Location	Basin	Water Body Type
27010875	28 41 12	80 48 47	Indian River at ICW CM 12, near Haulover Canal	Indian River Lagoon	Estuary
CC03	28 04 07	80 37 21	Indian River Lagoon, Crane Creek	Indian River Lagoon	Stream
IRLB02	28 26 01	80 38 22	CM 23, midway between NASA and SR 528 causeways	Indian River Lagoon	Estuary
IRLB04	28 22 00	80 38 00	East side of IRL, 1.5 km north of SR 520 causeway	Indian River Lagoon	Estuary
IRLB06	28 17 00	80 38 00	CM 4	Indian River Lagoon	Estuary
IRLB09	28 11 56	80 37 32	BRL just south of Pineda causeway (west of Tortoise Island)	Indian River Lagoon	Estuary
IRLBFC	28 45 18	80 50 42	IRL at Big Flounder Creek at end of Flounder Creek Road	Indian River Lagoon	Estuary
IRLCCU	28 04 39	80 36 08	IRL at Crane Creek at U.S. 1	Indian River Lagoon	Estuary
IRLEGU	28 07 25	80 37 50	IRL at Eau Gallie River at U.S. 1	Indian River Lagoon	Estuary
IRLGUS	27 58 05	80 32 41	IRL at Goat Creek at U.S. 1	Indian River Lagoon	Estuary
IRLHUS	28 09 55	80 38 31	IRL at Horse Creek at U.S. 1	Indian River Lagoon	Estuary
IRLI02	28 44 20	80 48 02	North IRL, northwest of Haulover Canal	Indian River Lagoon	Estuary
IRLI07	28 36 12	80 47 54	North IRL, south of SR 402 near west shore	Indian River Lagoon	Estuary
IRLI10	28 30 04	80 46 08	West side of IRL, south of NASA causeway	Indian River Lagoon	Estuary
IRLI13	28 23 34	80 44 10	On west side of IRL, south of SR 528 bridge	Indian River Lagoon	Estuary
IRLI15	28 20 06	80 42 48	IRL, south of SR 520 within 0.5 km of Rockledge WWTP discharge	Indian River Lagoon	Estuary
IRLI18	28 11 40	80 38 56	Near west shore of IRL, just south of Pineda causeway	Indian River Lagoon	Estuary
IRLI21	28 07 30	80 37 00	In IRL, east of mouth of Eau Gallie River	Indian River Lagoon	Estuary
IRLI23	28 04 12	80 35 40	In center of IRL, just south of Melbourne causeway	Indian River Lagoon	Estuary
IRLI27	27 56 44	80 31 46	Center of ICW, near Grant Farm Island	Indian River Lagoon	Estuary
IRLIRJ01	27 47 48	80 26 56	IRL at CM 70 off Spratt Point, south of Sebastian Inlet, west of ICW	Indian River Lagoon	Estuary
IRLIRJ04	27 41 33	80 23 14	IRL at CM 123, east of ICW	Indian River Lagoon	Estuary
IRLIRJ05	27 39 28	80 22 32	IRL at CM 135, east of ICW	Indian River Lagoon	Estuary
IRLIRJ07	27 37 11	80 22 04	IRL at CM 150, west of ICW	Indian River Lagoon	Estuary
IRLIRJ10	27 41 57	80 23 39	IRL at confluence of Vero North Canal (west of CM 120)	Indian River Lagoon	Estuary
IRLIRJ12	27 36 34	80 22 01	IRL at confluence of Vero South Canal	Indian River Lagoon	Estuary
IRLML02	28 43 35	80 43 05	Mosquito Lagoon, south of Haulover Canal	Indian River Lagoon	Estuary
IRLSUS	27 51 15	80 29 29	IRL at Sebastian River at U.S. 1	Indian River Lagoon	Estuary
IRLTBC	28 49 14	80 51 41	IRL at Turnbull Creek at U.S. 1	Indian River Lagoon	Estuary
IRLV05	29 00 29	80 54 34	IRL south of CM 47 at South Canal discharge	Indian River Lagoon	Estuary

Table A1—*Continued*

Station	Latitude	Longitude	Station Location	Basin	Water Body Type
IRLV11	28 57 09	80 50 41	IRL east of Cedar Island and west of Bethune Beach	Indian River Lagoon	Estuary
IRLV17	28 52 41	80 50 22	IRL south of CM 7, near Barlow's crab building and Oak Hill dock	Indian River Lagoon	Estuary
IRLVMC	27 38 57	80 24 08	IRL at Vero North Canal at U.S. 1	Indian River Lagoon	Stream
IRLVNC	27 41 34	80 24 49	IRL at Vero Main Canal at U.S. 1	Indian River Lagoon	Stream
IRLVSC	27 36 17	80 22 58	IRL at Vero South Canal at U.S. 1	Indian River Lagoon	Stream
02236000	29 00 29	81 22 58	St. Johns River, near DeLand	Lake George	Stream
20010002	29 10 05	81 31 25	St. Johns River at SR 40	Lake George	Stream
20030373	29 22 40	81 37 42	St. Johns River at CM 72	Lake George	Stream
BLSPR	28 56 38	81 20 24	Blue Spring, near Orange City	Lake George	Spring
KER	29 21 44	81 47 35	Lake Kerr, between Kauffmans Island and Point Pleasant	Lake George	Lake
LEO	29 20 05	81 36 58	Lake George at CMs 4 and 5	Lake George	Lake
LKWOOD	29 05 51	81 25 00	Lake Woodruff at center	Lake George	Lake
20030083	30 16 23	81 44 00	Cedar Creek at Blanding Boulevard bridge, Hwy 21	Lower St. Johns River	Stream
20030115	30 23 30	81 39 44	Moncrief Creek, near mouth	Lower St. Johns River	Estuary
20030153	30 07 53	81 37 44	Julington Creek at SR 13 bridge	Lower St. Johns River	Estuary
20030349	30 12 03	81 43 49	Ortega River at Collins Road	Lower St. Johns River	Stream
20030400	29 47 34	81 50 50	Georges Lake, 200 yards from west bank	Lower St. Johns River	Lake
BLC	30 04 55	81 48 35	Black Creek at Hwy 209	Lower St. Johns River	BWstream
BSF	30 03 37	81 52 18	South Fork of Black Creek at Hwy 218	Lower St. Johns River	BWstream
CLD	29 17 07	81 23 27	Center, Lake Disston	Lower St. Johns River	Lake
DBR	29 41 43	81 34 50	Dog Branch, 50 meters downstream of CR 2	Lower St. Johns River	Stream
DNC	29 34 39	81 37 35	Dunns Creek at U.S. 17	Lower St. Johns River	Stream
DPB	29 43 45	81 29 14	Deep Creek at railroad bridge	Lower St. Johns River	Stream
DTL	30 07 51	81 44 18	Doctors Lake at center	Lower St. Johns River	Estuary
GEN	29 46 06	82 01 31	Center, Lake Geneva	Lower St. Johns River	Lake
HAW	29 23 54	81 25 54	Haw Creek mouth at Dead Lake	Lower St. Johns River	Stream
HCC	30 01 40	81 39 13	Hallowes Cove at center	Lower St. Johns River	Estuary
JAXSJR21	30 19 20	81 39 31	SJR at Main Street bridge	Lower St. Johns River	Estuary
JAXSJR30	30 12 11	81 39 18	SJR at Beauclerc Bluff	Lower St. Johns River	Estuary
JAXSJR40	30 15 09	81 39 29	SJR near Piney Point, 100 meters southwest of green CM 5	Lower St. Johns River	Estuary

Table A1—*Continued*

Station	Latitude	Longitude	Station Location	Basin	Water Body Type
LSJ070	29 19 13	81 23 08	Little Haw Creek at U.S. 305, near Seville	Lower St. Johns River	BWstream
LSJ087	30 05 56	81 31 36	Durbin Creek at Racetrack Road	Lower St. Johns River	Stream
LSJ099	30 09 06	81 31 35	Big Davis Creek at U.S. 1	Lower St. Johns River	Stream
LSJ918	29 41 16	81 44 32	Rice Creek at SR 100	Lower St. Johns River	Stream
MOB	29 46 17	81 28 50	Moccasin Branch on SR 13	Lower St. Johns River	Stream
NBC	30 04 32	81 51 50	North Fork of Black Creek at SR 21	Lower St. Johns River	BWstream
OHD	29 42 49	81 32 43	Outlet of Hastings Drainage District	Lower St. Johns River	Stream
PTC	30 02 00	81 43 29	Peters Creek at Hwy 209	Lower St. Johns River	Stream
RCB	29 41 55	81 39 50	Rice Creek at U.S. 17 bridge	Lower St. Johns River	Stream
SHEEL	29 50 22	81 57 30	Lake Sheelar, center, at Gold Head State Park	Lower St. Johns River	Lake
SIM	29 44 27	81 42 49	Simms Creek, 2 miles north-northeast of Bardin	Lower St. Johns River	Stream
SJCM25	29 55 16	81 36 24	SJR at CM 25, near Picolata	Lower St. Johns River	Lake
SJM37	29 45 04	81 33 24	SJR at CM 37	Lower St. Johns River	Lake
SJP	29 38 48	81 37 30	SJR at Palatka (U.S. 17)	Lower St. Johns River	Lake
SJRCC	29 41 44	81 38 12	SJR below Rice Creek	Lower St. Johns River	Lake
SJRHBP	30 04 15	81 40 39	SJR at Hibernia Point	Lower St. Johns River	Estuary
SJSR16	29 58 57	81 37 06	SJR at SR 16, south of Shands bridge	Lower St. Johns River	Estuary
SMC	29 57 32	81 32 37	Sixmile Creek at SR 13	Lower St. Johns River	Stream
SPCR	30 05 59	81 44 48	Swimming Pen Creek at Hwy 220	Lower St. Johns River	Stream
SRB	29 35 42	81 40 56	SJR at Buffalo Bluff railroad bridge	Lower St. Johns River	Stream
SRP	29 47 56	81 33 52	SJR at Racy Point	Lower St. Johns River	Lake
WIO	29 10 48	81 20 05	Center of Lake Winona	Lower St. Johns River	Lake
02235000	28 48 54	81 25 10	Wekiva River, near Sanford	Middle St. Johns River	Stream
20010003	28 50 14	81 19 22	St. Johns River at U.S. 17 and U.S. 92	Middle St. Johns River	Stream
20010137	28 41 16	81 23 50	Little Wekiva River at Hwy 434	Middle St. Johns River	Stream
ASH	28 55 47	81 05 37	Center, Lake Ashby	Middle St. Johns River	Lake
BWC44	28 52 28	81 29 22	Blackwater Creek at SR 44	Middle St. Johns River	BWstream
BWCCPB	28 51 27	81 26 10	Blackwater Creek at Carter Property bridge	Middle St. Johns River	BWstream
DMR	28 50 46	81 04 46	Deep Creek at Maytown Road bridge	Middle St. Johns River	BWstream

Table A1—*Continued*

Station	Latitude	Longitude	Station Location	Basin	Water Body Type
ECH	28 40 40	81 06 51	Econlockhatchee River at Snowhill Road	Middle St. Johns River	Stream
LMAC	28 50 39	81 15 41	Lake Monroe at center	Middle St. Johns River	Lake
OW-2	28 46 05	81 10 28	Lake Jesup in 4-ft hole off Grassy Point	Middle St. Johns River	Lake
OW-4	28 42 21	81 14 12	Lake Jesup in 10-ft hole between Whites Landing and Bird Island	Middle St. Johns River	Lake
OW-6	28 42 50	81 16 52	Lake Jesup in 4-ft hole off center of far west arm	Middle St. Johns River	Lake
OW-SJR-1	28 47 05	81 10 08	Mid SJR at east of Barge Canal, near JJ Fish Camp	Middle St. Johns River	Stream
OW-SJR-2	28 47 45	81 10 48	Mid SJR between Brickyard Slough and Thornhill Lake	Middle St. Johns River	Stream
SRN	28 42 49	81 02 51	SJR at SR 46 Seminole Ranch, northbound	Middle St. Johns River	Stream
WIN	29 01 24	81 15 00	Center of Lake Winnemisett, near DeLand	Middle St. Johns River	Lake
NRI	30 34 53	81 41 09	Nassau River near Italia	Nassau River	Stream
02238000	28 52 20	81 46 50	Haines Creek at Lisbon	Ocklawaha River	Stream
20020001	29 04 53	81 53 05	Ocklawaha River at CR 464c	Ocklawaha River	Stream
20020012	29 22 18	81 54 03	Ocklawaha River at CR 316	Ocklawaha River	Stream
20020368	28 50 51	81 43 55	Lake Eustis, middle	Ocklawaha River	Lake
20020381	28 51 44	81 50 55	Lake Griffin, middle, offshore Treasure Island	Ocklawaha River	Lake
ABC	28 43 20	81 41 04	Apopka-Beauclair Canal, upstream of lock	Ocklawaha River	Stream
BCE	28 46 14	81 40 19	Lake Beauclair, east	Ocklawaha River	Lake
BIVARM	29 37 25	82 20 38	Bivens Arm, center	Ocklawaha River	Lake
CLA	28 37 30	81 37 30	Lake Apopka, center station	Ocklawaha River	Lake
CLW	29 01 13	81 56 12	Center of Lake Weir	Ocklawaha River	Lake
DEPHCA	28 53 22	81 49 35	Haines Creek, below flow-way discharges	Ocklawaha River	Stream
DNE	28 45 57	81 54 23	Lake Denham	Ocklawaha River	Lake
DOR	28 47 21	81 41 23	Lake Dora, center lobe	Ocklawaha River	Lake
HAR	28 46 19	81 49 00	Center of Lake Harris	Ocklawaha River	Lake
HAT26	29 41 14	82 12 24	Hatchet Creek at SR 26	Ocklawaha River	Stream
HOGSW2ND	29 39 02	82 22 31	Hogtown Creek at Southwest 2nd Avenue	Ocklawaha River	Stream
HRFA	28 45 49	81 53 49	Helena Run, below Lake Denham	Ocklawaha River	Stream
LGN	28 52 11	81 50 51	Lake Griffin, north	Ocklawaha River	Lake
LHAT26	29 40 57	82 13 59	Little Hatchet Creek	Ocklawaha River	Stream
LHT26E	29 41 17	82 13 15	Little Hatchet Creek, east	Ocklawaha River	Stream

Table A1—*Continued*

Station	Latitude	Longitude	Station Location	Basin	Water Body Type
LOL	29 31 12	82 07 29	Center, Lake Lochloosa	Ocklawaha River	Lake
LYC	28 54 52	81 44 01	Center of Lake Yale	Ocklawaha River	Lake
MBU	29 04 44	81 52 54	Moss Bluff structure above dam	Ocklawaha River	Stream
NEW	29 38 43	82 13 12	Newnans Lake, center	Ocklawaha River	Lake
NLA	28 39 42	81 36 16	Lake Apopka, north	Ocklawaha River	Lake
OLC	29 27 54	82 10 39	Orange Lake, center	Ocklawaha River	Lake
OR006	29 30 33	81 56 48	Orange Creek at SR 21	Ocklawaha River	Stream
ORD	29 13 03	81 59 09	Ocklawaha River, downstream of SR 40 just before 4th bend in the river	Ocklawaha River	Stream
SHORIA	28 59 38	81 50 19	Sunnyhill Farm Marsh, C-231 canal, near intake culvert	Ocklawaha River	Stream
SLA	28 34 02	81 39 02	Lake Apopka, east of Gourd Neck Spring	Ocklawaha River	Lake
YGCC	28 54 37	81 48 15	Yale-Griffin Canal	Ocklawaha River	Stream
19010001	30 44 16	81 41 14	St. Marys River, Georgia line, U.S. 17	St. Marys River	Stream
19010006	30 31 15	82 13 48	St. Marys River at SR 2	St. Marys River	BWstream
MPS	30 25 56	82 13 52	Middle Prong, St. Marys River at 127	St. Marys River	BWstream
02248000	29 03 01	81 02 49	Spruce Creek, near Samsula	Northern Coastal	Stream
27010579	29 13 01	81 06 33	Tomoka River at 11th Street bridge	Northern Coastal	Stream
BUL	29 24 26	81 07 19	Bulow Creek at low bridge	Northern Coastal	Estuary
CCC	29 58 41	81 20 13	Casa Cola Creek	Northern Coastal	Estuary
GAR	30 01 20	81 19 42	Guana River, 100 meters south of the dam	Northern Coastal	Estuary
JXTR17	29 59 05	81 19 42	Confluence of Tolomato and Guana rivers, at ICW	Northern Coastal	Estuary
JXTR21	29 46 06	81 15 32	Matanzas River, north of Crescent Beach at SR 206 bridge	Northern Coastal	Estuary
JXTR26	29 33 40	81 10 50	ICW marker at Fox Cut	Northern Coastal	Estuary
MAT	29 37 08	81 12 27	South of Washington Oaks, on Matanzas River at CM 109	Northern Coastal	Estuary
MCICW	29 49 43	81 18 44	Moultrie Creek at ICW	Northern Coastal	Estuary
MR312	29 52 19	81 18 24	Matanzas River at CR 312	Northern Coastal	Estuary
MRT	29 39 53	81 13 05	Confluence of Pellicer Creek and ICW	Northern Coastal	Estuary
MTC	29 50 50	81 21 41	Moultrie Creek at SR 207	Northern Coastal	Stream
PEL	29 39 05	81 17 14	Pellicer Creek at U.S. 1	Northern Coastal	Stream
SMITHSCR	30 05 25	81 22 15	Smiths Creek	Northern Coastal	Estuary
SSB	29 52 55	81 19 26	San Sebastian River at U.S. 1	Northern Coastal	Estuary

Table A1—*Continued*

Station	Latitude	Longitude	Station Location	Basin	Water Body Type
STOKESCR	30 00 57	81 21 24	Stokes Creek	Northern Coastal	Estuary
TOL	30 03 59	81 22 12	1 mile north of Deep Creek at Spanish Landing on Tolomato River	Northern Coastal	Estuary
BCL	27 43 36	80 45 13	Blue Cypress Lake at center	Upper St. Johns River	Lake
JGS	28 04 27	80 53 18	Jane Green Creek at USGS gage at Ten Mile Road	Upper St. Johns River	Stream
LPO	28 21 26	80 52 19	Lake Poinsett Outlet at SR 520	Upper St. Johns River	Lake
LWC	28 08 33	80 44 41	Lake Washington, center	Upper St. Johns River	Lake
SRS	28 32 34	80 56 35	Seminole Ranch, south boundary at SR 50, along SJR	Upper St. Johns River	Stream
USJ055	28 07 48	81 00 06	Crabgrass Creek at SR 192	Upper St. Johns River	Stream
USJ918	28 12 47	80 54 41	Wolf Creek at SR 419 bridge	Upper St. Johns River	Stream

Note: BWstream = blackwater stream
CM = channel marker

Table A2. Status results for each site by basin

Station	Station Location	Basin	Water Body Type	Method Used	Number of Seasonal Medians	Median Index Value	Quality
27010875	Indian River at ICW CM 12, near Haulover Canal	Indian River Lagoon	Estuary	TSI	10	53.4	Fair
CC03	Indian River Lagoon, Crane Creek	Indian River Lagoon	Stream	WQI	9	50	Fair
IRLB02	CM 23, midway between NASA and SR 528 causeways	Indian River Lagoon	Estuary	TSI	12	47.6	Good
IRLB04	East side of IRL, 1.5 km north of SR 520 causeway	Indian River Lagoon	Estuary	TSI	12	50.8	Fair
IRLB06	CM 4	Indian River Lagoon	Estuary	TSI	12	51.9	Fair
IRLB09	BRL, just south of Pineda causeway (west of Tortoise Island)	Indian River Lagoon	Estuary	TSI	12	53.8	Fair
IRLBFC	IRL at Big Flounder Creek at end of Flounder Creek Road	Indian River Lagoon	Estuary	TSI	12	68.7	Poor
IRLCCU	IRL at Crane Creek at U.S. 1	Indian River Lagoon	Estuary	TSI	12	55.2	Fair
IRLEGU	IRL at Eau Gallie River at U.S. 1	Indian River Lagoon	Estuary	TSI	12	63.5	Poor
IRLGUS	IRL at Goat Creek at U.S. 1	Indian River Lagoon	Estuary	TSI	12	46.9	Good
IRLHUS	IRL at Horse Creek at U.S. 1	Indian River Lagoon	Estuary	TSI	12	47.5	Good
IRLI02	North IRL, northwest of Haulover Canal	Indian River Lagoon	Estuary	TSI	12	52.4	Fair
IRLI07	North IRL, south of SR 402 near west shore	Indian River Lagoon	Estuary	TSI	12	56.2	Fair
IRLI10	West side of IRL, south of NASA causeway	Indian River Lagoon	Estuary	TSI	12	53.8	Fair
IRLI13	On west side of IRL, south of SR 528 bridge	Indian River Lagoon	Estuary	TSI	12	49.3	Good
IRLI15	Middle of IRL, south of SR 520, 0.5 km of Rockledge WWTP discharge	Indian River Lagoon	Estuary	TSI	12	50.8	Fair
IRLI18	Near west shore of IRL, just south of Pineda causeway	Indian River Lagoon	Estuary	TSI	12	50	Fair
IRLI21	In IRL, east of mouth of Eau Gallie River	Indian River Lagoon	Estuary	TSI	12	53.6	Fair
IRLI23	In center of IRL, just south of Melbourne causeway	Indian River Lagoon	Estuary	TSI	12	51.9	Fair
IRLI27	Center of ICW, near Grant Farm Island	Indian River Lagoon	Estuary	TSI	12	50.5	Fair
IRLIRJ01	IRL at CM 70 off Spratt Point, south of Sebastian Inlet, west of ICW	Indian River Lagoon	Estuary	TSI	12	47.7	Good
IRLIRJ04	IRL at CM 123, east of ICW	Indian River Lagoon	Estuary	TSI	12	51.2	Fair
IRLIRJ05	IRL at CM 135, east of ICW	Indian River Lagoon	Estuary	TSI	12	50.1	Fair
IRLIRJ07	IRL at CM 150, west of ICW	Indian River Lagoon	Estuary	TSI	12	48.9	Good
IRLIRJ10	IRL at confluence of Vero North Canal (west of CM 120)	Indian River Lagoon	Estuary	TSI	12	50.1	Fair
IRLIRJ12	IRL at confluence of Vero South Canal	Indian River Lagoon	Estuary	TSI	12	48.9	Good
IRLML02	Mosquito Lagoon, south of Haulover Canal	Indian River Lagoon	Estuary	TSI	12	47.4	Good
IRLSUS	IRL at Sebastian River at U.S. 1	Indian River Lagoon	Estuary	TSI	12	50.4	Fair
IRLTBC	IRL at Turnbull Creek at U.S. 1	Indian River Lagoon	Estuary	TSI	12	62.8	Poor
IRLV05	IRL, south of CM 47 at South Canal discharge	Indian River Lagoon	Estuary	TSI	12	46.4	Good
IRLV11	IRL, east of Cedar Island and West of Bethune Beach	Indian River Lagoon	Estuary	TSI	12	49	Good
IRLV17	IRL, south of CM 7, near Barlow's crab building/Oak Hill dock	Indian River Lagoon	Estuary	TSI	12	47.4	Good
IRLVMC	IRL at Vero North Canal at U.S. 1	Indian River Lagoon	Stream	WQI	12	40.6	Good

Table A2—*Continued*

Station	Station Location	Basin	Water Body Type	Method Used	Number of Seasonal Medians	Median Index Value	Quality
IRLVNC	IRL at Vero Main Canal at U.S. 1	Indian River Lagoon	Stream	WQI	12	43.5	Good
IRLVSC	IRL at Vero South Canal at U.S. 1	Indian River Lagoon	Stream	WQI	12	47.2	Fair
IRLVSC	IRL at Vero South Canal at U.S. 1	Indian River Lagoon	Stream	WQI	12	47.2	Fair
02236000	St. Johns River, near DeLand	Lake George	Stream	WQI	11	46.2	Fair
20010002	St. Johns River at SR 40	Lake George	Stream	WQI	9	38.9	Good
20030373	St. Johns River at CM 72	Lake George	Stream	WQI	10	40.5	Good
BLSPR	Blue Spring, near Orange City	Lake George	Spring	WQI	11	26.2	Good
KER	Lake Kerr, between Kauffmans Island and Point Pleasant	Lake George	Lake	TSI	11	24.9	Good
LEO	Lake George at CMs 4 and 5	Lake George	Lake	TSI	10	63.2	Fair
LKWOOD	Lake Woodruff, at center	Lake George	Lake	TSI	11	56.7	Good
20030083	Cedar Creek at Blanding Boulevard bridge, Hwy 21	Lower St. Johns River	Stream	WQI	10	47.3	Fair
20030115	Moncrief Creek, near mouth	Lower St. Johns River	Estuary	TSI	10	54.2	Fair
20030153	Julington Creek at SR 13 bridge	Lower St. Johns River	Estuary	TSI	10	56.2	Fair
20030349	Ortega River at Collins Road	Lower St. Johns River	Stream	WQI	10	49.3	Fair
20030400	Georges Lake, 200 yards from west bank	Lower St. Johns River	Lake	TSI	10	37.8	Good
BLC	Black Creek at Hwy 209	Lower St. Johns River	BWstream	WQI	11	38.2	Good
BSF	South Fork of Black Creek, at Hwy 218	Lower St. Johns River	BWstream	WQI	11	40.6	Good
CLD	Center, Lake Disston	Lower St. Johns River	Lake	TSI	11	47.9	Good
DBR	Dog Branch, 50 meters downstream of CR 2	Lower St. Johns River	Stream	WQI	11	55.7	Fair
DNC	Dunns Creek at U.S. 17	Lower St. Johns River	Stream	WQI	11	49.5	Fair
DPB	Deep Creek at railroad bridge	Lower St. Johns River	Stream	WQI	11	58.9	Fair
DTL	Doctors Lake at center	Lower St. Johns River	Estuary	TSI	11	65	Poor
GEN	Center, Lake Geneva	Lower St. Johns River	Lake	TSI	11	27.6	Good
HAW	Haw Creek mouth at Dead Lake	Lower St. Johns River	Stream	WQI	10	60.9	Poor
HCC	Hallowes Cove at center	Lower St. Johns River	Estuary	TSI	10	58.7	Fair
JAXSJR21	SJR at Main Street bridge	Lower St. Johns River	Estuary	TSI	8	53	Fair
JAXSJR30	SJR at Beauclerc Bluff	Lower St. Johns River	Estuary	TSI	7	57.9	Fair
JAXSJR40	SJR near Piney Point, 100 M southwest of green CM 5	Lower St. Johns River	Estuary	TSI	9	56.5	Fair
LSJ070	Little Haw Creek at U.S. 305, near Seville	Lower St. Johns River	BWstream	WQI	11	20.4	Good
LSJ087	Durbin Creek at Racetrack Road	Lower St. Johns River	Stream	WQI	10	55.1	Fair
LSJ099	Big Davis Creek at U.S. 1	Lower St. Johns River	Stream	WQI	10	42.2	Good
LSJ918	Rice Creek at SR 100	Lower St. Johns River	Stream	WQI	11	39.3	Good
MOB	Moccasin Branch on SR 13	Lower St. Johns River	Stream	WQI	11	50.5	Fair
NBC	North Fork of Black Creek at SR 21	Lower St. Johns River	BWstream	WQI	11	29.7	Good

Table A2—*Continued*

Station	Station Location	Basin	Water Body Type	Method Used	Number of Seasonal Medians	Median Index Value	Quality
OHD	Outlet of Hastings Drainage District	Lower St. Johns River	Stream	WQI	11	55.1	Fair
PTC	Peters Creek at Hwy 209	Lower St. Johns River	Stream	WQI	11	45	Good
RCB	Rice Creek at U.S. 17 bridge	Lower St. Johns River	Stream	WQI	11	66.6	Poor
SHEEL	Lake Sheelar, center, at Gold Head State Park	Lower St. Johns River	Lake	TSI	11	21.8	Good
SIM	Simms Creek, 2 miles north-northeast of Bardin	Lower St. Johns River	Stream	WQI	11	30.7	Good
SJCM25	SJR at CM 25, near Picolata	Lower St. Johns River	Lake	TSI	11	63.4	Fair
SJM37	SJR at CM 37	Lower St. Johns River	Lake	TSI	10	64.1	Fair
SJP	SJR at Palatka (U.S. 17)	Lower St. Johns River	Lake	TSI	11	62.3	Fair
SJRCC	SJR below Rice Creek	Lower St. Johns River	Lake	TSI	10	61.7	Fair
SJRHBP	SJR at Hibernia Point	Lower St. Johns River	Estuary	TSI	11	55.6	Fair
SJSR16	SJR at SR 16, south of Shands bridge	Lower St. Johns River	Estuary	TSI	11	59.4	Fair
SMC	Sixmile Creek at SR 13	Lower St. Johns River	Stream	WQI	11	55.7	Fair
SPCR	Swimming Pen Creek at Hwy 220	Lower St. Johns River	Stream	WQI	11	49.4	Fair
SRB	SJR at Buffalo Bluff railroad bridge	Lower St. Johns River	Stream	WQI	9	43.1	Good
SRP	SJR at Racy Point	Lower St. Johns River	Lake	TSI	11	64.4	Fair
WIO	Center of Lake Winona	Lower St. Johns River	Lake	TSI	11	24.1	Good
02235000	Wekiva River, near Sanford	Middle St. Johns River	Stream	WQI	10	30.6	Good
20010003	St. Johns River at U.S. 17 and U.S. 92	Middle St. Johns River	Stream	WQI	10	44.7	Good
20010137	Little Wekiva River at Hwy 434	Middle St. Johns River	Stream	WQI	10	44.9	Good
ASH	Center, Lake Ashby	Middle St. Johns River	Lake	TSI	9	53.5	Good
BWC44	Blackwater Creek at SR 44	Middle St. Johns River	BWstream	WQI	10	36.7	Good
BWCCPB	Blackwater Creek at Carter Property bridge	Middle St. Johns River	BWstream	WQI	10	43.6	Good
DMR	Deep Creek at Maytown Road bridge	Middle St. Johns River	BWstream	WQI	11	32.1	Good
ECH	Econlockhatchee River at Snowhill Road	Middle St. Johns River	Stream	WQI	11	40	Good
LMAC	Lake Monroe at center	Middle St. Johns River	Lake	TSI	11	63.1	Fair
OW-2	Lake Jesup in 4-ft hole off Grassy Point	Middle St. Johns River	Lake	TSI	11	78	Poor
OW-4	Lake Jesup in 10-ft hole between Whites Landing and Bird Is.	Middle St. Johns River	Lake	TSI	11	81.5	Poor
OW-6	Lake Jesup in 4-ft hole off center of far west arm	Middle St. Johns River	Lake	TSI	11	77.5	Poor
OW-SJR-1	Mid SJR, east of Barge Canal, near JJ Fish Camp	Middle St. Johns River	Stream	WQI	11	52.5	Fair
OW-SJR-2	Mid SJR between Brickyard Slough and Thornhill Lake	Middle St. Johns River	Stream	WQI	11	56.1	Fair
SRN	SJR at SR 46, Seminole Ranch, northbound	Middle St. Johns River	Stream	WQI	11	53.8	Fair
WIN	Center of Lake Winnemisett, near DeLand	Middle St. Johns River	Lake	TSI	11	32	Good
NRI	Nassau River, near Italia	Nassau River	Stream	WQI	11	58.2	Fair

Table A2—*Continued*

Station	Station Location	Basin	Water Body Type	Method Used	Number of Seasonal Medians	Median Index Value	Quality
02238000	Haines Creek at Lisbon	Ocklawaha River	Stream	WQI	11	61	Poor
20020001	Ocklawaha River at CR 464c	Ocklawaha River	Stream	WQI	10	57.5	Fair
20020012	Ocklawaha River at CR 316	Ocklawaha River	Stream	WQI	9	33.7	Good
20020368	Lake Eustis, middle	Ocklawaha River	Lake	TSI	11	69.8	Fair
20020381	Lake Griffin, middle, offshore Treasure Island	Ocklawaha River	Lake	TSI	11	90.6	Poor
ABC	Apopka-Beauclair Canal, upstream of lock	Ocklawaha River	Stream	WQI	11	66.6	Poor
BCE	Lake Beauclair, east	Ocklawaha River	Lake	TSI	11	85.5	Poor
BIVARM	Bivens Arm, center	Ocklawaha River	Lake	TSI	11	73.8	Poor
CLA	Lake Apopka, center station	Ocklawaha River	Lake	TSI	11	79.4	Poor
CLW	Center of Lake Weir	Ocklawaha River	Lake	TSI	9	40.1	Good
DEPHCA	Haines Creek, below flow-way discharges	Ocklawaha River	Stream	WQI	11	68	Poor
DNE	Lake Denham	Ocklawaha River	Lake	TSI	9	75.6	Poor
DOR	Lake Dora, center lobe	Ocklawaha River	Lake	TSI	11	84.4	Poor
HAR	Center of Lake Harris	Ocklawaha River	Lake	TSI	11	70.3	Poor
HAT26	Hatchet Creek at SR 26	Ocklawaha River	Stream	WQI	11	55.8	Fair
HOGSW2ND	Hogtown Creek at Southwest 2nd Avenue	Ocklawaha River	Stream	WQI	11	38.5	Good
HRFA	Helena Run, below Lake Denham	Ocklawaha River	Stream	WQI	11	58.3	Fair
LGN	Lake Griffin, north	Ocklawaha River	Lake	TSI	8	90.4	Poor
LHAT26	Little Hatchet Creek	Ocklawaha River	Stream	WQI	7	55.1	Fair
LHT26E	Little Hatchet Creek, east	Ocklawaha River	Stream	WQI	10	63.3	Poor
LOL	Center, Lake Lochloosa	Ocklawaha River	Lake	TSI	11	81.6	Poor
LYC	Center of Lake Yale	Ocklawaha River	Lake	TSI	11	62.6	Fair
MBU	Moss Bluff structure above dam	Ocklawaha River	Stream	WQI	10	65.3	Poor
NEW	Newnans Lake, center	Ocklawaha River	Lake	TSI	11	95.6	Poor
NLA	Lake Apopka, north	Ocklawaha River	Lake	TSI	11	78.4	Poor
OLC	Orange Lake, center	Ocklawaha River	Lake	TSI	9	67.5	Fair
OR006	Orange Creek at SR 21	Ocklawaha River	Stream	WQI	10	36.8	Good
ORD	Ocklawaha River downstream of SR 40, just before 4th bend in the river	Ocklawaha River	Stream	WQI	10	35.4	Good
SHORIA	Sunnyhill Farm Marsh, C-231 Canal, near intake culvert	Ocklawaha River	Stream	WQI	11	71	Poor
SLA	Lake Apopka, east of Gourd Neck Spring	Ocklawaha River	Lake	TSI	11	89	Poor
YGCC	Yale-Griffin Canal	Ocklawaha River	Stream	WQI	8	74.7	Poor
19010001	St. Marys River, Georgia line, U.S. 17	St. Marys River	Stream	WQI	9	50.3	Fair
19010006	St. Marys River at SR 2	St. Marys River	BWstream	WQI	11	14.7	Good

Table A2—*Continued*

Station	Station Location	Basin	Water Body Type	Method Used	Number of Seasonal Medians	Median Index Value	Quality
MPS	Middle Prong, St. Marys River at 127	St. Marys River	BWstream	WQI	11	20.2	Good
02248000	Spruce Creek near Samsula	Northern Coastal	Stream	WQI	11	56.7	Fair
27010579	Tomoka River at 11th Street bridge	Northern Coastal	Stream	WQI	9	47.2	Fair
BUL	Bulow Creek at low bridge	Northern Coastal	Estuary	TSI	11	58.7	Fair
CCC	Casa Cola Creek	Northern Coastal	Estuary	TSI	11	44.6	Good
GAR	Guana River, 100 meters south of the dam	Northern Coastal	Estuary	TSI	11	48.2	Good
JXTR17	Confluence of Tolomato and Guana rivers, ICW	Northern Coastal	Estuary	TSI	11	44.6	Good
JXTR21	Matanzas River, north of Crescent Beach at SR 206 bridge	Northern Coastal	Estuary	TSI	11	44.6	Good
JXTR21	Matanzas River, north of Crescent Beach at SR 206 bridge	Northern Coastal	Estuary	TSI	11	44.6	Good
JXTR26	ICW marker at Fox Cut	Northern Coastal	Estuary	TSI	11	44.6	Good
MAT	South of Washington Oaks, on Matanzas River at CM 109	Northern Coastal	Estuary	TSI	11	44.5	Good
MCICW	Moultrie Creek at ICW	Northern Coastal	Estuary	TSI	11	44.6	Good
MR312	Matanzas River at CR 312	Northern Coastal	Estuary	TSI	11	44.4	Good
MRT	Confluence of Pellicer Creek and ICW	Northern Coastal	Estuary	TSI	11	44.6	Good
MTC	Moultrie Creek at SR 207	Northern Coastal	Stream	WQI	10	51	Fair
PEL	Pellicer Creek at U.S. 1	Northern Coastal	Stream	WQI	11	49.6	Fair
SMITHSCR	Smiths Creek	Northern Coastal	Estuary	TSI	11	45	Good
SSB	San Sebastian River at U.S. 1	Northern Coastal	Estuary	TSI	11	44.6	Good
STOKESCR	Stokes Creek	Northern Coastal	Estuary	TSI	11	45.3	Good
TOL	1 mile north of Deep Creek at Spanish Landing, on Tolomato River	Northern Coastal	Estuary	TSI	11	45.9	Good
BCL	Blue Cypress Lake at center	Upper St. Johns River	Lake	TSI	9	53.2	Good
JGS	Jane Green Creek at USGS gage at Ten Mile Road	Upper St. Johns River	Stream	WQI	11	58	Fair
LPO	Lake Poinsett outlet at SR 520	Upper St. Johns River	Lake	TSI	11	57.2	Good
LWC	Lake Washington, center	Upper St. Johns River	Lake	TSI	11	54.3	Good
SRS	Seminole Ranch, south boundary at SR 50, along SJR	Upper St. Johns River	Stream	WQI	11	57.7	Fair
USJ055	Crabgrass Creek at SR 192	Upper St. Johns River	Stream	WQI	11	53	Fair
USJ918	Wolf Creek at SR 419 bridge	Upper St. Johns River	Stream	WQI	11	53	Fair

Note: BWstream = blackwater stream
CM = channel marker
TSI = trophic state index
WQI = water quality index
WWTP = wastewater treatment plant

Table A3. Trend results for each site by basin

Station	Basin	Type	Method	Seasonal Medians Available	Period of Record	Kendall K	Variance K	Z-score	Z-prob	Trend	Seasonality Condition
27010875	Indian River Lagoon	Estuary	TSI	14	7					Insufficient	Non-seasonal
CC03	Indian River Lagoon	Stream	WQI	13	7					Insufficient	Non-seasonal
IRLB02	Indian River Lagoon	Estuary	TSI	29	16	-38				Insignificant	Non-seasonal
IRLB04	Indian River Lagoon	Estuary	TSI	29	16	-20				Insignificant	Non-seasonal
IRLB06	Indian River Lagoon	Estuary	TSI	14	7					Insufficient	Seasonal
IRLB09	Indian River Lagoon	Estuary	TSI	30	16	-69				Insignificant	Non-seasonal
IRLBFC	Indian River Lagoon	Estuary	TSI	26	13	25				Insignificant	Non-seasonal
IRLCCU	Indian River Lagoon	Estuary	TSI	21	11	-62				Improving	Non-seasonal
IRLEGU	Indian River Lagoon	Estuary	TSI	21	11	-48				Insignificant	Non-seasonal
IRLGUS	Indian River Lagoon	Estuary	TSI	26	13	-89				Improving	Non-seasonal
IRLHUS	Indian River Lagoon	Estuary	TSI	26	13	81				Degrading	Non-seasonal
IRLI02	Indian River Lagoon	Estuary	TSI	26	15	133				Degrading	Non-seasonal
IRLI07	Indian River Lagoon	Estuary	TSI	20	13	48				Insignificant	Non-seasonal
IRLI10	Indian River Lagoon	Estuary	TSI	15	8					Insufficient	Non-seasonal
IRLI13	Indian River Lagoon	Estuary	TSI	16	9					Insufficient	Non-seasonal
IRLI15	Indian River Lagoon	Estuary	TSI	14	7					Insufficient	Non-seasonal
IRLI18	Indian River Lagoon	Estuary	TSI	21	13	-12	304.667	-0.63	0.528	Insignificant	Seasonal
IRLI21	Indian River Lagoon	Estuary	TSI	15	8					Insufficient	Non-seasonal
IRLI23	Indian River Lagoon	Estuary	TSI	15	8					Insufficient	Non-seasonal
IRLI27	Indian River Lagoon	Estuary	TSI	32	16	-44				Insignificant	Non-seasonal
IRLIRJ01	Indian River Lagoon	Estuary	TSI	24	13	10				Insignificant	Non-seasonal
IRLIRJ04	Indian River Lagoon	Estuary	TSI	24	13	4	425.333	0.145	0.884	Insignificant	Seasonal
IRLIRJ05	Indian River Lagoon	Estuary	TSI	23	13	-19	377.667	-0.926	0.354	Insignificant	Seasonal
IRLIRJ07	Indian River Lagoon	Estuary	TSI	24	13	6	425.333	0.242	0.808	Insignificant	Seasonal
IRLIRJ10	Indian River Lagoon	Estuary	TSI	22	12	24	330	1.266	0.206	Insignificant	Seasonal
IRLIRJ12	Indian River Lagoon	Estuary	TSI	22	12	-6	330	-0.275	0.784	Insignificant	Seasonal
IRLML02	Indian River Lagoon	Estuary	TSI	26	16	-41				Insignificant	Non-seasonal
IRLSUS	Indian River Lagoon	Estuary	TSI	23	12	-59	377.667	-2.985	0.002	Improving	Seasonal
IRLTBC	Indian River Lagoon	Estuary	TSI	26	13	7				Insignificant	Non-seasonal
IRLV05	Indian River Lagoon	Estuary	TSI	21	12	-50	290	-2.877	0.004	Improving	Seasonal

Table A3—*Continued*

Station	Basin	Type	Method	Seasonal Medians Available	Period of Record	Kendall K	Variance K	Z-score	Z-prob	Trend	Seasonality Condition
IRLV11	Indian River Lagoon	Estuary	TSI	28	15	-44	667.333	-1.665	0.096	Improving	Seasonal
IRLV17	Indian River Lagoon	Estuary	TSI	26	15	-49	546.333	-2.054	0.04	Improving	Seasonal
IRLVMC	Indian River Lagoon	Stream	WQI	26	13	-2	537.333	-0.043	0.966	Insignificant	Seasonal
IRLVNC	Indian River Lagoon	Stream	WQI	26	13	-4	537.333	-0.129	0.898	Insignificant	Seasonal
IRLVSC	Indian River Lagoon	Stream	WQI	26	13	-2	537.333	-0.043	0.966	Insignificant	Seasonal
02236000	Lake George	Stream	WQI	13	7					Insufficient	Non-seasonal
20010002	Lake George	Stream	WQI	11	6		45	-1.789	0.074	Insufficient	Seasonal
20030373	Lake George	Stream	WQI	13	7					Insufficient	Non-seasonal
ELSPR	Lake George	Spring	WQI	20	11	96				Degrading	Non-seasonal
KER	Lake George	Lake	TSI	29	15	8				Insignificant	Non-seasonal
LEO	Lake George	Lake	TSI	24	12	-12	425.333	-0.533	0.594	Insignificant	Seasonal
LKWOOD	Lake George	Lake	TSI	15	9					Insufficient	Seasonal
20030083	Lower St. Johns River	Stream	WQI	13	7					Insufficient	Seasonal
20030115	Lower St. Johns River	Estuary	TSI	13	7					Insufficient	Non-seasonal
20030153	Lower St. Johns River	Estuary	TSI	13	7					Insufficient	Seasonal
20030349	Lower St. Johns River	Stream	WQI	17	9					Insufficient	Seasonal
20030400	Lower St. Johns River	Lake	TSI	13	7	-16				Insufficient	Non-seasonal
ELC	Lower St. Johns River	BWstream	WQI	29	15	178				Degrading	Non-seasonal
ESF	Lower St. Johns River	BWstream	WQI	25	13	142				Degrading	Non-seasonal
CLD	Lower St. Johns River	Lake	TSI	31	16	-15	901.667	-0.466	0.642	Insignificant	Seasonal
DBR	Lower St. Johns River	Stream	WQI	29	15	-60	742	-2.166	0.030	Improving	Seasonal
DNC	Lower St. Johns River	Stream	WQI	31	16	57	901.667	1.865	0.062	Degrading	Seasonal
DPB	Lower St. Johns River	Stream	WQI	25	13	38	481.333	1.686	0.092	Degrading	Seasonal
DTL	Lower St. Johns River	Estuary	TSI	30	16	10	816.667	0.315	0.752	Insignificant	Seasonal
GEN	Lower St. Johns River	Lake	TSI	23	12	53				Insignificant	Non-seasonal
HAW	Lower St. Johns River	Stream	WQI	30	15	74	816.667	2.554	0.010	Degrading	Seasonal
HCC	Lower St. Johns River	Estuary	TSI	24	12	-12	425.333	-0.533	0.594	Insignificant	Seasonal
JAXSJR21	Lower St. Johns River	Estuary	TSI	19	11	-63				Improving	Non-seasonal
JAXSJR30	Lower St. Johns River	Estuary	TSI	18	11	-51				Improving	Non-seasonal
JAXSJR40	Lower St. Johns River	Estuary	TSI	14	9					Insufficient	Seasonal

Table A3—*Continued*

Station	Basin	Type	Method	Seasonal Medians Available	Period of Record	Kendall K	Variance K	Z-score	Z-prob	Trend	Seasonality Condition
LSJ070	Lower St. Johns River	BWstream	WQI	18	10	-10	184	-0.663	0.508	Insignificant	Seasonal
LSJ087	Lower St. Johns River	Stream	WQI	19	10	-39				Insignificant	Non-seasonal
LSJ099	Lower St. Johns River	Stream	WQI	18	9					Insufficient	Seasonal
LSJ918	Lower St. Johns River	Stream	WQI	20	11	-21	257	-1.248	0.212	Insignificant	Seasonal
MOB	Lower St. Johns River	Stream	WQI	29	16	16	742	0.551	0.582	Insignificant	Seasonal
NBC	Lower St. Johns River	BWstream	WQI	23	12	31	377.667	1.544	0.122	Insignificant	Seasonal
OHD	Lower St. Johns River	Stream	WQI	28	15	-34	667.333	-1.277	0.202	Insignificant	Seasonal
PTC	Lower St. Johns River	Stream	WQI	25	14	-70	481.333	-3.145	0.002	Improving	Seasonal
RCB	Lower St. Johns River	Stream	WQI	25	13	-54				Insignificant	Non-seasonal
SHEEL	Lower St. Johns River	Lake	TSI	17	10	20	157.333	1.515	0.130	Insignificant	Seasonal
SIM	Lower St. Johns River	Stream	WQI	23	12	17				Insignificant	Non-seasonal
SJCM25	Lower St. Johns River	Lake	TSI	22	12	8	330	0.385	0.700	Insignificant	Seasonal
SJM37	Lower St. Johns River	Lake	TSI	18	9					Insufficient	Seasonal
SJP	Lower St. Johns River	Lake	TSI	29	15	24	742	0.844	0.398	Insignificant	Seasonal
SJRCC	Lower St. Johns River	Lake	TSI	18	9					Insufficient	Seasonal
SJRHBP	Lower St. Johns River	Estuary	TSI	22	12	6	330	0.275	0.784	Insignificant	Seasonal
SJSR16	Lower St. Johns River	Estuary	TSI	22	12	-4	330	-0.165	0.868	Insignificant	Seasonal
SMC	Lower St. Johns River	Stream	WQI	31	16	65	901.667	2.131	0.034	Degrading	Seasonal
SPCR	Lower St. Johns River	Stream	WQI	19	10	17	217	1.086	0.278	Insignificant	Seasonal
SRB	Lower St. Johns River	Stream	WQI	23	12	9	377.667	0.412	0.680	Insignificant	Seasonal
SRP	Lower St. Johns River	Lake	TSI	31	16	51	901.667	1.665	0.096	Degrading	Seasonal
WIO	Lower St. Johns River	Lake	TSI	22	12	-23				Insignificant	Non-seasonal
02235000	Middle St. Johns River	Stream	WQI	14	7					Insufficient	Seasonal
20010003	Middle St. Johns River	Stream	WQI	13	7					Insufficient	Non-seasonal
20010137	Middle St. Johns River	Stream	WQI	14	7					Insufficient	Seasonal
ASH	Middle St. Johns River	Lake	TSI	19	10	67				Degrading	Non-seasonal
BWC44	Middle St. Johns River	BWstream	WQI	21	11	20	290	1.116	0.264	Insignificant	Seasonal
BWCCPB	Middle St. Johns River	BWstream	WQI	21	11	30				Insignificant	Non-seasonal
DMR	Middle St. Johns River	BWstream	WQI	19	10	5	217	0.272	0.786	Insignificant	Seasonal
ECH	Middle St. Johns River	Stream	WQI	29	15	-18	742	-0.624	0.532	Insignificant	Seasonal

Table A3—*Continued*

Station	Basin	Type	Method	Seasonal Medians Available	Period of Record	Kendall K	Variance K	Z-score	Z-prob	Trend	Seasonality Condition
LMAC	Middle St. Johns River	Lake	TSI	21	11	24				Insignificant	Non-seasonal
OW-2	Middle St. Johns River	Lake	TSI	15	8					Insufficient	Non-seasonal
OW-4	Middle St. Johns River	Lake	TSI	15	8					Insufficient	Non-seasonal
OW-6	Middle St. Johns River	Lake	TSI	15	8					Insufficient	Non-seasonal
OW-SJR-1	Middle St. Johns River	Stream	WQI	13	7					Insufficient	Seasonal
OW-SJR-2	Middle St. Johns River	Stream	WQI	13	7					Insufficient	Non-seasonal
SRN	Middle St. Johns River	Stream	WQI	29	15	112	742	4.075	0	Degrading	Seasonal
WIN	Middle St. Johns River	Lake	TSI	20	11	32				Insignificant	Non-seasonal
NRI	Nassau River	Stream	WQI	14	8					Insufficient	Seasonal
02238000	Ocklawaha River	Stream	WQI	15	8					Insufficient	Seasonal
20020001	Ocklawaha River	Stream	WQI	13	7					Insufficient	Non-seasonal
20020012	Ocklawaha River	Stream	WQI	12	7					Insufficient	Non-seasonal
20020368	Ocklawaha River	Lake	TSI	24	13	-2	425.333	-0.048	0.962	Insignificant	Seasonal
20020381	Ocklawaha River	Lake	TSI	14	8					Insufficient	Non-seasonal
ABC	Ocklawaha River	Stream	WQI	24	14	-48	425.333	-2.279	0.022	Improving	Seasonal
ECE	Ocklawaha River	Lake	TSI	22	12	-1				Insignificant	Non-seasonal
EIVARM	Ocklawaha River	Lake	TSI	17	9					Insufficient	Non-seasonal
CLA	Ocklawaha River	Lake	TSI	31	16	-159				Improving	Non-seasonal
CLW	Ocklawaha River	Lake	TSI	29	15	22				Insignificant	Non-seasonal
DEPHCA	Ocklawaha River	Stream	WQI	15	8					Insufficient	Seasonal
DNE	Ocklawaha River	Lake	TSI	25	13	-12				Insignificant	Non-seasonal
DOR	Ocklawaha River	Lake	TSI	30	16	-4	816.667	-0.105	0.916	Insignificant	Seasonal
HAR	Ocklawaha River	Lake	TSI	24	13	86				Degrading	Non-seasonal
HAT26	Ocklawaha River	Stream	WQI	17	9					Insufficient	Non-seasonal
HOGSW2ND	Ocklawaha River	Stream	WQI	17	9					Insufficient	Seasonal
HRFA	Ocklawaha River	Stream	WQI	20	11	64				Degrading	Non-seasonal
LGN	Ocklawaha River	Lake	TSI	10	7					Insufficient	Non-seasonal
LHAT26	Ocklawaha River	Stream	WQI	13	8					Insufficient	Non-seasonal
LHT26E	Ocklawaha River	Stream	WQI	16	8					Insufficient	Non-seasonal
LOL	Ocklawaha River	Lake	TSI	30	16	231				Degrading	Non-seasonal

Table A3—*Continued*

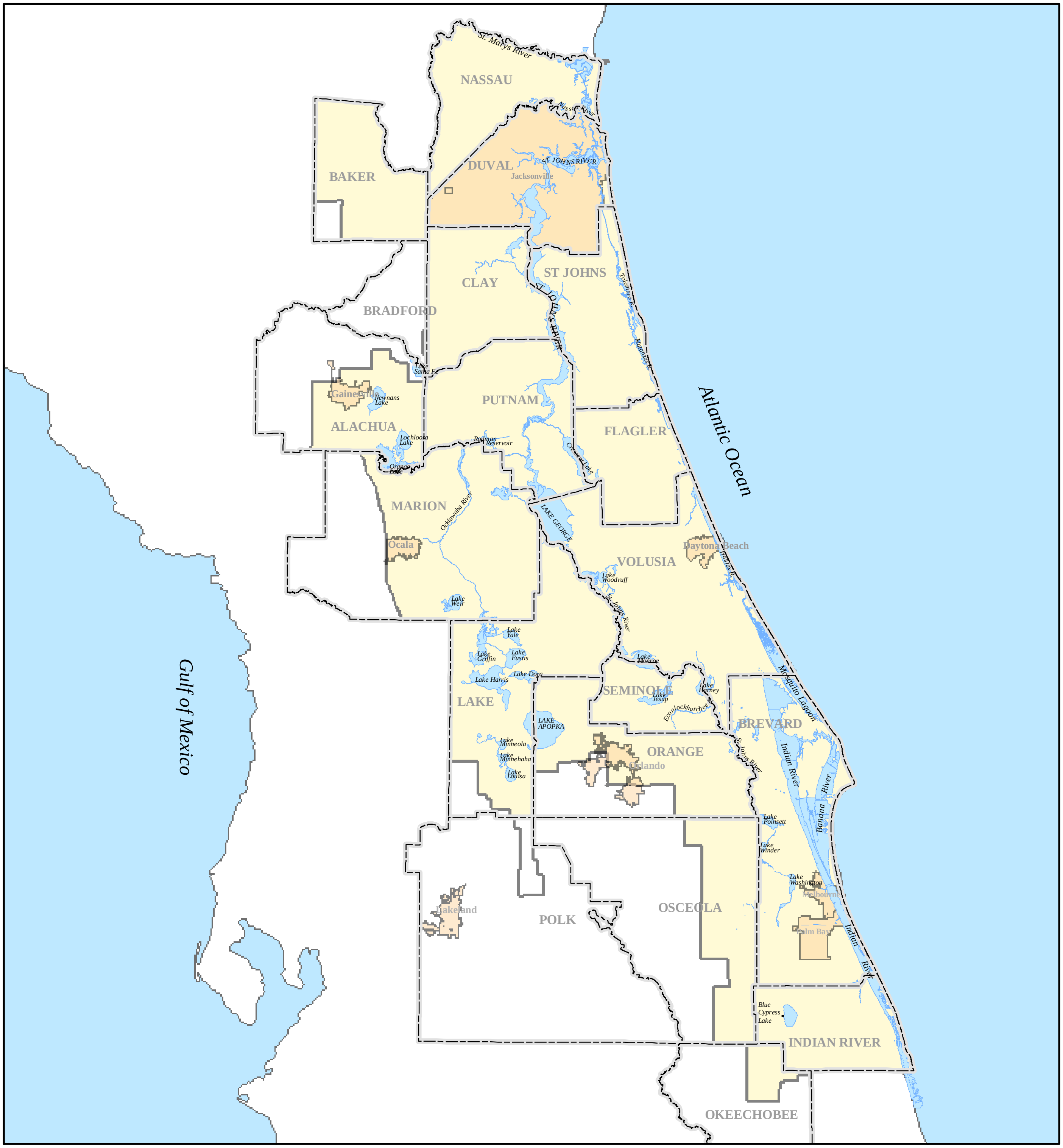
Station	Basin	Type	Method	Seasonal Medians Available	Period of Record	Kendall K	Variance K	Z-score	Z-prob	Trend	Seasonality Condition
LYC	Ocklawaha River	Lake	TSI	31	16	291				Degrading	Non-seasonal
MBU	Ocklawaha River	Stream	WQI	30	15	46	816.667	1.575	0.116	Insignificant	Seasonal
NEW	Ocklawaha River	Lake	TSI	17	9					Insufficient	Non-seasonal
NLA	Ocklawaha River	Lake	TSI	31	16	-161				Improving	Non-seasonal
OLC	Ocklawaha River	Lake	TSI	28	15	158				Degrading	Non-seasonal
OR006	Ocklawaha River	Stream	WQI	20	10	22				Insignificant	Non-seasonal
ORD	Ocklawaha River	Stream	WQI	16	8					Insufficient	Seasonal
SHORIA	Ocklawaha River	Stream	WQI	27	14	35	602.333	1.385	0.166	Insignificant	Seasonal
SLA	Ocklawaha River	Lake	TSI	23	12	-45				Insignificant	Non-seasonal
YGCC	Ocklawaha River	Stream	WQI	12	7					Insufficient	Non-seasonal
19010001	St. Marys River	Stream	WQI	12	7					Insufficient	Seasonal
19010006	St. Marys River	BWstream	WQI	14	8					Insufficient	Non-seasonal
MPS	St. Marys River	BWstream	WQI	21	11	6	290	0.294	0.770	Insignificant	Seasonal
02248000	Northern Coastal	Stream	WQI	14	8					Insufficient	Non-seasonal
27010579	Northern Coastal	Stream	WQI	12	7					Insufficient	Seasonal
BUL	Northern Coastal	Estuary	TSI	31	16	11	901.667	0.333	0.740	Insignificant	Seasonal
CCC	Northern Coastal	Estuary	TSI	11	6					Insufficient	Non-seasonal
GAR	Northern Coastal	Estuary	TSI	11	6					Insufficient	Non-seasonal
JXTR17	Northern Coastal	Estuary	TSI	11	6					Insufficient	Non-seasonal
JXTR21	Northern Coastal	Estuary	TSI	11	6					Insufficient	Non-seasonal
JXTR26	Northern Coastal	Estuary	TSI	11	6					Insufficient	Non-seasonal
MAT	Northern Coastal	Estuary	TSI	31	16	25	901.667	0.799	0.424	Insignificant	Seasonal
MCICW	Northern Coastal	Estuary	TSI	11	6					Insufficient	Non-seasonal
MR312	Northern Coastal	Estuary	TSI	23	12	19				Insignificant	Non-seasonal
MRT	Northern Coastal	Estuary	TSI	11	6					Insufficient	Non-seasonal
MTC	Northern Coastal	Stream	WQI	30	16	18	816.667	0.595	0.552	Insignificant	Seasonal
PEL	Northern Coastal	Stream	WQI	31	16	101	901.667	3.33	0	Degrading	Seasonal
SMITHSCR	Northern Coastal	Estuary	TSI	11	6					Insufficient	Non-seasonal
SSB	Northern Coastal	Estuary	TSI	11	6					Insufficient	Non-seasonal
STOKESCR	Northern Coastal	Estuary	TSI	11	6					Insufficient	Non-seasonal

Table A3—*Continued*

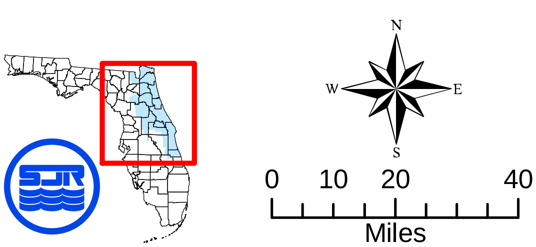
Station	Basin	Type	Method	Seasonal Medians Available	Period of Record	Kendall K	Variance K	Z-score	Z-prob	Trend	Seasonality Condition
TOL	Northern Coastal	Estuary	TSI	31	16	61				Insignificant	Non-seasonal
BCL	Upper St. Johns River	Lake	TSI	28	15	18				Insignificant	Non-seasonal
JGS	Upper St. Johns River	Stream	WQI	23	12	17	377.667	0.823	0.410	Insignificant	Seasonal
LPO	Upper St. Johns River	Lake	TSI	29	15	88	742	3.194	0.002	Degrading	Seasonal
LWC	Upper St. Johns River	Lake	TSI	23	12	31	377.667	1.544	0.122	Insignificant	Seasonal
SRS	Upper St. Johns River	Stream	WQI	23	12	55	377.667	2.779	0.006	Degrading	Seasonal
USJ055	Upper St. Johns River	Stream	WQI	19	11	3	217	0.136	0.892	Insignificant	Seasonal
USJ918	Upper St. Johns River	Stream	WQI	19	11	-21	217	-1.358	0.174	Insignificant	Seasonal

Note: BWstream = blackwater stream
TSI = trophic state index
WQI = water quality index

APPENDIX B—MAPS



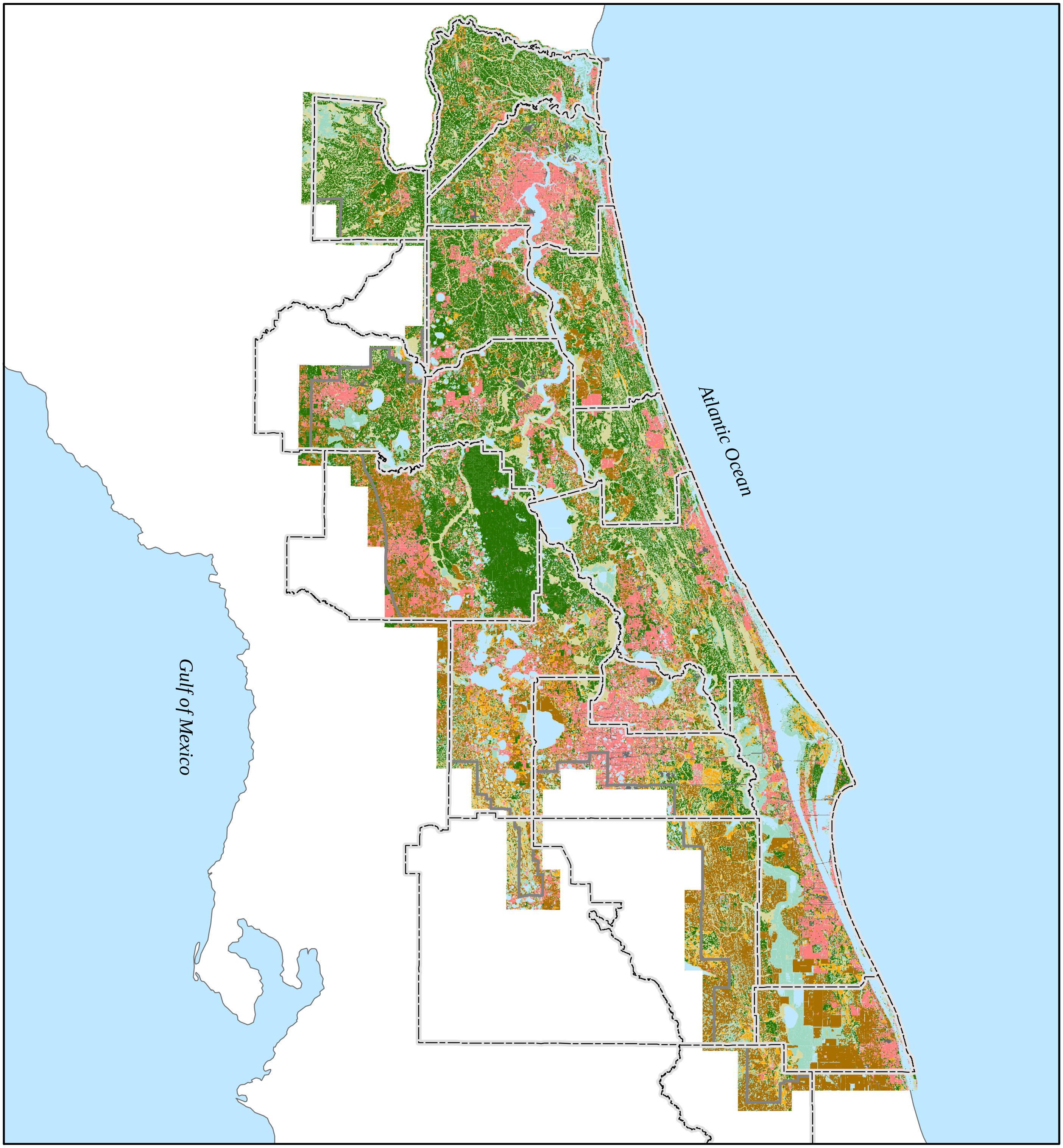
Map 1. **The St. Johns River Water Management District**



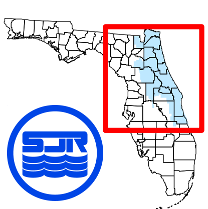
Legend

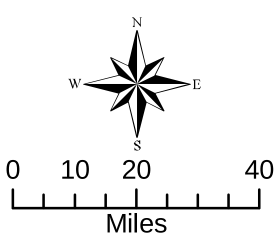
- SJRWMD
- City > 40,000 population
- Hydrography
- County boundary
- SJRWMD boundary

The St. Johns River Water Management District prepares and uses this information for its own purposes, and this information may not be suitable for other purposes. This information is provided as is. Further documentation of this data can be obtained by contacting the St. Johns River Water Management District, Geographic Information Systems, Program Management, 4049 Reid Street, Palatka, FL 32177. Tel: (386) 329-4176.



Map 2. **1995 land use and land cover within the St. Johns River Water Management District**





Legend

- Urban and suburban
- Agriculture
- Rangeland
- Upland forests
- Water
- Wetland forests
- Other wetlands
- Barren land
- Transportation, communication, utilities

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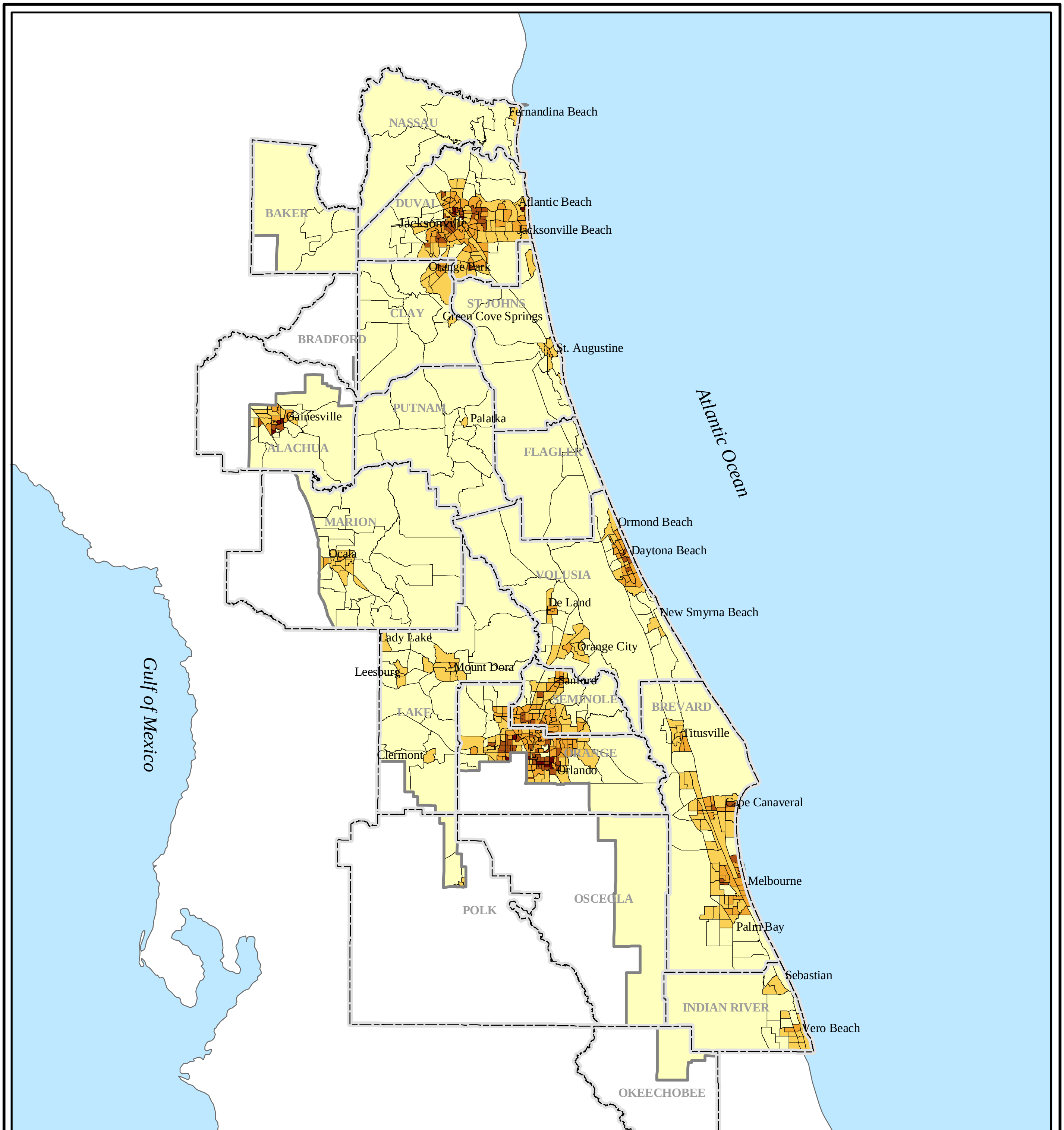
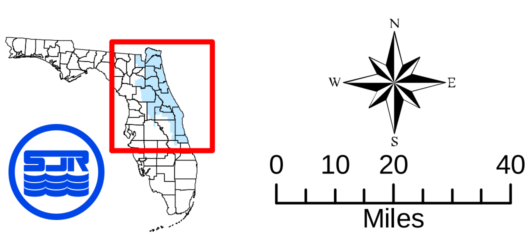


Map 3. **2000 population density in the St. Johns River Water Management District**



Legend

Population per square mile

- 5 - 1,000
- 1001 - 2,400
- 2,401 - 4,000
- 4,001 - 6,300
- 6,301 - 15,550

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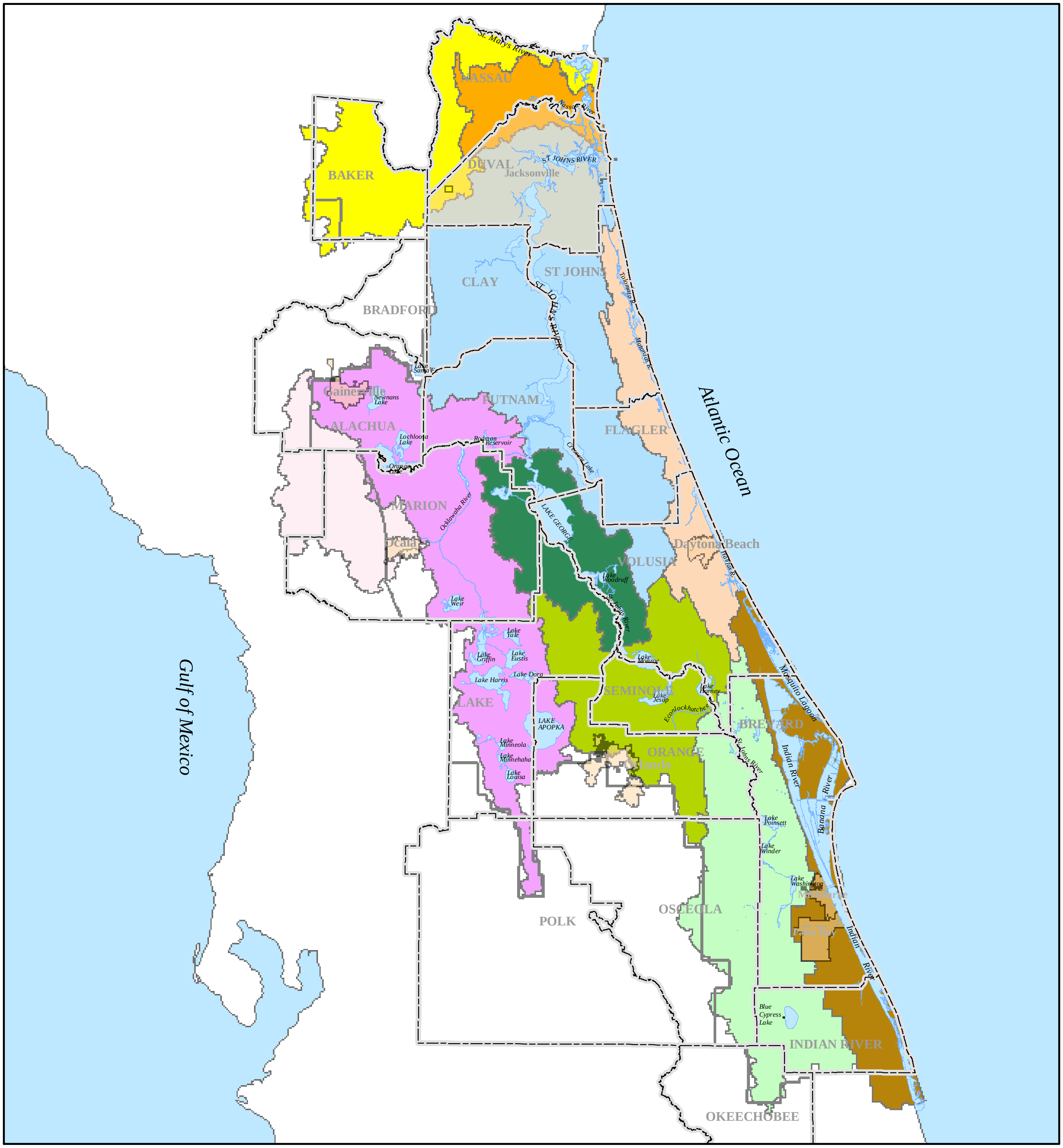
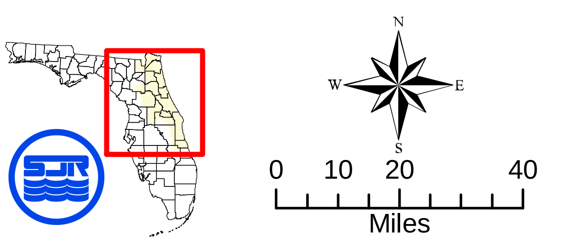
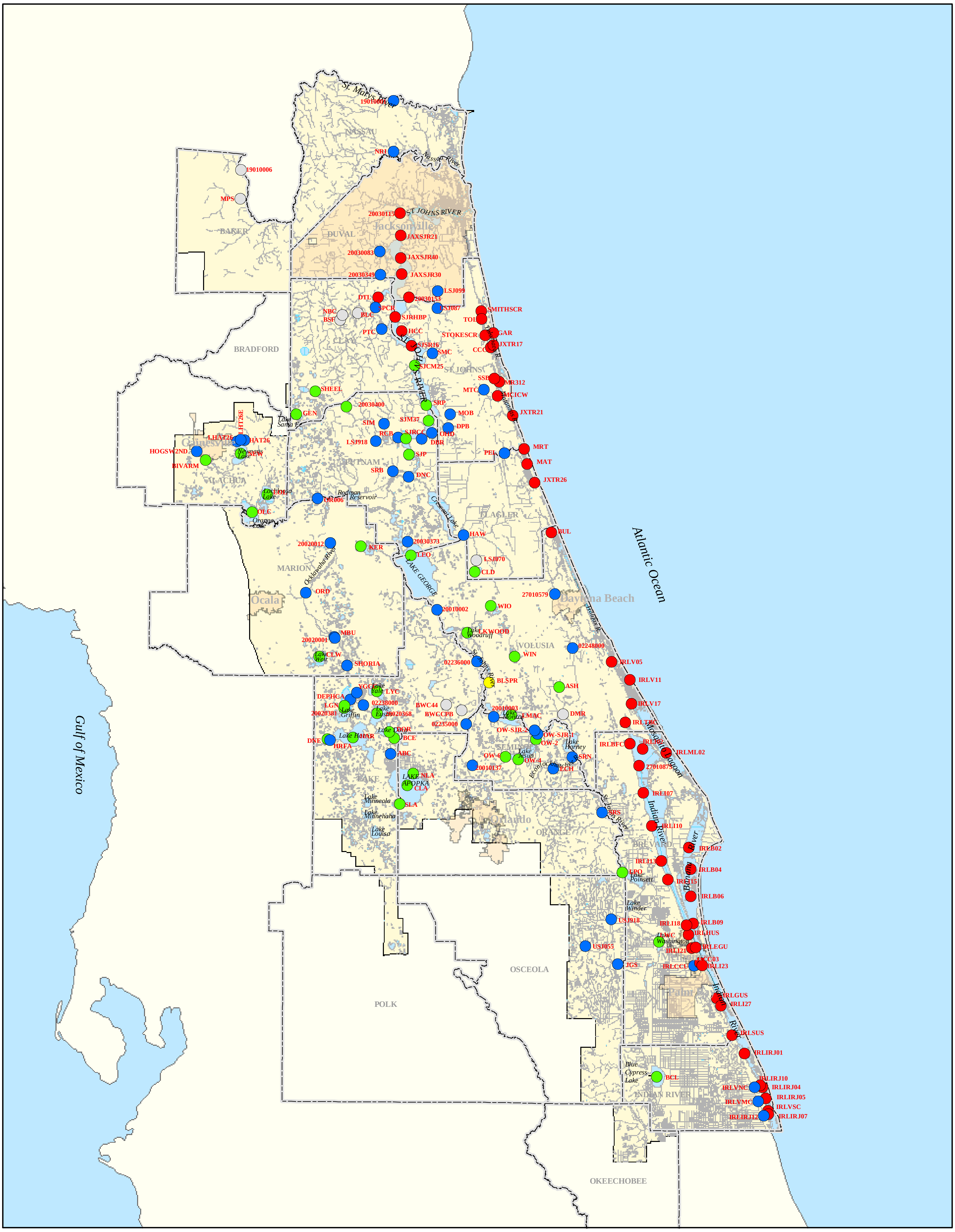


Map 4. **Surface water basins within the St. Johns River Water Management District**

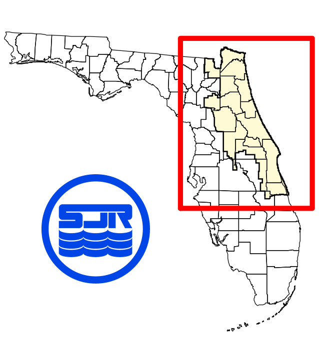


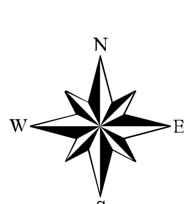
Legend

- Nassau River
- St. Marys River
- Lower St. Johns River
- Middle St. Johns River
- Lake George
- Upper St. Johns River
- Ocklawaha River
- Florida Ridge
- Northern Coastal
- Indian River Lagoon



Map 5. **Ambient water quality sites by water body type**





0 10 20 40
Miles

Legend

- Blackwater stream
- Estuary
- Lake
- Spring
- Stream
- Hydrography
- City > 40,000 population
- Estuarine
- County boundary
- Hydrography arc

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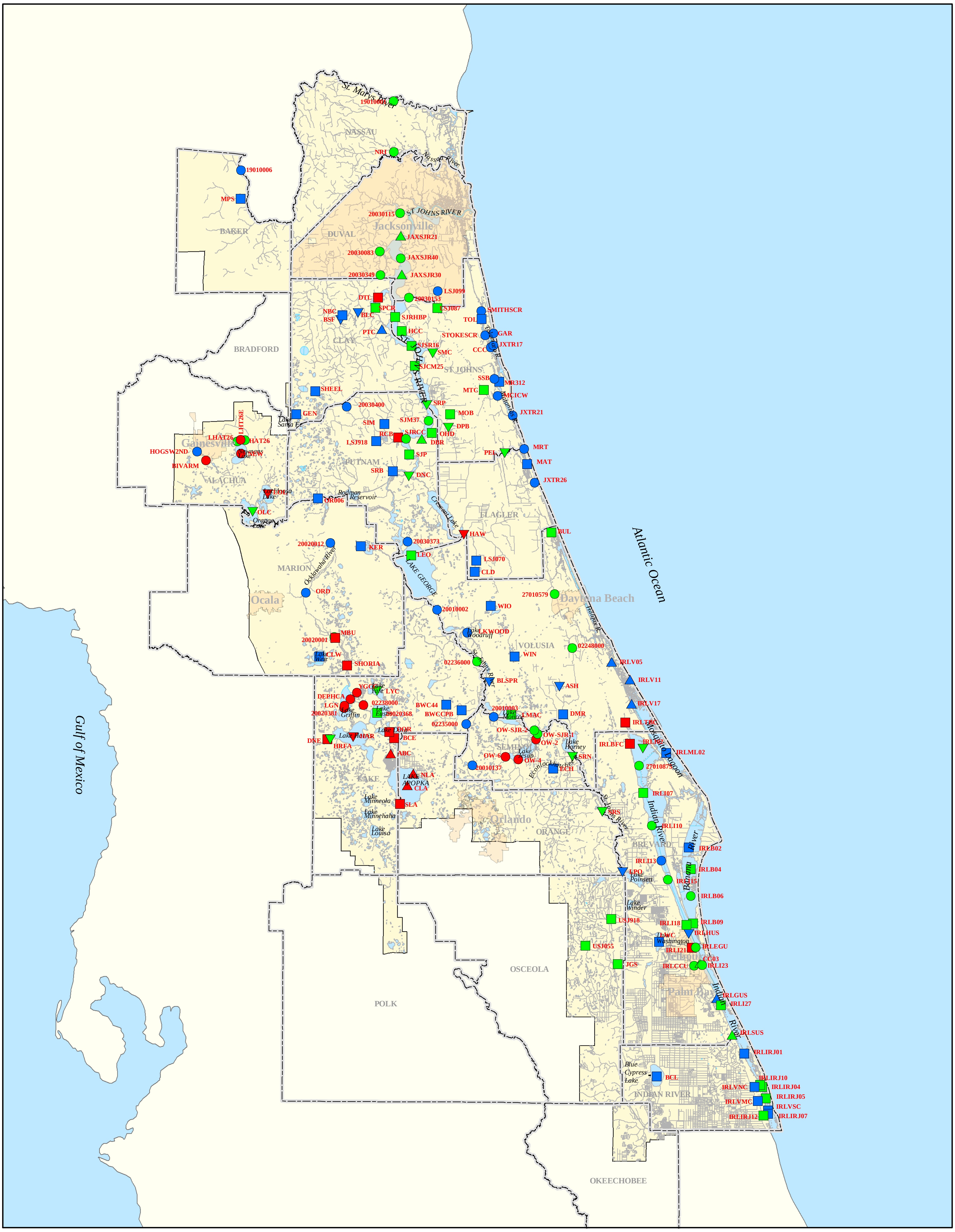
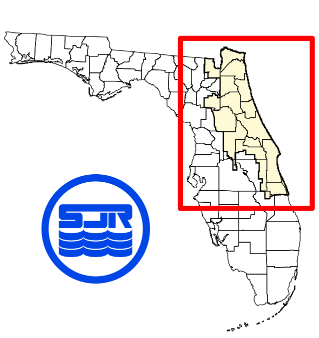
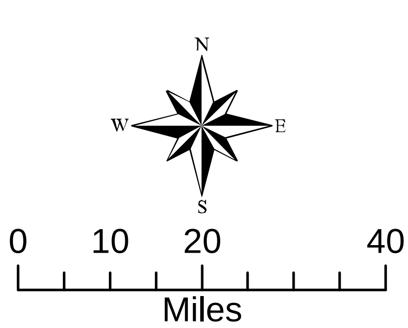
Tel: (386) 329-4176.



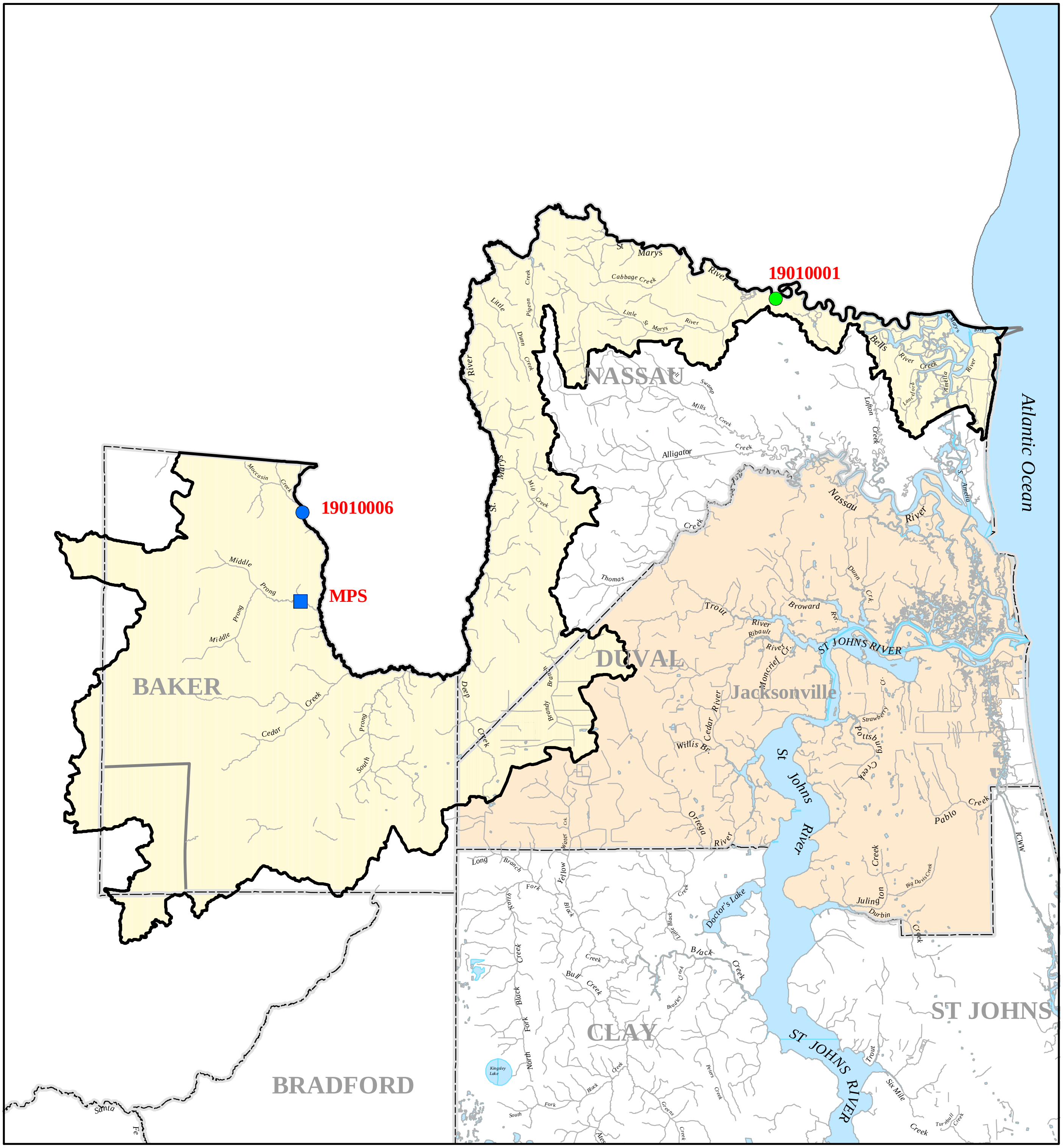
Map 6. **Water quality status and trends in the St. Johns River Water Management District, 2002**





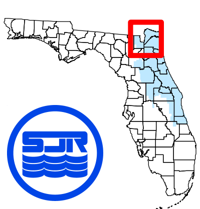
Legend

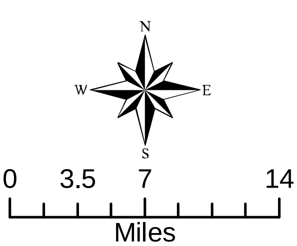
- Good, improving
- Good, degrading
- Good, insignificant
- Good, insufficient data
- Fair, improving
- Fair, degrading
- Fair, insignificant
- Fair, insufficient data
- Poor, improving
- Poor, degrading
- Poor, insignificant
- Poor, insufficient data
- Hydrography
- City > 40,000 population
- County boundary
- Hydrography arc



Map 7. **St. Marys River Basin**

Water quality status and trends, 2002



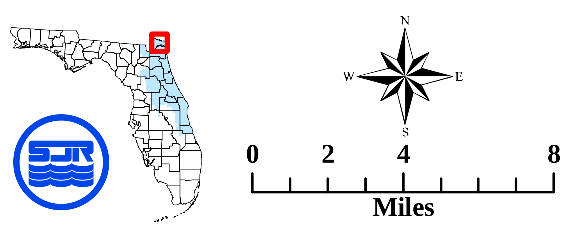


Legend

- Good, insignificant
- Good, insufficient data
- Fair, insufficient data

Map 8. **Nassau River Basin**

Water quality status and trends, 2002



Legend

Fair, insufficient data

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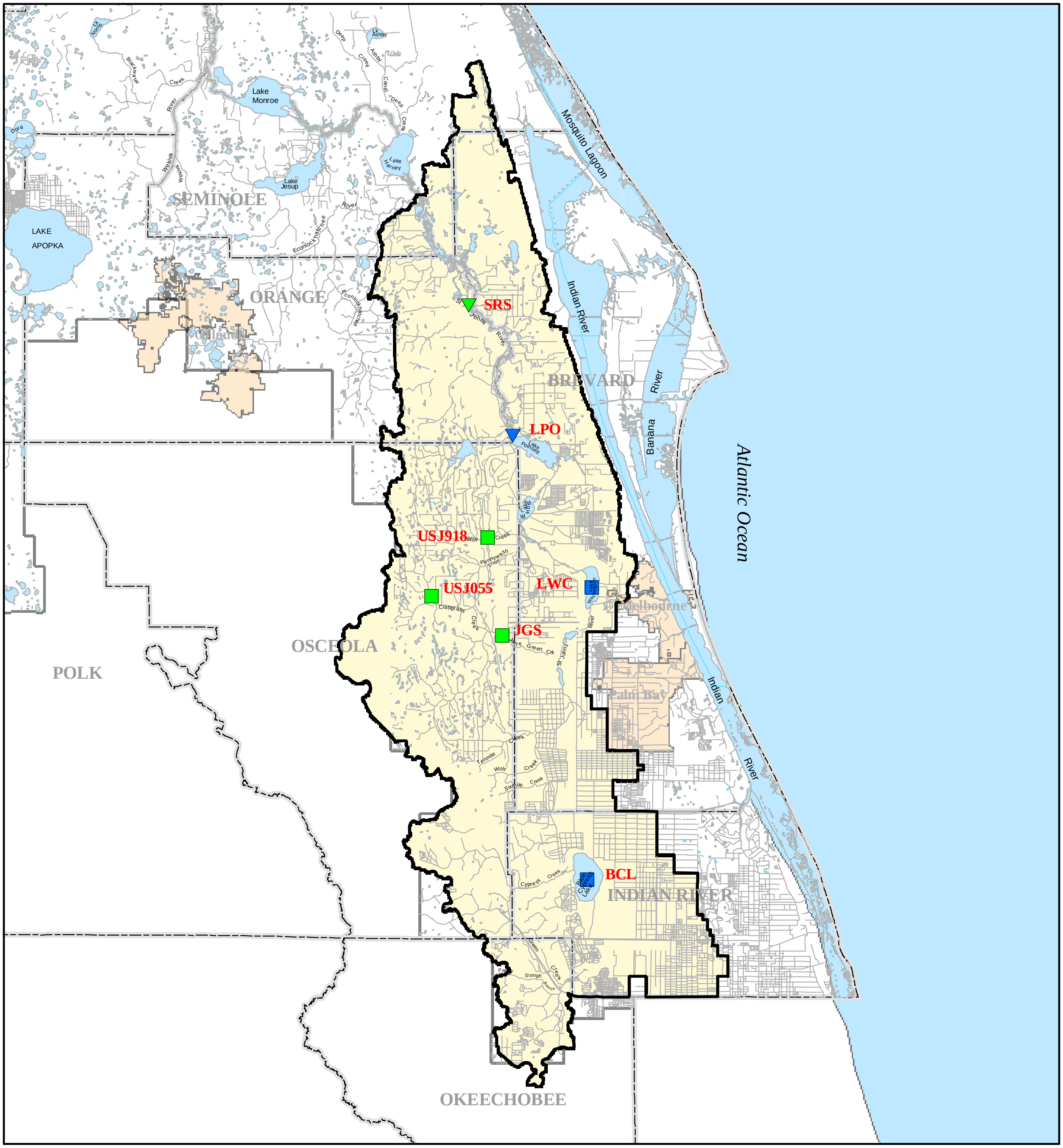
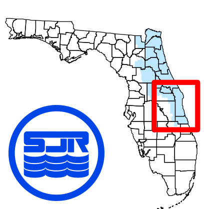
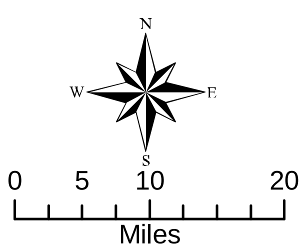


Map 9. **Upper St. Johns River Basin**

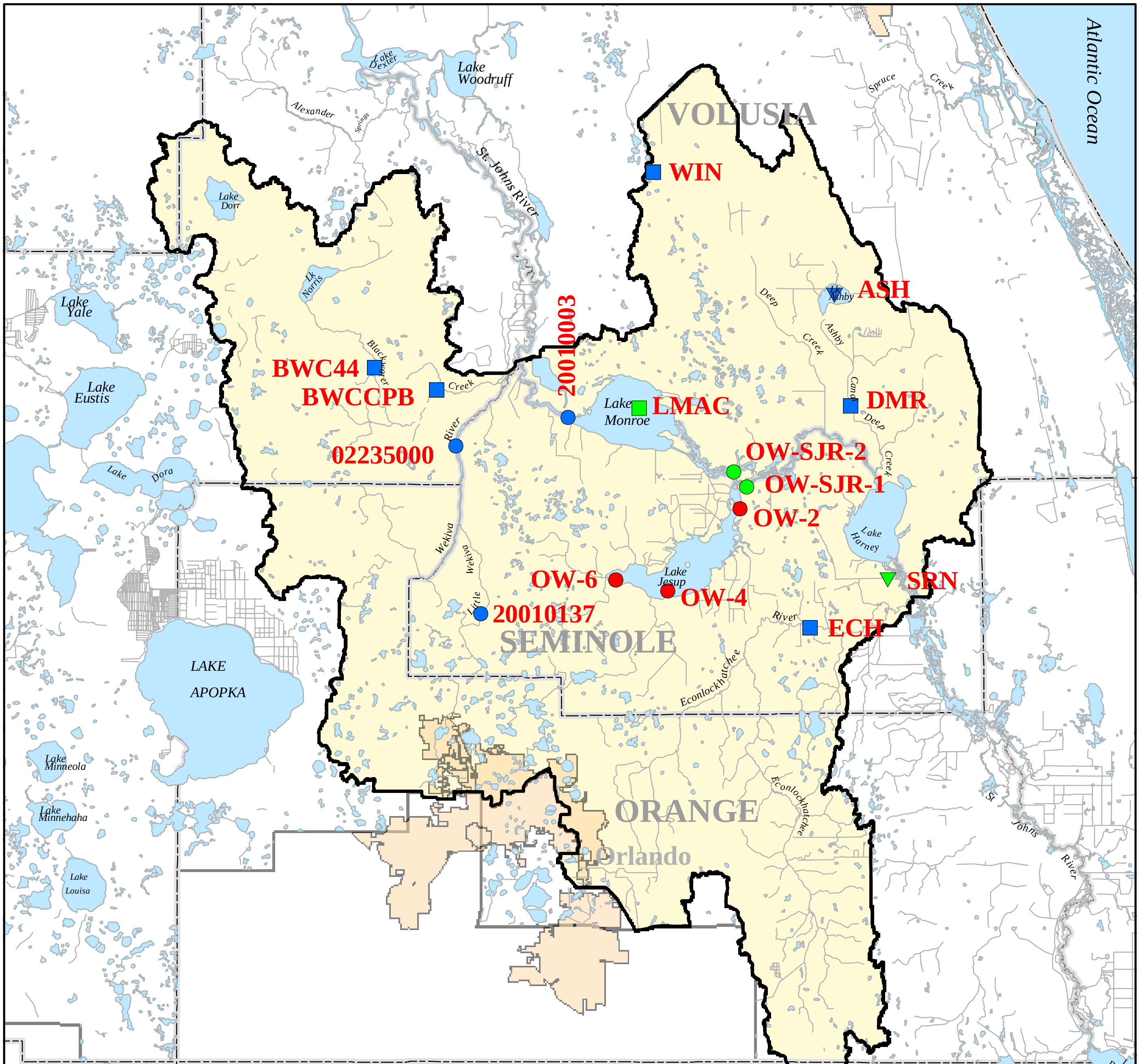
Water quality status and trends, 2002





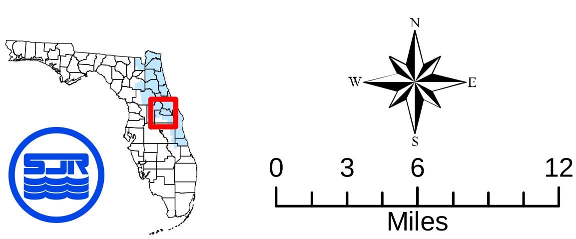
Legend

- Good, degrading
- Good, insignificant
- Fair, degrading
- Fair, insignificant



Map 10. **Middle St. Johns River Basin**

Water quality status and trends, 2002



Legend

- Good, degrading
- Good, insignificant
- Good, insufficient data
- Fair, degrading
- Fair, insignificant
- Fair, insufficient data
- Poor, insufficient data

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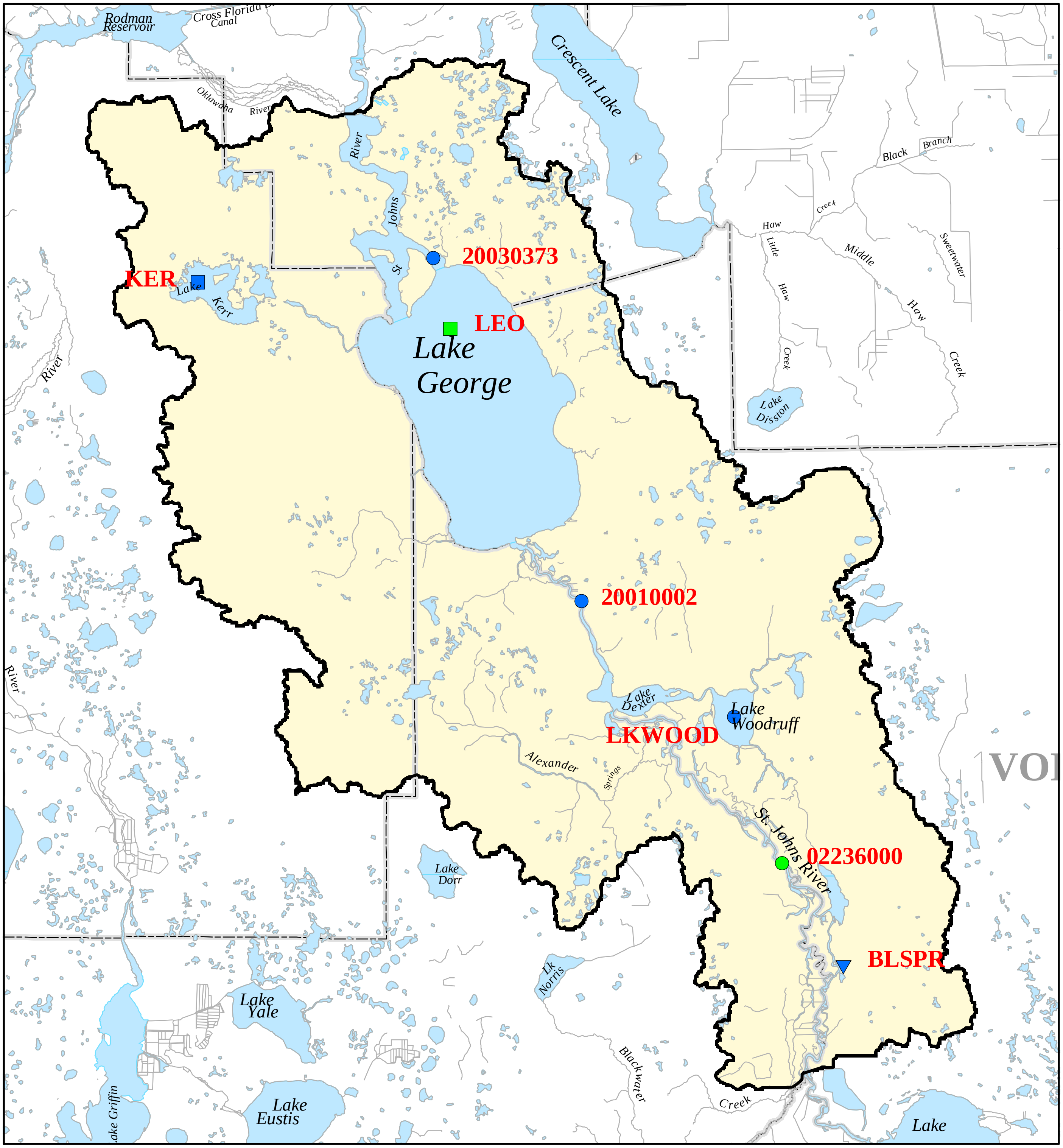
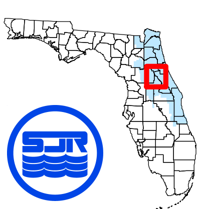
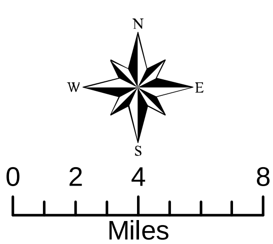


Map 11. **Lake George Basin**

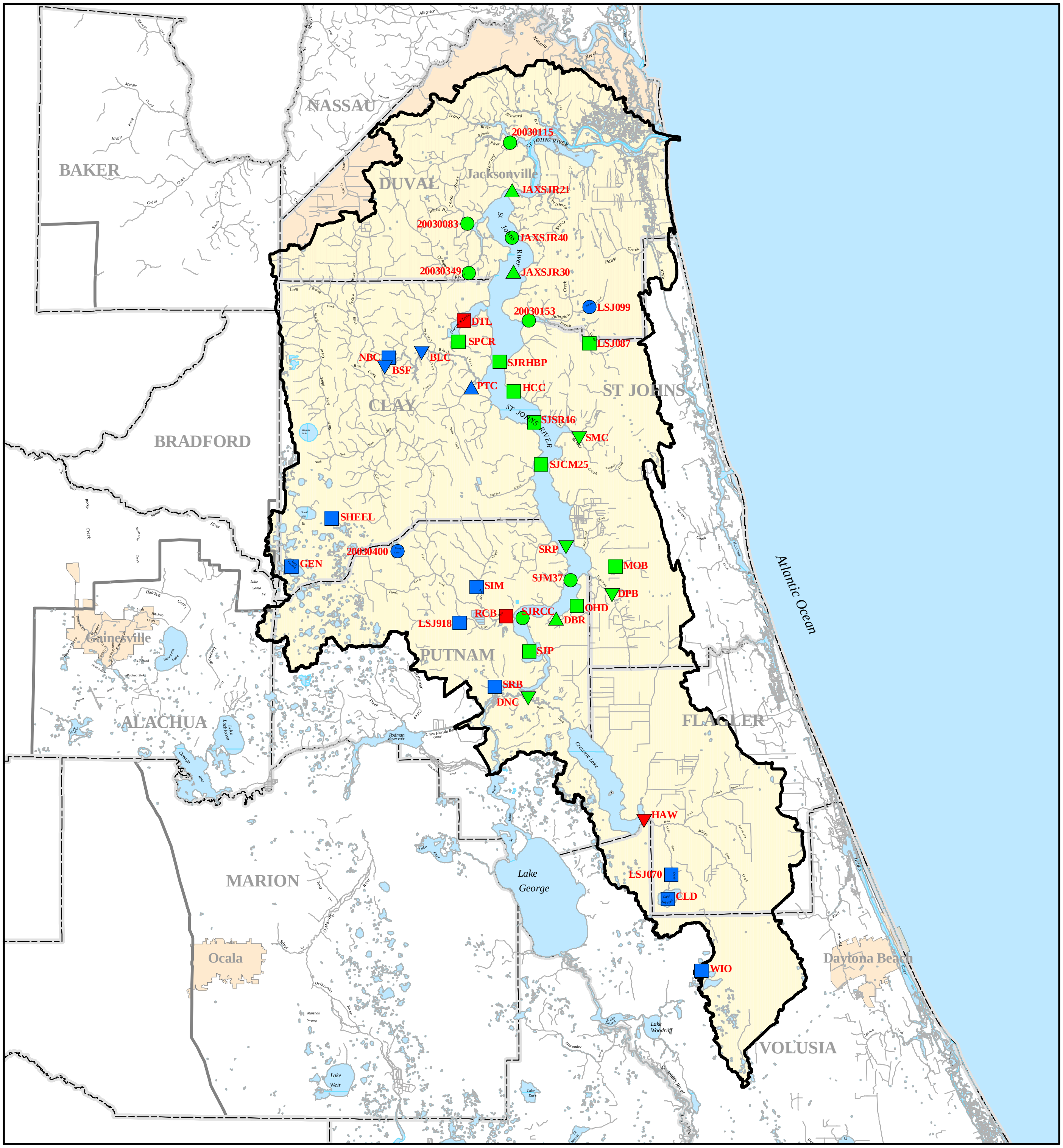
Water quality status and trends, 2002





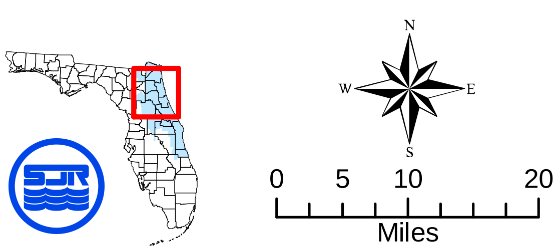
Legend

- Good, degrading
- Good, insignificant
- Good, insufficient data
- Fair, insignificant
- Fair, insufficient data



Map 12. **Lower St. Johns River Basin**

Water quality status and trends, 2002



Legend

- Good, improving
- Good, degrading
- Good, insignificant
- Good, insufficient data
- Fair, improving
- Fair, degrading
- Fair, insignificant
- Fair, insufficient data
- Poor, degrading
- Poor, insignificant

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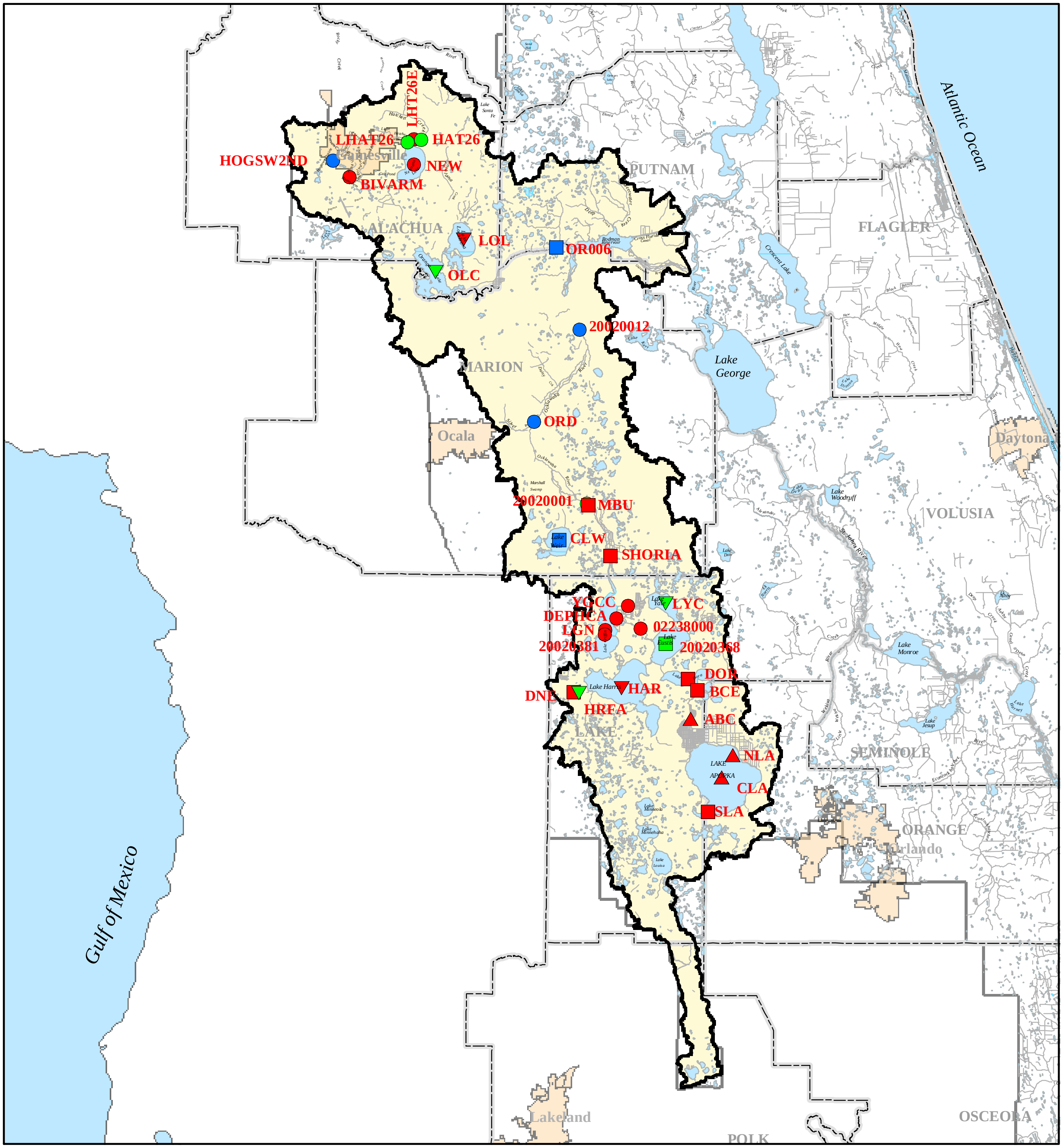
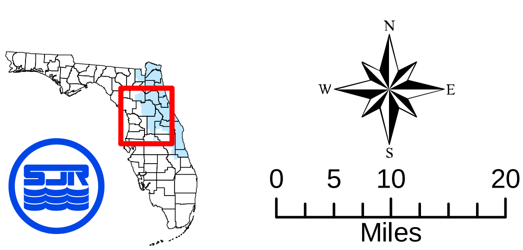


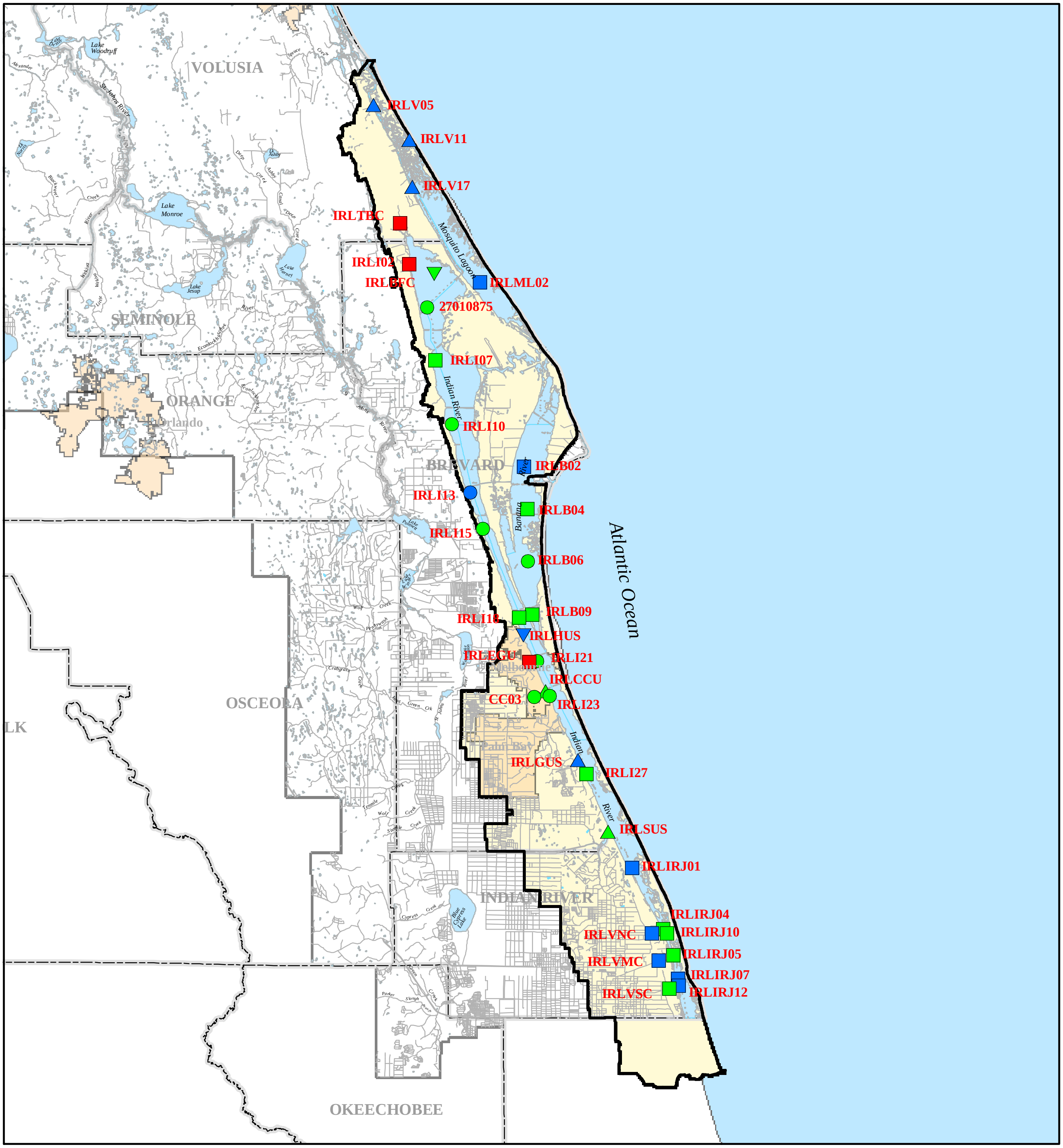
Map13. **Ocklawaha River Basin**

Water quality status and trends, 2002



Legend

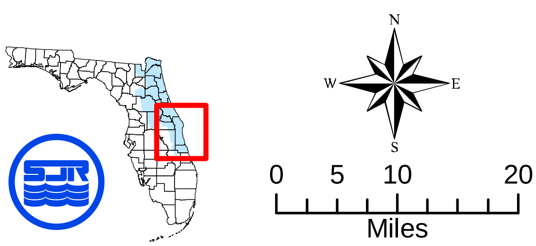
- Good, insignificant
- Good, insufficient data
- Fair, degrading
- Fair, insignificant
- Fair, insufficient data
- Poor, improving
- Poor, degrading
- Poor, insignificant
- Poor, insufficient data



Map 14.

Indian River Lagoon Basin

Water quality status and trends, 2002



Legend

- Good, improving
- Good, degrading
- Good, insignificant
- Good, insufficient data
- Fair, improving
- Fair, degrading
- Fair, insignificant
- Fair, insufficient data
- Poor, insignificant

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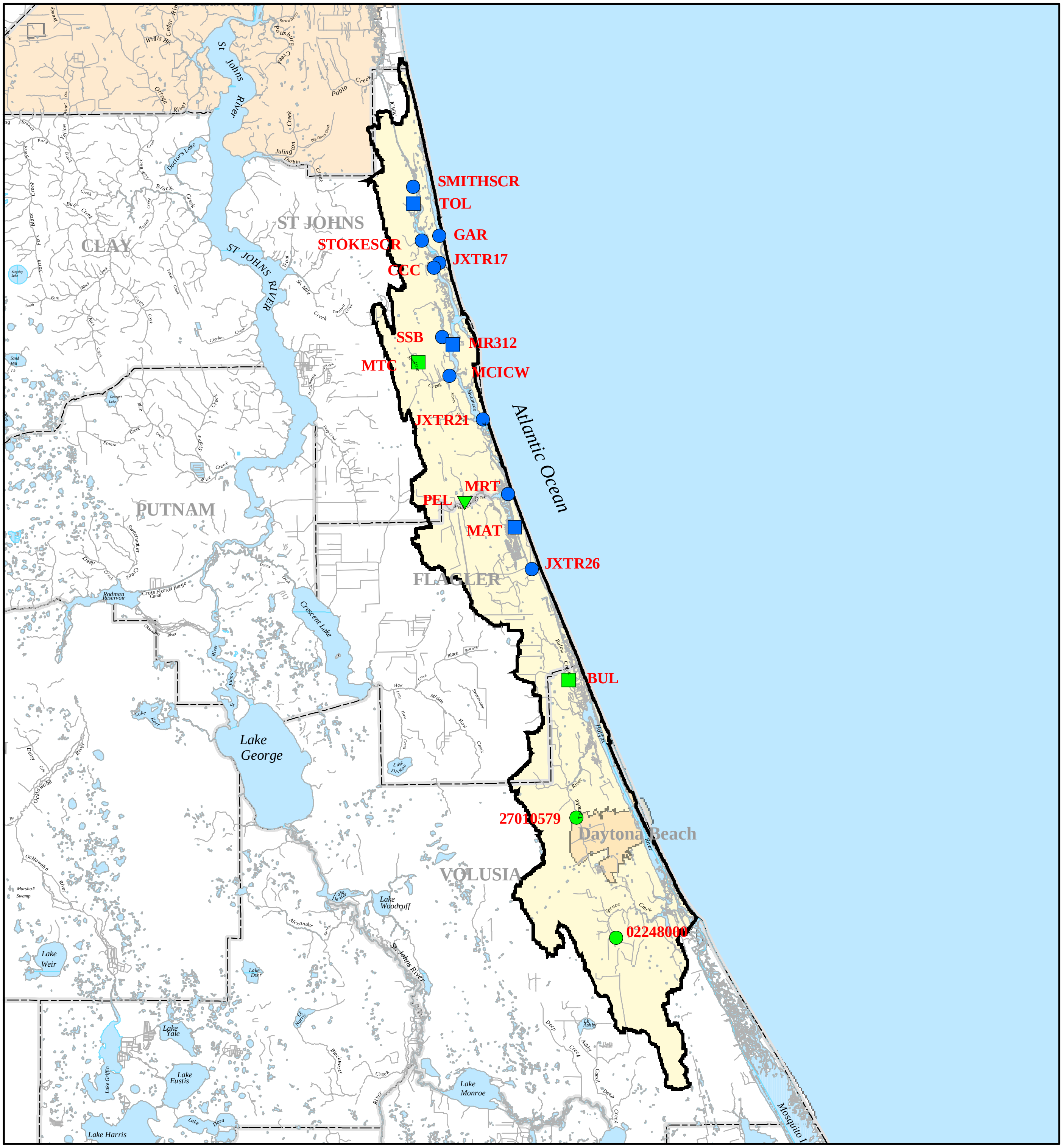
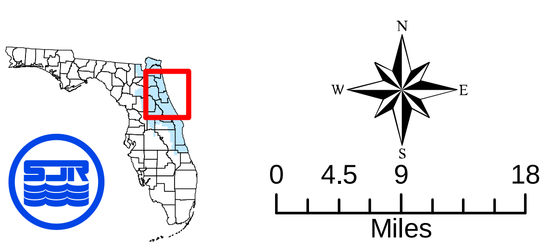


Map 15. **Northern Coastal Basin**

Water quality status and trends, 2002



Legend

- Good, insignificant
- Good, insufficient data
- Fair, degrading
- Fair, insignificant
- Fair, insufficient data